DIALLEL CROSS ANALYSIS FOR SOME FLAX GENOTYPES UNDER NORMAL AND SALINE ENVIRONMENTS Abo-Kaied, H.M.H.; Afaf E. A. Zahana and M.M.M. Hussein Fiber Crops Res. Department, Field Crops Res .Inst., A.R.C., Giza, Equpt.

ABSTRACT

The present investigation was conducted using six flax genotypes with their 15 crosses in F₂ and F₃ generations grown under normal salinity (Etay El-Baroud Exp. Station, El-Beheira Governorate) and stress salinity soil conditions (Tag El-Ezz Exp. Station, El Dakahlia Governorates) to determine salinity tolerance and combining ability in these entries (parents and their crosses). In two seasons, 2005/06 and 2006/07, the six parents (P₁= S.413/3/3/1, P₂= S.400/4/4/2, P₃= S.402/1, P₄ = S.421/6/4/5, P₅ = Gentiana and P₆= Daniela) and their 15 progenies were evaluated in a randomized complete block design with three replications at the two abovementioned locations.

The collected data indicated that additive effects were more important than non-additive effects for straw weight and its two important components (plant height and technical stem length) as well as for seed weight and its all components under the two environments in both generations. While, both non-additive and additive genetic effects play an important role in the inheritance of No. of basal branches per plant. The interaction of general (GCA) and specific (SCA) combining ability with environments indicated that both additive and non-additive genetic effects are influenced by environments. However, additive genetic effects were more influenced by environmental fluctuation than non-additive effects for straw weight per plant and its two important components. P3 and P6 showed high GCA effects for straw weight and its two important components in most cases. However, P1 and P3 showed high GCA effects for seed weight and its two important components (No. of capsules and 1000-seed weight). While, P2 proved to be high general combiner for 1000-seed weight only. SCA effects indicated that the two crosses, $P_{3} \times P_{6}$ and $P_{5} \times P_{6}$ gave high SCA effects for straw weight, plant height and technical stem length, these crosses resulted from crossing between parents which one parent at least have high GCA effects for these traits. $P_1 \times P_2$ for seed weight per plant and $P_1 \times P_6$ for 1000-seed weight included high x low general combiner parents.

Concerning salinity tolerance, P_6 exhibited high yielding potential and low susceptibility to saline environments for straw weight and its two important components. Also, the cross P_3xP_6 showed high means for straw weight and its components, so it could be identified as low susceptible to salinity stress in both generations. The cross P_5xP_6 gave high yield potentiality and low susceptibility for straw weight and its two important components in F_3 only. The results indicated that tolerant parents could produce tolerant hybrids. Hence the two crosses, P_3xP_6 and P_5xP_6 may be useful as potential breeding material for developing genotypes tolerant to soil salinity for straw weight and its components. P_3 exhibited low or moderate susceptibility for seed weight and its two important components. However, P_5 and P_6 could be identified as high tolerant to salinity for No. of seeds per capsule. The two crosses P_1xP_2 and P_2xP_4 exhibited high or moderate tolerance for seed weight and its components. While, the cross P_3xP_5 exhibited high tolerance of salinity for both seed weight and No. of seeds per capsule.

Keywords: Flax, Diallel analysis, Gene action, Salinity tolerance.

INTRODUCTION

One of the earliest plants used in the manufacture of clothing is flax (*Linum usitatissimum* L.). Flax plant had been known since the dawn of civilization where it was cultivated as a crop for food and fiber. In Egypt, flax is one of the important oil and fiber crops (cultivated for two purposes). Flax has always had industrial uses; recently its uses have been widened to include a range of new products such as cigarette papers, car door panels and compressed boards. But more and more, flax is carving a niche as a health food. Alpha - linolenic acid (an omega-3 fatty acid found in flax) is essential for the human diet. It can reduce heart disease and lower cholesterol level.

Information on the relative importance of general (GCA) and specific (SCA) combining abilities is essential for flax breeder. Generally, GCA is associated with additive genes, while SCA is attributed primarily to non-additive (dominance and epistasis). It is very useful that the breeder should evaluate the potentialities of the available germplasm for new recombinations and eventually combining ability have proved to be of considerable use in crop plants. Information about combining ability and type of gene action for traits under saline conditions are necessary for flax breeder to design an appropriate breeding program for improving salinity tolerance. Published work on the combining ability and type of gene action of flax traits under salinity-stress conditions is generally lacking. On the other hand, many studies investigated combining ability in flax under normal conditions, *i.e.* Shehata and Comstock (1971), Foster *et al.*, (1998), Patil and Chopde (1981), Patil, *et al.*, (1997), Abo El-Zahab and Abo-Kaied (2000), Abo-Kaied (2002) and Abo-Kaied (2006).

A stress susceptibility index (S) proposed by Fisher and Maurer (1978) can be used as indicator for measuring salinity tolerance under stress conditions an could help for isolating improved tolerant genotypes (Winter *et al.*, 1988).

The present study aimed 1) to estimate combining ability of 21 flax entries (6 parents and their 15 crosses in F_2 and F_3 generations) under both saline and normal conditions, 2) to evaluate the influence of salinity stress on yield and yield components of these parents and their crosses and 3) to identify the best parents and crosses which could be recommended for breeding salinity tolerant flax lines.

MATERIALS AND METHODS

In an earlier study (Zahana,2006) fifteen hybrids derived from crossing six parental genotypes of flax, using a half diallel mating system, were utilized to estimate, combining ability and type of gene action in F₁ generation. The genotypes used included; four promising strains *i.e.*, S.413/3/3/1 (dual purpose), S.400/4/4/2, (oil type), S.402/1 (dual purpose) and S.421/6/4/5 (dual purpose) as well as two introductions *i.e.*, Gentiana (oil type) and Daniela (fiber type).

In the first season (2005/06), the F₁ seed bulks of the 15 diallel crosses were used to evaluate its F₂ progenies with the six parents at two locations viz: Etay El-Baroud Exp.Station, El-Beheira Governorate (clay, organic matter of 3.5%, available nitrogen 42.12 ppm, E.C. 1.91 and pH = 8.05) and Tag El-Ezz Exp.Station, El Dakahlia Governorates (clay, organic matter of 0.91%, available nitrogen 71.40 ppm, E.C. 11.3 and pH = 7.31).

In the second season (2006/07), the F_2 seed bulks of the 15 diallel crosses were used to evaluate the F_3 generations with the six parents at the previous experiment stations.

Each of the two experiments were laid out in a randomized complete block design with three replications with restricted randomization where each replicate consisted of 21 entries (6 parents and 15 crosses) and each entry was sown in one plot. Each plot consisted of three rows. Rows were 3 m long, spaced 20 cm apart. Single seeds were hand drilled at 5 cm spacing within rows. The normal cultural practices usually recommended for flax cultivation were applied at the proper time in both generations. Observations and measurements were recorded for each plot (parent or cross) on 20 guarded plants chosen at random from each plot for the following characteristics:

1- Straw weight per plant and its components:

(1)Straw weight/plant (g), (2) Plant height (cm), (3) Technical stem length (cm) and (4) No. of basal branches.

2- Seed weight per plant and its components:

(1) Seed weight/plant (g), (2) No. of capsules/plant, (3) 1000-seed weight (gm), and (4) No. of seeds/capsule.

Statistical manipulation of the data:

Plot means were used for statistical analysis. Data from each macro environment (combination of year and location) were analyzed and Barteltt's test for heterogeneity of error variances across environments indicated that error terms were homogeneous. In the combined analysis across environmental effect was assumed to be fixed.

Combining ability analysis:

Combining abilities, general (GCA) and specific (SCA) were calculated according to Griffing's method 2, model 1 (fixed effects). Forms of analysis for individual environments as given by Griffing (1956) and for combined analysis as suggested by Singh (1973).

Susceptibility analysis:

A stress - susceptibility analysis index (S) was used to characterize each genotype in the stress environments and the index was calculated using genotype means and a generalized formula (Fisher and Maurer 1978) in which

S = (1-YS / YN) / D, where YS = mean yield with stress environment, YN = mean yield with normal environment, and D = environment stress intensity = 1- (mean YS of all genotypes / mean YN of all genotypes).

The "S" was used to characterize the relative salinity stress tolerance of the various genotypes, where S<0.50 is indicated highly stress tolerant genotypes, S>0.50<1.00 designated moderately stress tolerant and S>1.00 referred to susceptible genotypes.

RESULTS AND DISCUSSION

1-Combining ability:

1-1-Straw weight per plant and its components :

Results presented in Table (1) show that mean square estimates of ordinary and combining ability analysis for straw weight and its components (plant height, technical stem length and No. of basal branches/plant) recorded in F2 and F3 generations under normal (E1= Etay El-Baroud) and saline (E₂=Tag EI-Ezz) environments and their combined data. Differences between the two environments were found to be highly significant for all studied traits. Also differences among genotypes, parents and crosses were highly significant for all traits at both environments and their combined analysis except parents in F2 and F3 at E2 as well as crosses for No. of basal branches in F₃ at E₁ were not significant. This indicated that, under each environment, variability was existed among such populations and increase the chance of isolating good new recombinations in the following generations. Such result was confirmed by the genetic diversity between the parental genotypes and their crosses which clearly shown in Table (7). Mean squares due to general (GCA) and specific (SCA) combining ability were highly significant (or significant) for straw weight and its components in both generations (F₂ and F₃) under normal and salinity environments with exception No. of basal branches in F2 and F3 at E1 was not significant. These results indicate that both additive and non-additive genetic effects were involved in the inheritance of straw weight and its components. However, the magnitude of mean squares due to GCA with that for SCA revealed that GCA/SCA ratio was more than unity for straw weight and its two important components (plant height and technical stem length) under the two environments in both generations and combined. While, the non-additive and additive genetic effects play an important role in the inheritance of No. of basal branches/plant. Therefore, the magnitude of additive genetic effects, must be of considerable value for each character. Consequently, effective selection could be possible within these F2 and subsequent populations for straw weight/plant, plant height and technical stem length. Similar results were reported by Abo El-Zahab and Abo-Kaied (2000) and Abo-Kaied (2002).

The interaction between each of genotypes, parents, crosses and parent *vs.* crosses with environment was highly significant for all traits recorded, revealing inconsistent responses for these sources of variations from saline to normal conditions. The interaction mean squares of GCA with environments (E) were highly significant (or significant) in both generations for all characters with the exception of straw weight in F_3 and No. of basal branches per plant in F_2 only. Also, SCA x E mean squares were significant in most traits except plant height in F_3 and technical stem length in F_2 crosses. Hence, both additive and non-additive genetic effects are influenced by environment than non-additive effects for straw weight/plant and its important components (plant height and technical stem length). These results are in agreement with reported by Patil and Chopde (1981) and Patil, *et al.*, (1997).

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					F ₂					F ₃					F_2			E ₃		
S.O.V	ďf		E		E ₂		C.		1	E ₂		C.	E		E2	C.	E ₁	E;	2	C.
	S.	C.			Strav	٧V	/eight/pl	ant (g						P	Plant he	eight/plan	t (cm)			
Environment (E)		1					54.08 **				Τ	104.09 **				4843.07 **				10771.10
Reps/E		4					0.92 **					0.23 ns				31.85 **				253.61
Genotypes(G)	20	20	2.45	**	2.08	**	2.32 **	2.1	8 **	1.62	**	3.14 **	325.63 *	* 22	24.01 **	467.50 **	139.86 *	* 179.18	; **	287.33
Parents (P)	5	5	6.02	**	2.21	**	2.36 **	2.2	4 *	1.58	**	3.66 **	516.92 *	* 33	37.43 **	793.09 **	146.00 *	* 237.53	; **	341.99
Crosses(C.)	14	14	1.34	**	1.59	**	2.09 **	1.9	8 **	1.75	**	3.01 **	276.14 *	* 16	62.91 **	351.36 **	116.53 *	* 165.32	**	256.40
P.vs.C	1	1	0.16	Ins	8.31	**	5.39 **	4.6	7 **	0.00		2.34 **	62.05 *	5	12.25 **	465.44 **	435.79 *	* 81.47	*	447.05
GxE		20		1			3.76 **		T			2.75 **			9.58	393.81 **				223.26
PxE		5		1			7.45 **		T			2.59 **				589.99 **				269.5
CxE		14					0.85 **		T			0.71 **				87.69 **				25.4
^p vs C xE		1		1			6.67 **		T			3.89 **				419.15 **				368.24
GCA	5	5	1.14	**	1.30	**	0.98 **	_	5 *	1.66	**	3.12 **	364.19 **	* 1/	41.41 **	457.87 **	125.53 *	* 160.47	* **	269.1
SCA	15	15	0.71	**	0.49	**	0.70 **	0.4	5 **	0.17	**	0.36 **	23.33 **	* (52.42 **	55.15 **	20.32 *	26.14	**	37.9
GCA x E		5		T			1.46 **		Ť			0.10 ns				47.73 **				16.8
SCA x E		15		T			0.50 **	_	Ť		1	0.26 **				20.60 **				8.4
Error	40	80	0.114		0.192		0.153	0.13	5	0.034		0.084	4.904		3.193	4.048	10.281	4.044		7.16
GCA/SCA			1.61	_	2.66		1.40	3.4		10.08		8.76	15.61		2.70	8.30	6.18	6.14	_	7.09
S.O.V	S.	C.	T	ecł	nical	ste	m lengt	ı/plan	t ía	mì	Ī		Nu	mb	er of b	asal bran	ches/pla	ant		
Environment (E)		1				_	4381.39 **		1		1	8133.27 **				3.30 **				3.0
Reps/E		4		T			38.38 **		+			19.80 **		1		0.07 ns				0.0
Genotypes(G)	20	20	211.20	**	185.38	**	378.95 **		1 **	186.26	**	284.69 **	0.13 *	*	0.13 **	0.14 **	0.08 *	0.11	**	0.11
Parents (P)	5		368.36		317.73		655.82 **		_	186.67	_	316.07 **	0.24 *	_	0.06 ns	0.14 **	0.15 *	_	_	
Crosses(C.)			165.79		150.97		303.47 **		_	198.67		271.03 **	0.09 *	_	0.13 **	0.14 **	0.07 r	_	_	0.1
P.vs.C	1	1	61.14	_	5.37	_	51.38 **		_		_		0.00 n	_	0.56 **	0.31 **	0.00 r			0.2
GxE	Ė	20		1			270.27 **		-			215.98 **				0.21 **				0.16
PxE		5		t			467.48 **	_	+			225.54 **				0.25 **				0.18
CxE		14		t			13.30 **	_	+			19.56 **				0.09 **				0.0
P vs C xE		1		T			49.39 **		t			388.34 **		1		0.46 **				0.53
GCA	5	5	221.80	**	185.72	**	393.09 **		1 **	191.91	**	292.58 **	0.02 n	ns	0.05 **	0.05 **	0.02 r	s 0.05	; **	0.0
SCA		15	19.94		20.49		37.39 **		_		-	29.00 **	0.05 *	_	0.04 **	0.05 **	0.03 *	-	_	0.04
GCAXE		5		1			14.42 **				1	12.75 **				0.03 ns			Ħ	0.03
SCAXE		15		1			3.03 n:	_	t		1	7.39 *				0.04 **			Ħ	0.03
Error	40	80	2.883		3.814		3.349	4.70	0	3.039		3.870	0.015	1	0.013	0.014	0.012	0.009	H	0.011
	1.4	1.4	11.13	-	9.07		10.51	6.4		10.20	-	10.09	0.50	+`	1.07	0.94	0.47	1.55	_	0.85

Estimates of GCA effects (g_i) for six parents as affected by normal and saline environments and their combined data are presented in Table (2). P_6 (Daniela) and P_3 (S.402/1) were found to be high general combiners for straw

weight and its two important components (plant height and technical stem length) at individual environments and combined in both generations except P_3 in F_2 only. Using such parents in hybridization programs may result in isolating desirable sergeants for the above-mentioned traits. However, P_2 (S.400/4/4/2) showed high g_i effect in saline environment and combined data only for No. of basal branches/plant. The correlation coefficient (r) between mean performance (Table 7) of parents and their GCA values (Table 2) was significantly positive at both environments and combined for straw weight, plant height and technical stem length, indicating that the superiority of a parent in cross combinations could be directly predicted its *per se* performance. In general, P_6 and P_3 were more efficient under both environments (normal and saline) as they possess favourable genes and yield improvement can be attained by their use in a breeding program at irrespective salinity conditions.

SCA effects (S_{ii}) for straw weight and its components in F_2 and F_3 crosses under both environments and their combined data are given in Table (3). The data indicated that there was no cross combination which was consistently good for all the straw weight per plant and its components. Out of the 15 F_2 and F_3 crosses, only one cross ($P_5 \times P_6$) exhibited significant positive SCA effects for straw weight, plant height and technical stem length, as well as P₃×P₆ indicated high SCA effect for the same traits except straw weight in F_2 only. For No. of basal branches/plant, one cross ($P_2 \times P_4$) showed significant positive SCA effects in F_2 and F_3 crosses under individual environment and combined. However, $P_1 \times P_5$ and $P_1 \times P_6$ crosses showed significant positive SCA effects at normal environment and combined in both generations. It could concluded that, the two crosses $(P_3 \times P_6 \text{ and } P_5 \times P_6)$ resulted from crossing between parents which one parent at least have high GCA effects for straw weight, plant height and technical stem length. Therefore, these crosses ($P_5 \times P_6$ and $P_3 \times P_6$) may prove useful for simultaneous improvement of these traits. The simple correlation (r) between cross means and their SCA values was significant and positive for all characters, indicating that high performing crosses were high specific combinations. Therefore, the choice of promising cross combination could be based on SCA effects or high mean performance in this case.

1-2-Seed weight per plant and its components :

Analysis of variance showed that mean squares due to genotypes, parents and crosses were highly significant for seed weight and its components viz., No. of capsules per plant, 1000-seed weight and No. of seeds per capsule for individual environments and combined data (Table 4). These results indicated that the parental genotypes and their F_2 and F_3 crosses showed reasonable degree of variability for these traits. Also, both mean squares due to GCA and SCA were highly significant for all characters. High ratio of GCA/SCA were also detected. These results revealed that the inheritance of these characters were mainly controlled by additive genetic effects of genes. Similar results were reported by Shehata and Comstock (1971), Patil and Chopde (1981) and Abo El-Zahab and Abo-Kaied (2000).

-	enotype				-		4						
ar	nd their	con	nbined	dat	a (C.) f	or s	taw we	igh	t and it:	в с	ombone	ents.	
			F ₂						F ₃				
Parents	E1		E ₂		c.		E1		E ₂		C.		
				_	veight/p				-2				
P1	-0.038	ns	0.002	_	-0.018	ns	-0.163	ns	-0.308	**	-0.235	**	
P2	-0.050	_	-0.176		-0.113	ns	-0.418		-0.391		-0.405	**	
P3	0.180	-	-0.508		-0.164	ns	0.505		0.406		0.456	**	
P4	0.347	_	-0.208		0.069	ns	-0.534		-0.400		-0.467	**	
P5	-0.699	**	0.236	_	-0.232	*	0.157		0.009		0.083	ns	
P6	0.261	*	0.654	**	0.457	**	0.453	**	0.684	**	0.568	**	
LSD 5%	0.342		0.443		0.277		0.371		0.186		0.205		
(Sij-Sik) 1%	0.457		0.593		0.367		0.497		0.248		0.272		
r .	0.985	**	0.940	**	0.940	**	0.942	**	0.910	**	0.940	**	
			Plan	t he	eight/pla	ant	(cm)						
P1	-2.285	**	-3.564	_	-2.925	**	-2.064	ns	-3.425	**	-2.745	**	
P2	-2.097	**	-0.796	ns	-1.447	**	-0.074	ns	-3.388	**	-1.731	**	
P3	9.523	**	6.712	**	8.118	**	4.156	**	5.693	**	4.924	**	
P4	-6.255	**	-0.898	ns	-3.577	**	-3.367	**	-1.036	ns	-2.201	**	
P5	-6.059	**	-4.477	**	-5.268	**	-4.052	**	-3.465	**	-3.758	**	
P6	7.173	**	3.023	**	5.098	**	5.401	**	5.621	**	5.511	**	
LSD 5%	2.238		1.806		1.423		3.240		2.032		1.892		
(Sij-Sik) 1%	2.994		2.416		1.885		4.335		2.719		2.508		
r	0.945	**	0.860	**	0.910	**	0.960	**	0.830	*	0.900	**	
		Τε	echnical	ste	em leng	ŗth/p	olant (cn	n)					
P1	-1.635	**	-3.179	**	-2.407	**	-0.985	ns	-2.279	**	-1.632	**	
P2	-2.771	**	-2.398	**	-2.585	**	-1.532	*	-3.537	**	-2.535	**	
P3	6.885	_	6.811	**	6.848	**	3.420		6.290		4.855	**	
P4	-4.847	_	-1.275		-3.061	**	-3.481		-2.542		-3.011	**	
P5	-4.039		-5.089		-4.564	**	-3.207		-4.166		-3.686	**	
P6	6.408	**	5.129	**	5.769	**	5.785	**	6.234	**	6.009	**	
LSD 5%	1.716		1.973		1.294		2.191		1.762		1.391		
(Sij-Sik) 1%	2.296		2.640		1.715		2.931		2.357		1.843		
r	0.934	_	0.930		0.930	**	0.943	_	0.900	**	0.930	**	
				_			hes/plar						
P1	-0.067	_	-0.033		-0.050	ns	-0.048		-0.013		-0.030		
P2	0.050		0.142		0.096	**	0.017		0.137		0.077	**	
P3	-0.017		0.017		0.000	ns	-0.004		0.041		0.018	ns	
P4	0.042	_	-0.008		0.017	ns	0.047	_	-0.026		0.011	ns	
P5	0.050	-	-0.083		-0.017	ns	0.041		-0.093		-0.026	ns	
P6	-0.058	ns	-0.033	ns	-0.046	ns	-0.054	ns	-0.047	ns	-0.050	~	
LSD 5%	0.122		0.115		0.083		0.110		0.098		0.073		
(Sij-Sik) 1%	0.164		0.153	**	0.110		0.147		0.131	++	0.096		
ſ	0.702		0.920	^^	0.850	*	0.742		0.950	~~	0.750	"	

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Parents E, E, <t< th=""><th></th><th></th><th>E2</th><th></th><th></th><th>Fa</th><th></th><th></th><th>E2</th><th></th><th></th><th>Fa</th><th></th></t<>			E2			Fa			E2			Fa	
PhrP2 0.502 ns 0.101 ns 0.301 ns 1.049 mi 0.108 ns 0.579 mi 0.885 ns 1.221 ns 1.574 ns 3.589 ns <t< th=""><th>Parents</th><th>E,</th><th>E,</th><th>С.</th><th>E,</th><th>Ε,</th><th>C.</th><th>E,</th><th>E,</th><th>С.</th><th>E,</th><th>E,</th><th>C.</th></t<>	Parents	E,	E,	С.	E,	Ε,	C.	E,	E,	С.	E,	E,	C.
P1xP3 0.149 ns 0.021 ns 0.234 ns 0.196 ns 0.502 "h 0.153 ns 4.289 *h 1.121 ns 1.574 ns 3.044 ns 2.035 ns 2.243 ns 2.013 ns 2.213 ns 2.013 ns 1.021 "h 0.421 ns 2.013 ns 1.124 "h 0.421 ns 2.013 ns 1.135 ns 0.324 ns 1.014 "h 6.229 "h 0.424 ns 2.013 ns 1.014 "h 6.229 "h 0.421 ns 2.013 ns 1.014 "h 6.229 "h 0.421 ns 2.013 ns 0.020 ns P1xPG 0.043 ns 0.046 ns 0.110 ns 0.037 ns 0.042 ns 1.021 ms 0.746 ns 0.110 ns 0.746 ns 0.716 ns 0.746 ns													
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normai	(E1)	ani	d saline	9 (t	z ₂) envi	ronment	s ar	nd their ci	ombined c	iata (U.).							
					F2				F ₃			F ₂			F ₃		
S.O.V	ďf		E ₁		E ₂	C		E	E ₂	C.	E	E2	C.	E ₁	E ₂		C.
	S.	C.	See	d v	veight/	plant (g)					Number (of capsule	s/plant			
Environment (E)		1				6.15) **			1.97 **			1256.16 **				1649.71
Reps/E		4				0.2				0.03 *			78.04 **				42.39
Genotypes(G)	20		0.56	**	0.54	* 0.8	**	0.38 **	0.45 **	0.61 **	132.90 **	124.16 **	162.37 **	79.71	* 108.08	**	160.49
Parents (P)	5		0.70	**	0.27			0.52 **	0.17 **	0.49 **			84.54 **	86.66			123.43
Crosses(C.)	14	14	0.54	**	0.55	* 0.8	} **	0.35 **	0.44 **	0.65 **	128.32 **	128.12 **	192.92 **	80.34	* 115.87	**	167.35
P.vs.C	1	1	0.12	ns	1.87	0.5	2 **	0.06 ns	1.87 **	0.63 **	34.09 na	465.29 **	123.75 **	36.25	ns 266.68	**	249.79
GxE		20				0.84	**			0.62 **			202.95 **				134.30
PxE		5				0.76) **			0.53 **			182.19 **				100.07
CxE		14				0.20				0.15 **			63.52 **				28.86
P vs C xE		1				1.8	2 **			1.72 **			458.14 **				219.67
GCA	5	5	0.46	**	0.34	* 0.7	**	0.32 **	0.25 **	0.51 **	60.09 **	42.05 **	63.55 **	74.80	* 61.13	**	121.91
SCA	15	15	0.10	*	0.13	* 0.10	2 **	0.06 **	0.12 **	0.10 **	39.04 **	41.17 **	50.98 **	10.50	27.66	**	30.69
GCA x E		5				0.0	3 *			0.06 *			38.59 **				14.03
SCA x E		15				0.10) **			0.08 **			29.23 **				7.46
Error	40	80	0.039		0.027	0.03	3	0.023	0.016	0.019	9.723	8.971	9.347	5.190	6.090		5.640
GCA/SCA			4.87		2.58	5.82	2	5.38	2.10	5.08	1.54	1.02	1.25	7.13	2.21		3.97
S.O.V	S.	C.			1000-	seed w	eigl	nt (g)		N	umber o	f seeds/c	apsule				
Environment (E)	Γ	1				1.2				4.98 **			1.61 **				21.91
Reps/E		4				0.0) ns			2.76 ns			0.40 ns				3.55
Genotypes(G)	20	20	5.37	**	5.50	* 10.8	} **	5.23 **	5.22 **	10.38 **	1.80 **	1.64 **	2.35 **	1.92	* 1.19	**	2.19
Parents (P)	5	5	9.00	**	8.94	* 17.92	2 **	9.94 **	8.23 **	18.10 **	2.09 **	4.12 **	5.16 **	2.47	* 3.43	**	5.17
Crosses(C.)	14	14	4.26	**	4.60	* 8.82	2 **	3.87 **	4.44 **	8.24 **	1.55 **	0.87 **	1.33 **	1.63	* 0.47	**	1.16
P.vs.C	1	1	2.67	**	0.95	3.4	**	0.66 **	1.04 **	1.68 **	3.86 **	0.13 *	2.69 **	3.37	* 0.01	ns	1.84
GxE		20				7.26	; **			6.99 **			2.66 **				2.38
PxE		5				11.9	**			12.14 **			4.48 **				4.17
CxE		14				0.04	**			0.07 **			1.10 **				0.94
P vs C xE		1				2.4	} **			1.14 **			3.09 **				2.76
GCA	5	5	6.10	**	6.45	* 12.54	**	6.19 **	6.13 **	12.31 **	0.49 **	1.28 **	1.66 **	1.08	* 0.84	**	1.88
SCA	15		0.35	_	0.30 *	_		0.26 **	0.28 **	0.51 **	0.64 **	0.31 **	0.49 **	0.50	_	_	0.35
GCA x E		5				0.01	ns			0.01 ns			0.11 ns				0.04
SCA x E		15				0.0				0.03 **			0.45 **				0.39
Error	40	80	0.002		0.005	0.004	_	0.019	0.006	0.013	0.078	0.045	0.061	0.102	0.040		0.071
GCA/SCA	Ē	-	17.22		21.71	19.84	_	23.70	22.21	24.18	0.78	4.19	3.37	2.17	3.37	_	5.36

The interaction between each of genotypes, parents and crosses with environment was highly significant for seed weight and its components in both generations, revealing inconsistent responses for these sources of variations from saline to normal environments. GCA x E mean squares were highly significant (or significant) for seed weight and No. of capsules/plant in

both generations. But GCA x E mean squares were not significant for 1000seed weight and No. of seeds/capsule in both generations. On the other hand, variances due to SCA x E mean squares were significant for seed weight and its components in both generations except for No. of capsules/plant in F₃ only. This indicates that, both additive and non-additive genetic effects are influenced by environmental fluctuation for the previous characters, which were showed significant with environments. Also, significant GCA x E interaction means that selection in the succeeding generations must be practiced under the aimed environments. These results are in agreement with those reported by Patil and Chopde (1981) and Abo El-Zahab and Abo-Kaied (2000).

The estimates of GCA effects (gi) for six parent as affected by normal (E1) and saline (E2) environments and their combined data for seed weight/plant and its components are shown in Table (5). P1 (S.413/3/3/1) and P₃ (S.402/1) showed significant positive GCA effects for seed weight and its two important components (No. of capsules and 1000-seed weight) at both environments and combined data. Therefore, these parents (P_1 and P_3) could be used in single cross combination to produce progeny having good levels of seed weight suitable to normal or saline conditions. While, P2 (S.400/4/4/2) was high general combiner for 1000-seed weight only. However, P₅ (Gentiana) and P₆ (Daniela) were high general combiners for No. of basal branches/plant at individual environments and combined. The simple correlation (r) between GCA values and parental means for seed weight/plant and all its components were significant except for No. of capsules/plant in E1 and combined at F2. These results indicated that the parents showing higher mean performance proved to be the highest general combiners for these traits under normal or saline conditions.

Specific combining ability effects (S_{ij}) for seed weight and its components in F₂ and F₃ crosses under both normal and saline environments and their combined data are given in Table (6). In general, the specific combining ability estimates indicated that there was no cross combination which was consistently good for all characters. Out of the 15 F₂ and F₃ crosses, two crosses (P₁×P₂ and P₂×P₄) showed significant positive SCA effects for seed yield/plant under two environments and combined data as well as, P₁×P₆ gave positive significant SCA effects for saline environment and combined analysis in both generations. Only one cross (P₁×P₂) for No. of capsules/plant, four crosses (P₁×P₃, P₁×P₆, P₂×P₅ and P₂×P₆) for 1000-seed weight and one cross(P₂×P₄) for No. of seeds/capsule exhibited significant positive SCA effects under two environments and combined in both generations.

It could be noticed that, one cross ($P_1 \times P_2$) for seed weight/plant and one cross, ($P_1 \times P_6$) for 1000-seed weight included high x low general combiner parents. On the other hand, one cross ($P_2 x P_4$) for seed weight/plant and No. of seeds/capsule included low x low general combiner parents. In such case (high x low combiners), desirable transgressive segregates might be expected in the subsequent generations if the additive genetic system was present in the good combiner and the complementary epistatic effects acted

in the same direction to maximize seed weight/plant. These results are more or less in harmony with those previously obtained in F₁ generation (Zahana,2006). The simple correlation (r) between cross means and their SCA values was significant and positive for all traits under the two environments and combined in both generations, indicating that high performing crosses were high specific combinations for seed yield and its components.

gen	otypes :	as	affected	d bj	y norma	al (I	E₁) and	sa	line (E ₂) er	nvironm	er
and	their co	ml	bined d:	ata	(C.) for	' se	ed weig	jht	and its	со	mbonei	nt
			F ₂						F 3			
Parents	E1		E2		C.		E1		E2		C.	
			See	d v	veight/p	lan	t (g)					
P1	0.132	*	0.136	*	0.134	*	0.102	*	0.074	*	0.088	**
P2	0.050	ns	0.123	*	0.087	ns	0.063	ns	0.084		0.074	*
P3	0.206	**	0.267	**	0.237	**	0.175	**		**	0.221	*:
P4	· · · · · ·	**	-0.084	ns	0.065	ns	0.167	**	-0.066	ns	0.051	n
P5	-0.283	**	-0.197	**	-0.240	ns	-0.238	**	-0.156	**	-0.197	*:
P6	-0.318	**	-0.244	**	-0.281	**	-0.269	**	-0.202	**	-0.236	*:
LSD 5%	0.200		0.165		0.372		0.153		0.127		0.098	
(Sij-Sik) 1%	0.267		0.221		0.493		0.205		0.170		0.130	
r	0.775	*	0.970	**	0.890	**	0.796	*	0.960	**	0.860	*:
			Numb	ег	of capsi	lles	s/plant					
P1	1.639	*	2.486	*	2.063	**	1.033	*	1.772	*	1.403	*
P2	-0.869	ns	1.251	ns	0.191	ns	1.347	*	1.550	**	1.449	*:
P3		*		*	2.332	*	1.0.10	*	2.215	**	2.030	*:
P4	2.626		-2.256	_	0.185	*	2.733	**	0.500	ns	1.617	*
P5	-2.804		-2.023	_	-2.414	**	-2.060		-0.942		-1.501	*
P6	-2.159	*	-2.754	**	-2.457	**	-4.897	**	-5.094	**	-4.996	*
LSD 5%	3.151		3.027		2.162		2.302		2.494		1.679	1
(Sij-Sik) 1%	4.216		4.049		2.864		3.080		3.336		2.225	1
r	0.649	_	0.950		0.600		0.934	**	0.770	*	0.880	*:
		_			eed we							_
P1	0.110	**	0.460		0.435	**	0.500	**	0.456		0.478	*:
P2	0.011	**	0.002	**	0.653	**	0.617	**	0.653		0.635	*:
P3	1.143	_	1.152		1.148	**	1.111	**	1.116		1.114	*:
P4	-0.200	**	-0.309		-0.300	**	-0.269	**	-0.311	**	-0.290	*:
P5	0.000	**	-0.874		-0.866	**	-0.911	**	-0.853		-0.882	*:
P6	-1.049	**	-1.091	**	-1.070	**	-1.048	**	-1.062	**	-1.055	*:
LSD 5%	0.050		0.068		0.042		0.140		0.078		0.079	+
(Sij-Sik) 1%	0.067		0.092	++	0.056	**	0.188		0.104		0.105	*:
r	0.975	~^	0.980		0.980		0.981	~~	0.980	^^	0.980	1.4
D4	0.000				of seed:		-	**	0.040	**	0.040	*
P1	-0.268	_	-0.395		-0.332	**	-0.307		-0.313		-0.310	*
P2	-0.126	ΠS *	-0.329		-0.228	**	-0.282	** *	-0.246	-	-0.264	*
P3	-0.201		-0.312		-0.257		-0.224		-0.266		-0.245	+
P4 P5		⊓S **	0.138	NS **	0.069	NS **	-0.079	NS **	0.085	NS **	0.003	П *:
P5 P6	0.200		0.361		0.315	**	0.297	**	0.291		0.294	*
P6 LSD 5%	0.328		0.536		0.432		0.596		0.450		0.523	+
LSD 5 % (Sij-Sik) 1%	0.282		0.214		0.175	-	0.322		0.202		0.166	+
(3)-31()170	0.377		0.200		0.232	**	0.431		0.271		0.249	*:

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		mbined (C E2	.) data lo	0000 1101	F ₂	oomoon		F2			Fa	
Crosses	E,	E,	C.	E,	E,	C.	E,	E,	C.	E,	E,	C.
	-			ight/plan			_	umber of			-/	
P1xP2	0.196 *	0.455 **	0.326 **	0.172 *	0.298 *	0.235 *			10.645 **	5.720 **	9.134 **	7.427 **
P1xP3	0.364 *	0.159 ns	0.262 *	0.259 ns	0.161 ns	0.210 *	1.536 ns	-0.189 ns	0.674 ns	-0.135 ns	4.743 *	2.304 ns
P1xP4	0.081 ns	-0.255 ns	-0.087 ns	-0.009 ns	-0.242 *	-0.126 ns	4.494 ns	-6.522 *	-1.014 ns	2.081 ns	-1.216 ns	0.433 ns
P1xP5	-0.061 ns	-0.098 ns	-0.079 ns	-0.015 ns	-0.039 ns	-0.027 ns	-2.806 ns	-2.592 ns	-2.699 ns	-0.306 ns	-4.010 ns	-2.158 ns
P1xP6	-0.140 ns	0.715 **	0.287 *	-0.080 ns	0.727 **	0.324 **	-4.225 ns	11.102 **	3.439 ns	-0.729 ns	-1.028 ns	-0.879 ns
P2xP3	0.210 ns	-0.041 ns	0.085 ns	0.155 ns	0.102 ns	0.129 ns	3.735 ns	-1.021 ns	1.357 ns	3.720 ns	0.379 ns	2.049 ns
P2xP4	0.186 *	0.481 **	0.333 **	0.167 *	0.465 **	0.316 **	-0.811 ns	4.083 ns	1.636 ns	0.887 ns	2.646 ns	1.767 ns
P2xP5	0.165 ns	0.065 ns	0.115 ns	0.141 ns	0.095 ns	0.118 ns	-2.104 ns	0.244 ns	-0.930 ns	-1.964 ns	5.996 **	2.016 ns
P2xP6	-0.062 ns	-0.387 *	-0.224 ns	-0.044 ns	-0.332 **	-0.188 ns	-8.700 **	-7.582 **	-8.141 **	-4.327 *	-4.396 ns	-4.361 **
P3xP4	-0.557 **	0.145 ns	-0.206 ns		0.145 ns	-0.144 ns	-8.227 **	1.050 ns	-3.589 ns	-3.242 ns	-4.359 ns	-3.800 *
P3xP5	-0.002 ns	0.361 *	0.179 ns	-0.012 ns	0.309 **	0.149 ns	6.534 *	5.677 *	6.105 **	1.948 ns	1.591 ns	1.769 ns
P3xP6	-0.146 ns	0.120 ns	-0.013 ns	-0.080 ns	0.085 ns	0.002 ns	-1.256 ns	2.644 ns	0.694 ns	2.191 ns	0.579 ns	1.385 ns
P4xP5	-0.011 ns	0.122 ns	0.056 ns	0.007 ns	0.092 ns	0.049 ns	4.724 ns	7.687 ns	6.206 **	3.947 ns	8.672 ns	6.310 **
P4xP6	-0.428 *	-0.055 **	-0.241 ns	-0.388 **	-0.072 **	-0.230 *	-6.981 *	0.735 *	-3.123 ns	-3.683 ns	-1.329 ns	-2.506 ns
P5xP6	-0.207 ns	-0.153 ns	-0.180 ns	-0.137 ns	-0.162 ns	-0.150 ns	-2.111 ns	-1.605 ns	-1.858 ns	1.087 ns	2.116 ns	1.602 ns
LSD 5%	0.528	0.437	0.314	0.405	0.336	0.241	8.337	8.007	5.295	6.091	6.598	4.113
(Sij-Sik) 1%	0.707	0.584	0.416	0.541	0.450	0.319	11.154	10.714	7.016	8.149	8.827	5.450
r	0.756 **	0.830 **	0.800 **	0.725 **	0.850 **	0.800 **	0.866 **	0.910 **	0.910 **	0.725 **	0.860 **	0.800 **
				d weiaht				umber of				
P1xP2	-0.500 **	-0.526 **	-0.513 **	-0.442 **	-0.415 **	-0.428 **	-0.731 **	-0.275 ns	-0.503 **	-0.803 **	0.094 ns	-0.355 ns
P1xP3	0.407 **	0.484 **	0.446 **	0.312 *	0.511 **	0.412 **	0.544 *	0.175 ns	0.359 *	0.414 ns	0.243 ns	0.329 ns
P1xP4	-0.023 ns	0.076 ns	0.026 ns	-0.148 ns	0.058 ns	-0.045 ns	-0.489 ns	0.625 **	0.068 ns	-0.203 ns	0.516 **	0.157 ns
P1xP5	0.108 *	0.101 ns	0.104 *	0.110 ns	0.080 ns	0.095 ns	0.340 ns	0.035 ns	0.187 ns	-0.099 ns	-0.016 ns	-0.058 ns
P1xP6	0.826 **	0.661 **	0.744 **	0.630 **	0.616 **	0.623 **	-0.552 *	-0.140 ns	-0.346 *	-0.218 ns	-0.172 ns	-0.195 ns
P2xP3	0.276 **	0.325 **	0.301 **	-0.172 ns	0.375 **	0.101 ns	-0.298 ns	-0.159 ns	-0.228 ns	-0.501 ns	0.016 ns	-0.242 ns
P2xP4	-0.108 *	0.053 ns	-0.027 ns	-0.122 ns	0.031 ns	-0.045 ns	0.802 **	0.991 **	0.897 **	0.605 *	0.852 **	0.729 **
P2xP5	0.953 **	1.012 **	0.983 **	0.900 **	0.950 **	0.925 **	0.232 ns	-0.599 **	-0.184 ns	0.326 ns	-0.590 **	-0.132 ns
P2xP6	0.742 **	0.572 **	0.657 **	0.713 **	0.536 **	0.624 **	1.473 **	0.340 *	0.566 **	1.363 **	-0.359 *	0.502 **
P3xP4	0.510 **	0.107 ns	0.309 **	0.448 **	0.091 ns	0.270 **	-0.589 *	0.208 ns	-0.191 ns	-0.823 **	0.155 ns	-0.334 ns
P3xP5	-0.589 **	-0.692 **	-0.640 **	-0.593 **	-0.673 **	-0.633 **	-0.860 **	0.718 **	-0.071 ns	-0.566 ns	0.626 **	0.030 ns
P3xP6	-0.067 ns	-0.181 **	-0.124 **	-0.030 ns	-0.187 **	-0.109 ns	-0.485 ns	-0.057 ns	-0.271 ns	-0.166 ns	-0.097 ns	-0.131 ns
P4xP5	-0.699 **	-0.647 **	-0.673 **	-0.680 **	-0.610 **	-0.645 **	-0.193 ns	-0.632 ns	-0.413 *	-0.107 ns	-0.545 ns	-0.326 ns
P4xP6	0.319 **	0.154 **	0.237 **	0.173 ns	0.159 *	0.166 *	-0.752 **	-0.707 **	-0.729 **	-0.630 *	-0.614 **	-0.622 **
P5xP6	-0.203 **	-0.331 **	-0.267 **	-0.128 ns	-0.305 ns		-0.789 **	-0.264 **	-0.527 **	-0.786 **	-0.206 **	-0.496 **
LSD 5%	0.133	0.181	0.103	0.371	0.206	0.194	0.746	0.566	0.429	0.852	0.535	0.461
(Sij-Sik) 1%	0.178 0.487 *	0.242	0.137	0.497	0.275	0.258	0.999	0.757	0.569	1.141	0.716	0.611

2-Stress-susceptibility index (S):

2-1-Straw weight per plant and its components :

Salinity is one of the major limitations on crop productivity and crop quality. Hoorn *et al.,* (2002) has shown that the negative effects of high salinity are reducing the growth rate, as well as the plant biomass decreasing, plant stature, leaf area, and nutrient uptake as well as mineral disorders.

Mean performance for straw weight and its components recorded under normal and saline environments as well as their combined data and the susceptibility index (S) are shown in Table (7). S values for straw weight/plant revealed that out of the six genotypes used as parents, P₆ (Daniela) was identified as moderately tolerant genotype as well as high mean performance. Out of the 15 F2 and F3 crosses, four crosses (P1xP6, P1xP6, P3xP6 and P₄xP₆) were showed high or moderate tolerance to salinity in one or both generations as well as superiority for straw weight compared with other crosses, indicating that stress tolerance is due to high yielding potential and low or moderate susceptibility. However the cross P₂xP₆ revealed high tolerance with low of mean performance. In contrast, the cross P₂xP₄ had relatively high straw weight with high susceptibility. For plant height, P3 (S.402/1) and P₄ (S.421/6/4/5) in both generations and P₆ (Daniela) in F₃ only showed moderate or high tolerance to salinity and high tallest than other parents. Out of the 15 F_2 and F_3 crosses, two crosses (P_3xP_6 and P_5xP_6) exhibited high tallest than other crosses but had low susceptibility. In addition, the two crosses (P₃xP₅ and P₃xP₄) showed moderate plant height with moderate tolerance to salinity. Also, for technical stem length, the abovementioned parents (P₃ and P₆) and crosses (P₃xP₄, P₃xP₅, P₃xP₆ and, P₅xP₆) exhibited the same trend as plant height trait. Concerning No. of basal branches/plant, $P_1(S.413/3/3/1)$ and P_2 (S.400/4/4/2) exhibited moderate stress tolerance. Two crosses (P2xP4 and P3xP6) gave high or moderately tolerance to salinity and had high or moderate No. of basal branches/plant.

In general, P₆ exhibited high yielding potential and low susceptibility for straw weight and its two important components (plant height and technical stem length). Also, the cross (P₃xP₆) had high mean performance for straw weight and its components although its low susceptibility in both generations. The cross P₅xP₆ gave high yield potential and low susceptibility in F₃ only for straw weight and its two important components. The results indicated that tolerant parents produced tolerant hybrids. Hence the two crosses (P₃xP₆ and P₅xP₆) identified as tolerant adapted crosses in both generations may be useful as potential breeding material for developing genotypes tolerant to salinity for straw weight and its components. Apparently, tolerance to salinity for straw weight and its components measured by susceptibility index (S), may be simple inherited and can be predicted for parental cross combination for potential parental performance and its tolerance to salinity.

		F,			-	F1				F,				F1		_
aenotype	E,	E,	C.	S	E,	Ε,	C.	S	E	E,	С.	S	E.	Ε,	C.	
Parents			Straw wei								Plant heigh					
P1	5.69 d	4.78 b	5.24 c	0.46			d 4.10			86.13 cd	94.98 bd	1.15		75.27 bc	85.00 ab	
P2	5.93 c	4.29 c	5.11 c	0.80			c 4.07			80.27 d	88.73 d	1.17	95.63 a	76.01 a	85.82 ab	_
P3	7.20 b	3.20 e	5.20 c	1.60		4.70			120.60 a	102.87 a	111.73 a		105.04 a	90.71 a	97.87 a	_
P4	7.61 a	3.73 d	5.67 b	1.47	4.82 c	3.43				91.93 bc	93.93 cd	0.28	91.84 a	85.55 a	88.69 ab	_
P5	5.10 e	3.80 d	4.45 d	0.73		4.68				72.47 e	78.90 e	1.01	86.77 b	66.90 c	76.84 b	_
P6	7.18 b	5.48 a	6.33 a	0.68		4.91			115.47 a	92.67 bc		1.33	103.60 a	86.38 a	94.99 a	_
Mean	6.45	4.21	5.33		5.49	4.11	4.80		103.06	87.72	95.39		96.27	80.14	88.20	
Crosses																
P1xP2	6.73 b	4.93 de	5.83 c-e			3.52				86.67 de	93.90 ef	1.22	101.88 ab	78.72 b-e	90.30 b	
P1xP3	6.31 df	4.10 f	5.20 f	1.96	6.46 a	3.70			107.60 b-e	96.50 bc	102.05 b-d	0.88	99.47 ab	82.17 b-d	90.82 b	
P1xP4	6.19 eq	4.19 f	5.19 f	1.81	5.19 fq	3.57		f 0.96		80.07 f	85.80 q	1.07	95.42 b	74.66 de	85.04 b	
P1xP5	6.70 bc	6.16 a	6.43 b	0.45	6.40 ab	3.64 (\$h 5.02	d 1.32	99.80 e-q	94.33 bc	97.07 de	0.47	94.77 b	75.83 de	85.30 b	
P1xP6	6.59 bc	6.10 a	6.34 b	0.42	6.10 cd	5.08	b 5.59	a 0.51	106.40 c-e	87.27 de	96.83 de	1.53	105.47 ab	84.23 bc	94.85 ab	
P2xP3	6.02 q	4.52 b	5.27 f	1.39		4.47 (od 5.31	b 0.84	117.47 ab	96.28 bc	106.87 b		103.54 ab	84.99 bc	94.26 ab	1
P2xP4	7.82 a	5.55 b	6.68 a	1.62		3.14			102.13 c-f	93.90 c	98.02 c-e	0.69	101.66 ab	72.00 e	86.83 b	
P2xP5	6.11 fq	4.59 e	5.35 f	1.39	5.76 e	2.99		f 1.48	99.53 e-q	92.27 cd		0.62	98.07 ab	76.83 c-e	87.45 b	
P2xP6	5.45 h	5.27 bc	5.36 f	0.18	5.25 fg	4.44			109.97 bc	100.60 ab	105.28 bc	0.73	105.99 ab	81.89 b-d	93.94 b	
P3xP4	6.10 fg	5.48 b	5.79 de	0.57	5.90 c-e	4.30	f 5.10	cd 0.83	109.50 b-d	97.03 bc	103.27 bc	0.97	102.55 ab	85.14 b	93.84 b	
P3xP5	6.33 df	5.05 cd	5.69 e	1.13	5.85 de	4.54	c 5.20	bc 0.68	105.60 c-e	98.27 bc	101.93 b-d	0.59	103.13 ab	86.35 b	94.74 ab	
P3xP6	6.48 cd	5.40 bc		0.93	7.79 a	5.58			127.23 a	105.50 a	116.37 a		117.46 a	99.03 a	108.24 a	
P4xP5	4.96	4.63 e	4.80 g	0.37		3.34		q 1.03		81.73 ef		1.17	91.87 b	77.38 c-e	84.63 b	
P4xP6	6.68 bc	6.05 a	6.37 b	0.52		4.35	e 5.20	bc 0.86	101.63 c-f	92.83 cd		0.74	100.88 ab	84.97 bc	92.93 b	
P5xP6	6.90 bc	6.29 a	6.60 a	0.49		4.95	b 6.34	a 1.10	113.63 ab		105.95 bc		109.19 ab	95.63 a	102.41 a	
Mean	6.36	5.22	5.79		6.10	4.11	4.68		105.86	93.43	92.58		102.09	82.65	85.54	
Parents				sten	n length/plar								branches/			
P1	91.59 b	77.51 cd	84.55 c	1.30	85.43 bc	71.39	b 78.41	b 1.15	1.07 d	1.20 b	1.14 e	0.35	1.21 d	1.15 b	1.18 e	
P2	84.87 c	72.25 d	78.56 c	1.26	82.74 c	69.65	b 7619	bc 1.10	1.73 b	1.40 a	1.57 a	0.62	1.62 c	1.40 a	1.51 a	
	104.54 a								1.10 0							1
P3		92.57 a	98.55 a	0.97	92.14 a		a 88.26	a 0.59	1.80 a	1.13 c	1.47 b	1.19	1.73 b	1.13 b	1.43 b	
P3 P4	84.62 c		98.55 a 83.70 c	0.97 0.18	92.14 a 83.25 bc	84.38 74.12	a 88.26	a 0.59	1.80 a	1.13 c			1.73 b	1.13 b 1.13 b	1.43 b 1.50 a	1
		92.57 a 82.77 bc 65.26 r			83.25 bc	84.38	a 88.26 b 78.69	a 0.59 b 0.76	1.80 a 1.80 a		1.47 b	1.19	1.73 b 1.87 a 1.72 b	1.13 b 1.13 b 1.00 d		
P4	84.62 c	82.77 bc	83.70 c	0.18	83.25 bc 76.70 d	84.38 74.12	a 88.26 b 78.69 c 69.47	a 0.59 b 0.76 c 1.31	1.80 a 1.80 a 1.73 b	1.13 c 1.13 c	1.47 b 1.47 b	1.19 1.19	1.73 b 1.87 a	1.13 b	1.50 a	
P4 P5 P6	84.62 c 75.83 d	82.77 bc 65.26 r	83.70 c 70.55 d	0.18 1.18	83.25 bc 76.70 d	84.38 74.12 62.25 80.33	a 88.26 b 78.69 c 69.47	a 0.59 b 0.76 c 1.31 a 1.13	1.80 a 1.80 a 1.73 b	1.13 c 1.13 c 1.00 e	1.47 b 1.47 b 1.37 c	1.19 1.19 1.36	1.73 b 1.87 a 1.72 b	1.13 b 1.00 d	1.50 a 1.36 c	
P4 P5 P6 Mean	84.62 c 75.83 d 102.09 a	82.77 bc 65.26 r 88.97 ab	83.70 c 70.55 d 95.53 b	0.18 1.18	83.25 bc 76.70 d 95.88 a	84.38 74.12 62.25	a 88.26 b 78.69 c 69.47 a 88.10	a 0.59 b 0.76 c 1.31 a 1.13	1.80 a 1.80 a 1.73 b 1.60 c	1.13 c 1.13 c 1.00 e 1.07 c	1.47 b 1.47 b 1.37 c 1.33 d	1.19 1.19 1.36	1.73 b 1.87 a 1.72 b 1.60 c	1.13 b 1.00 d 1.07 c	1.50 a 1.36 c 1.33 d	
P4 P5 P6	84.62 c 75.83 d 102.09 a	82.77 bc 65.26 r 88.97 ab	83.70 c 70.55 d 95.53 b 85.24	0.18 1.18 1.09	83.25 bc 76.70 d 95.88 a 86.02	84.38 74.12 62.25 80.33	a 88.26 b 78.69 c 69.47 a 88.10 79.85	a 0.59 b 0.76 c 1.31 a 1.13	1.80 a 1.80 a 1.73 b 1.60 c	1.13 c 1.13 c 1.00 e 1.07 c 1.16	1.47 b 1.47 b 1.37 c 1.33 d	1.19 1.19 1.36	1.73 b 1.87 a 1.72 b 1.60 c	1.13 b 1.00 d 1.07 c	1.50 a 1.36 c 1.33 d 1.39	
P4 P5 P6 Mean Crosses	84.62 c 75.83 d 102.09 a 90.59 90.30 c-e	82.77 bc 65.26 r 88.97 ab 79.89	83.70 c 70.55 d 95.53 b	0.18 1.18 1.09	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q	84.38 74.12 62.25 80.33 73.69	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15	a 0.59 b 0.76 c 1.31 a 1.13	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c	1.13 c 1.13 c 1.00 e 1.07 c	1.47 b 1.47 b 1.37 c 1.33 d 1.39	1.19 1.19 1.36 1.07	1.73 b 1.87 a 1.72 b 1.60 c 1.63	1.13 b 1.00 d 1.07 c 1.15	1.50 a 1.36 c 1.33 d	
P4 P5 P6 Mean Crosses P1xP2	84.62 c 75.83 d 102.09 a 90.59 90.30 c-e	82.77 bc 65.26 r 88.97 ab 79.89 78.00 c-e	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q	0.18 1.18 1.09	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h	84.38 74.12 62.25 80.33 73.69 68.71	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-e 1.31	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c	1.13 c 1.13 c 1.00 e 1.07 c 1.16 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c	1.19 1.19 1.36 1.07 1.19	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d	1.13 b 1.00 d 1.07 c 1.15 1.43 c	1.50 a 1.36 c 1.33 d 1.39 1.53 d	
P4 P5 P6 Mean Crosses P1xP2 P1xP3	84.62 c 75.83 d 102.09 a 90.59 90.30 c-e 93.62 b-d	82.77 bc 65.26 r 88.97 ab 79.89 78.00 c-e 78.72 c-e	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e	0.18 1.18 1.09 1.03 1.21 0.81	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh	84.38 74.12 62.25 80.33 73.69 68.71 76.42	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-e 1.31	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.67 d	1.13 c 1.13 c 1.00 e 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b	1.19 1.36 1.07 1.19 0.99	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d 1.72 b	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b	
P4 P5 Mean Crosses P1xP2 P1xP3 P1xP4	84.62 c 75.83 d 102.09 a 90.59 90.30 c-e 93.62 b-d 80.66 q	82.77 bc 65.26 r 88.97 ab 79.89 78.00 c-e 78.72 c-e 72.07 e	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h	0.18 1.18 1.09 1.03 1.21 0.81 1.18	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.98	1.80 a 1.80 a 1.60 c 1.60 c 1.62 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c	1.13 c 1.00 e 1.07 c 1.07 c 1.06 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.60 b 1.53 c	1.19 1.36 1.07 1.19 0.99 1.86	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d 1.72 b 1.59 e	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h	
P4 P5 P6 Crosses P1xP2 P1xP3 P1xP4 P1xP5	84.62 c 75.83 d 102.09 a 90.59 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f	82.77 bc 65.26 r 88.97 ab 78.89 78.00 c-e 78.72 c-e 72.07 e 74.65 de 78.57 c-e	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e	0.18 1.18 1.09 1.03 1.21 0.81 1.18	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.35 b	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34 b 85.97	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.98 bc 0.96	1.80 a 1.80 a 1.60 c 1.60 c 1.62 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c	1.13 c 1.00 e 1.07 c 1.07 c 1.06 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.60 b 1.53 c	1.19 1.36 1.07 1.19 0.99 1.86 1.48	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d 1.72 b 1.59 e 1.82 a	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c	
P4 P5 P6 Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6	84.62 c 75.83 d 102.09 a 90.59 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f 95.73 bc	82.77 bc 65.26 r 88.97 ab 78.89 78.00 c-e 78.72 c-e 72.07 e 74.65 de 78.57 c-e	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e	0.18 1.18 1.09 1.03 1.21 0.81 1.18 1.36 0.61	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.35 b 94.65 bc	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34 b 85.97	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.98 bc 0.96	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c 1.67 d 1.87 b 1.73 c 1.53 f 1.93 a	1.13 c 1.00 e 1.07 c 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.60 b	1.19 1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19 1.12	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d	
P4 P5 P6 Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3	84.62 c 75.83 d 102.09 a 90.59 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d	82.77 bc 65.26 r 88.97 ab 78.00 c-e 78.72 c-e 78.72 c-e 74.65 de 78.57 c-e 86.67 b 76.92 c-e	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c	0.18 1.09 1.03 1.21 0.81 1.18 0.61 0.62	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.35 b 94.65 bc 85.30 qh	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34 b 85.97 c 75.37	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.96 bc 0.96 e 1.22	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c 1.67 d 1.87 b 1.73 c 1.53 f 1.93 a	1.13 c 1.00 e 1.07 c 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.33 d 1.53 c 1.57 b 1.37 d 1.60 b 1.53 c 1.53 c 1.53 c	1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19	1.73 b 1.87 a 1.72 b 1.60 c 1.63 d 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e	
P4 P5 P6 Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4	84.62 c 75.83 d 102.09 a 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq	82.77 bc 65.26 r 88.97 ab 78.00 c-e 78.72 c-e 78.72 c-e 74.65 de 78.57 c-e 86.67 b	83.70 c 70.55 d 95.53 b 86.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 81.39 e-h	0.18 1.09 1.03 1.21 0.81 1.18 0.61 0.62	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 94.65 bc 85.30 gh 88.57 d-h 94.98 bc	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30 65.44 65.13	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34 b 85.97 c 75.37 c 76.85	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.96 e 1.22 de 1.39	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c 1.67 d 1.87 b 1.73 c 1.53 f 1.93 a 1.73 c	1.13 c 1.13 c 1.00 e 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.60 b 1.53 c 1.57 c 1.37 d 1.60 b 1.53 c	1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.82 a 1.77 b 1.59 e 1.89 a 1.66 c	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e 1.79 a	
P4 P5 P6 Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5	84.62 c 75.83 d 102.09 a 90.59 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq 89.60 d-f 95.19 bc	82.77 bc 65.26 r 88.97 ab 78.00 c-e 78.72 c-e 72.07 e 74.65 de 78.57 c-e 86.67 b 76.92 c-e 73.18 e 84.01 bc	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 81.39 e-h 89.60 c	0.18 1.18 1.09 1.03 1.21 0.81 1.36 0.61 1.39 0.89	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 94.65 bc 85.30 gh 88.57 d-h 94.98 bc	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30 65.44 65.13 76.19	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 76.89 c 78.67 b 87.34 b 85.97 c 75.37 c 76.85 b 85.59	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.96 b 0.96 e 1.22 de 1.33 bc 0.96 c 1.22 de 1.34	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.67 d 1.73 c 1.60 c 1.67 d 1.73 c 1.67 d 1.73 c 1.60 c 1.60 c 1.67 d 1.73 c 1.67 d 1.73 c 1.67 d 1.73 c 1.67 d 1.73 c 1.67 d 1.67 d 1.69 c 1.67 d 1.69 c 1.67 d 1.67 d 1.69 c 1.67 d 1.67 d 1.67 d 1.63 c 1.69 c 1.60 c 1.67 d 1.67 d 1.60 c 1.67 d 1.67 d 1.63 c 1.63 c 1.60 c 1.67 d 1.67 d 1.63 c 1.63 c 1.63 c 1.60 c 1.67 d 1.63 c 1.63 c 1.63 c 1.63 c 1.60 c 1.67 d 1.63 c 1.63 c 1.60 c	1.13 c 1.13 c 1.00 e 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.40 d 1.40 d	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.53 c 1.57 b 1.37 d 1.53 c 1.57 c 1.37 d 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.55 c 1.57 b 1.53 c 1.55 c 1.57 c 1.55 c 1.55 c 1.55 c 1.57 c 1.55	1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36 0.60	1.73 b 1.87 a 1.72 b 1.60 c 1.63 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.89 a 1.66 c 1.56 e	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.47 b 1.40 d	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e 1.79 a 1.56 c 1.48 e	
P4 P5 P6 Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4	84.62 c 75.83 d 102.09 a 90.59 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq 89.60 d-f 95.19 bc 98.50 b	82.77 bc 65.26 r 88.97 ab 79.89 78.00 c-e 78.72 c-e 72.07 e 74.65 de 78.57 c-e 86.67 b 76.92 c-e 73.18 e 84.01 bc 87.36 b	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 81.39 e-h 89.60 c 92.93 b	0.18 1.18 1.09 1.03 1.21 0.81 1.18 1.36 0.61 0.62 1.39 0.89 0.89	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.35 b 94.65 bc 95.30 gh 88.57 d-h 94.88 bc 91.12 c-q 91.12 c-q	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30 65.44 65.13 76.19 79.18	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34 b 85.97 c 75.37 c 76.85 b 85.59 b 85.59 b 85.59 b 85.59	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.99 b 0.96 b 0.96 e 1.22 de 1.39 bc 0.96 bc 0.96 bc 0.65	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.67 d 1.77 d 1.77 b 1.73 c 1.53 f 1.93 a 1.73 c 1.50 f 1.93 a 1.73 c	1.13 c 1.13 c 1.00 e 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.40 d 1.07 i 1.33 e 1.20 q 1.20 q 1.53 b 1.40 d 1.27 f	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.50 c 1.37 d 1.63 b 1.57 a 1.63 b 1.57 c 1.37 d 1.53 c 1.57 d 1.53 c 1.57 c 1.37 d 1.53 c 1.57 c	1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36 0.65 0.71	1.73 b 1.87 a 1.72 b 1.60 c 1.63 d 1.72 b 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.82 a 1.75 b 1.59 e 1.89 a 1.66 c 1.66 c 1.63 d 1.72 b 1.60 c 1.63 d 1.72 b 1.63 d 1.72 b 1.59 e 1.63 d 1.75 b 1.59 e 1.63 d 1.75 b 1.59 e 1.63 d 1.75 b 1.59 e 1.87 a 1.65 d 1.75 b 1.59 e 1.89 a 1.65 d 1.75 b 1.59 e 1.89 a 1.65 d 1.75 b 1.59 e 1.89 a 1.65 d 1.75 b 1.59 e 1.89 a 1.65 d 1.65 d 1.65 d 1.65 d 1.75 b 1.59 e 1.89 a 1.65 d 1.65 d 1.55 e 1.45 f 1.65 d 1.55 f 1.55	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.47 b 1.40 d 1.33 e	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e 1.79 a 1.56 c 1.48 e 1.39 q	
P4 P5 P6 Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5	84.62 c 75.83 d 102.09 a 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq 89.60 d-f 95.19 bc 98.50 b 95.01 bc	82.77 bc 65.26 r 88.97 ab 79.89 78.00 c-e 78.72 c-e 72.07 e 74.65 de 78.57 c-e 86.67 b 76.92 c-e 73.18 e 84.01 bc 87.36 b 81.35 b-d	83.70 c 70.55 d 95.53 b 86.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 83.39 e-h 83.90 c 92.93 b 88.18 cd	0.18 1.09 1.03 1.21 0.81 1.18 0.61 0.62 1.39 0.89 0.86 1.09	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.55 b 94.65 bc 94.65 bc 94.65 bc 94.88 bc 91.12 c-q 94.28 bcd	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 77.30 65.44 65.13 76.19 79.18 76.92	a 88.26 b 78.69 c 69.47 a 88.10 79.85 c 80.15 b 83.68 c 76.89 c 78.67 b 87.34 b 85.97 c 75.37 c 75.37 c 76.85 b 85.59 b 85.59 b 85.59 b 85.59 b 85.59	a 0.59 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.96 bc 0.96 e 1.22 de 1.35 bc 1.04 bc 0.69 bc 0.97	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c 1.53 f 1.93 a 1.73 c 1.53 f 1.93 a 1.73 c 1.60 e 1.47 g 1.67 d	1.13 c 1.13 c 1.00 e 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.40 d 1.07 i 1.33 e 1.40 d 1.07 i 1.40 d 1.40 d 1.47 f 1.47 c	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.60 b 1.53 c 1.57 d 1.60 b 1.53 c 1.37 d 1.60 b 1.53 c 1.37 d 1.60 b 1.53 c 1.37 d 1.53 c 1.37 d 1.57 c 1.57 b 1.37 d 1.53 c 1.57 b 1.57 c 1.57 b 1.57 c 1.57 b 1.57 c 1.57 c 1.50 c 1.57 c	1.19 1.19 1.36 1.07 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36 0.60 0.65 0.71 0.62	1.73 b 1.87 a 1.72 b 1.60 c 1.63 d 1.72 b 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.82 a 1.77 b 1.59 e 1.82 a 1.75 b 1.59 e 1.82 a 1.75 b 1.60 c 1.63 d 1.72 b 1.63 d 1.75 b 1.65 c 1.65 d 1.75 b 1.65 d 1.75 b 1.65 c 1.65 d 1.75 b 1.65 d 1.75 b 1.65 c 1.65 d 1.75 b 1.65 d 1.65 d 1.65 d 1.75 b 1.65 d 1.65 d 1.65 d 1.75 b 1.65 d 1.65 d 1.66 c 1.66 c 1.65 d 1.65 d 1.66 d 1.66 d 1.66 d 1.65 d 1.66 d 1.66 d 1.66 d 1.66 d 1.65 d 1.66	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.47 b 1.40 d 1.47 b 1.40 d 1.43 c	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.58 c 1.55 d 1.46 c 1.79 a 1.56 c 1.48 e 1.59 c 1.51 d	
P4 P5 P6 Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5 P3xP6	84.62 c 75.83 d 102.09 a 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq 89.60 d-f 95.19 bc 95.50 bc 95.50 bc 95.01 bc	82.77 bc 65.26 r 88.97 ab 78.00 c-e 78.72 c-e 72.07 e 74.65 de 76.92 c-e 73.18 e 84.01 bc 84.01 bc 81.35 b-d 97.71 a	83.70 c 70.55 d 95.53 b 86.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 81.39 e-h 89.60 c 92.93 b 88.18 cd 103.67 a	0.18 1.19 1.09 1.03 1.21 0.81 1.18 1.36 0.61 0.62 1.39 0.89 0.86 1.09 0.82	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.35 b 94.65 bc 65.30 gh 88.57 d-h 94.98 bc 91.12 c-q 94.28 bc 11.42 c-q 94.28 bc 11.42 c-q 11.42	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30 65.44 65.13 76.19 79.18 76.92 92.09	a 88.266 b 78.69 c 69.47 a 88.10 79.85 c 80.15.5 b 83.68 c 76.89 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 b 85.97 b 85.97 b 85.59 b 85.59 b 85.51 b 85.60 c 80.51 c 76.85 c 76.85 c 76.85 c 76.85 c 78.67 c 78.	a 0.55 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.17 c-e 1.19 b 0.96 b 0.96 e 1.22 de 1.35 b c 0.96 e 1.22 de 1.35 b 0.66 b 0.96 g 0.97 a 0.64	1.80 a 1.80 a 1.73 b 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c 1.53 f 1.93 a 1.73 c 1.53 f 1.93 a 1.73 c 1.67 d 1.87 b 1.73 c 1.53 f 1.93 a 1.73 c 1.67 d 1.73 c 1.67 d 1.73 c 1.67 d 1.73 c 1.73 c 1.67 d 1.73 c 1.73 c 1.73 c 1.73 c 1.67 d 1.73 c 1.73 c 1.67 d 1.73 c 1.67 d 1.67 d 1.73 c 1.67 d 1.67 d 1.73 c 1.67 d 1.67 d 1.73 c 1.67 d 1.67 d 1.67 d 1.67 d 1.73 c 1.67 d 1.67 d 1.47 q 1.67 d 1.67 d 1.47 q 1.67 d 1.67 d	1.13 c 1.13 c 1.00 e 1.07 c 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.20 q 1.80 a 1.53 b 1.40 d 1.47 c 1.47 c	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.53 c 1.57 b 1.37 d 1.63 b 1.53 c 1.37 d 1.63 b 1.50 c 1.37 d 1.50 c 1.37 d 1.63 b 1.50 c 1.57 d 1.63 c 1.57 c 1.57 c 1.57 d 1.57 c 1.57 d 1.57 d 1.57 c 1.57 d 1.57 d 1.47 c	1.19 1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36 0.60 0.65 0.71 0.62 0.00	1.73 b 1.87 a 1.72 b 1.60 c 1.63 d 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.89 a 1.66 c 1.66 c 1.45 f 1.63 d 1.55 e	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.47 b 1.40 d 1.47 b 1.40 d 1.47 b	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e 1.79 a 1.56 c 1.48 e 1.56 c 1.48 e 1.59 d 1.51 d	
P4 P5 P6 Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP6 P3xP6 P4xP5	84.62 c 75.83 d 102.09 a 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq 89.60 d-f 95.19 bc 98.50 b 95.01 bc 109.63 a 85.25 e-q	82.77 bc 65.26 r 88.97 ab 78.00 c-e 78.72 c-e 72.07 e 74.65 de 78.57 c-e 86.67 b 76.92 c-e 73.18 e 84.01 bc 87.36 b 81.35 b-d 97.71 a 73.58 e	83.70 c 70.55 d 95.53 b 86.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 81.39 e-h 89.60 c 92.83 b 88.18 cd 103.67 a 79.41 qh	0.18 1.09 1.03 1.21 0.81 1.18 1.36 0.61 1.39 0.86 1.09 0.86 1.09 0.82 1.04	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 86.70 d-h 96.35 b 94.65 bc 85.30 gh 88.57 d-h 94.98 bc 91.12 c-q 94.28 bd 101.42 a 83.34 h	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30 65.44 65.13 76.19 79.18 76.92 92.09 64.40	a 88.26 b 78.69 c 69.47 a 88.10 79.85 79.85 c 80.15 b 83.68 c 80.15 b 83.68 c 76.89 c 78.67 b 85.97 c 75.37 b 85.59 c 73.87	a 0.55 b 0.76 c 1.31 a 1.13 b-e 1.31 b-d 0.84 de 1.47 c-e 1.45 b 0.96 bc 0.96 c 1.22 de 1.33 bc 1.04 bc 0.65 bc 0.97 a 0.64 e 1.15	1.80 a 1.80 a 1.73 b 1.60 c 1.60 c 1.73 c 1.73 c 1.60 e 1.47 q 1.47 q 1.47 q 1.47 q 1.47 q 1.60 e	1.13 c 1.13 c 1.00 e 1.07 c 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.20 q 1.80 a 1.53 b 1.40 d 1.27 q 1.80 a 1.53 b 1.40 d 1.27 q 1.80 a 1.53 b 1.40 d 1.27 q 1.80 a 1.27 q 1.40 d 1.27 q 1.80 a 1.27 q 1.81 a 1.27 q 1.81 a 1.27 q 1.47 c 1.47 c 1.43 b	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.53 c 1.57 b 1.37 d 1.63 b 1.50 c 1.37 d 1.63 b 1.50 c 1.37 d 1.50 c 1.37 d 1.63 b 1.50 c 1.37 d 1.63 b 1.50 c 1.37 d 1.63 b 1.50 c 1.37 d 1.57 d 1.57 c 1.37 d 1.57 c 1.37 d 1.57 c 1.37 d 1.57 c 1.57 c 1.37 d 1.50 c 1.57 d 1.57 d 1.57 c 1.57 d 1.57 d	1.19 1.19 1.36 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36 0.65 0.71 0.65 0.71 0.62	1.73 b 1.87 a 1.72 b 1.60 c 1.63 d 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.87 a 1.59 e 1.89 a 1.56 c 1.56 c 1.56 c 1.56 c 1.55 e 1.67 c	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.47 b 1.40 d 1.47 b 1.40 d 1.40 d 1.47 b 1.40 d 1.40 d 1.47 b 1.40 d 1.40 d 1.40 d 1.40 d 1.47 b 1.40 d 1.40 d 1.40 d 1.40 d 1.47 b 1.40 d 1.40 d 1.47 b 1.40 d 1.47 b 1.47 b 1.40 d 1.47 b 1.47 b 1.47 b 1.47 c 1.47 c	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e 1.79 a 1.56 c 1.48 e 1.39 d 1.51 d 1.31 d 1.51 d	
P4 P5 P6 Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5 P3xP6	84.62 c 75.83 d 102.09 a 90.30 c-e 93.62 b-d 80.66 q 88.45 d-f 95.73 bc 94.26 b-d 83.77 fq 89.60 d-f 95.19 bc 98.50 b 95.01 bc 109.63 a 85.25 e-q	82.77 bc 65.26 r 88.97 ab 78.00 c-e 78.72 c-e 72.07 e 74.65 de 76.92 c-e 73.18 e 84.01 bc 84.01 bc 81.35 b-d 97.71 a	83.70 c 70.55 d 95.53 b 85.24 84.15 c-q 86.17 c-e 76.37 h 81.55 d-h 87.15 c-e 90.46 c 80.34 f-h 81.39 e-h 80.34 f-h 81.39 e-h 80.34 f-h 81.39 e-h 80.34 f-h 81.39 e-h 80.34 f-h 80.34 f-h	0.18 1.09 1.03 1.21 0.81 1.18 1.36 0.61 1.39 0.86 1.09 0.86 1.09 0.82 1.04	83.25 bc 76.70 d 95.88 a 86.02 91.59 c-q 90.93 d-h 86.53 fh 88.70 d-h 96.35 b 94.65 bc 94.65 bc 94.65 bc 94.98 bc 91.12 c-q 94.28 bd 104.93 a 83.34 h 92.20 b-e	84.38 74.12 62.25 80.33 73.69 68.71 76.42 67.24 68.63 78.32 77.30 65.44 65.13 76.19 79.18 76.92 92.09 64.40 75.51	a 88.266 b 78.69 c 69.47 a 88.10 79.85 c 80.15.5 b 83.68 c 76.89 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 c 78.67 b 85.97 b 85.97 b 85.59 b 85.59 b 85.51 b 85.60 c 80.51 c 76.85 c 76.85 c 76.85 c 76.85 c 78.67 c 78.	a 0.55 b 0.76 c 1.31 a 1.13 b-d 0.84 de 1.17 c-e 1.15 b 0.96 bc 0.96 e 1.22 de 1.35 bc 1.04 e 1.25 b 0.65 b 0.05 b 0.097 a 0.64 e 1.15 b 0.05 b 0.05 b 0.05 b 0.96 c 1.31 b 0.96 b 0.96 c 1.31 b 0.96 c 1.31 c 0.96 c 1.35 b 0.96 c 1.35 b 0.96 c 1.35 c 0.96 c 1.35 b 0.96 c 1.35 b 0.96 c 1.35 b 0.96 c 1.35 c 0.96 c 1.35 b 0.96 c 0.96	1.80 a 1.80 a 1.73 b 1.60 c 1.60 c 1.62 1.73 c 1.73 c 1.73 c 1.73 c 1.73 c 1.67 d 1.87 b 1.73 c 1.53 c 1.50 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.53 c 1.55 c 1.55 c 1.55 c 1.55 c 1.55 c 1.55 c 1.55 c 1.57 d 1.57 c 1.57	1.13 c 1.13 c 1.00 e 1.07 c 1.07 c 1.16 1.33 e 1.40 d 1.07 i 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.20 q 1.80 a 1.53 b 1.40 d 1.47 c 1.47 c	1.47 b 1.47 b 1.37 c 1.33 d 1.39 1.53 c 1.57 b 1.37 d 1.53 c 1.57 b 1.37 d 1.63 b 1.53 c 1.37 d 1.63 b 1.50 c 1.37 d 1.50 c 1.37 d 1.63 b 1.50 c 1.57 d 1.63 c 1.57 c 1.57 c 1.57 d 1.57 c 1.57 d 1.57 d 1.57 c 1.57 d 1.57 d 1.47 c	1.19 1.19 1.36 1.07 1.07 1.19 0.99 1.86 1.48 1.19 1.12 0.36 0.60 0.65 0.71 0.62 0.00	1.73 b 1.87 a 1.72 b 1.60 c 1.63 d 1.63 d 1.72 b 1.59 e 1.82 a 1.77 b 1.59 e 1.89 a 1.66 c 1.66 c 1.45 f 1.63 d 1.55 e	1.13 b 1.00 d 1.07 c 1.15 1.43 c 1.57 a 1.07 h 1.33 e 1.33 e 1.33 e 1.33 e 1.33 e 1.47 b 1.40 d 1.47 b 1.40 d 1.47 b	1.50 a 1.36 c 1.33 d 1.39 1.53 d 1.64 b 1.33 h 1.58 c 1.55 d 1.46 e 1.79 a 1.56 c 1.48 e 1.56 c 1.48 e 1.39 q 1.51 d	

2-2-Seed weight per plant and its components:

Table (8) shows mean performance of six parents and their 15 F₂ and F₃ crosses for seed weight and its components under normal and saline environments as well as their combined data and the susceptibility index (S). out of six genotypes used as parents, P_6 (S.400/4/4/2) was identified as high tolerant with moderate of seed weight in both generations. However, P_3 (S.402/1) gave high seed yield with moderate tolerance in both generations. While, P5 (Gentiana) was identified as moderately tolerant with low seed weight/plant. Out of 15 crosses, three crosses (P₃xP₄, P₃xP₅ and P₃xP₆) had high tolerance but not possess high mean of seed weight per plant, followed by two crosses (P₂xP₄ and P₁xP₂) identified as high yield potential and low or moderate susceptibility. For No. of capsules/plant, P1 (S.413/3/3/1), P2 (S.400/4/4/2) and P₃ (S.402/1) exhibited low or moderate of both stress tolerance and capsules number/plant, but P4 only had high capsules number/plant with low susceptibility. The cross P₃xP₆ is considered the best cross because it is own moderate No. of capsules/plant with high tolerance in F_2 generation. However the cross P_2xP_4 exhibited moderate of both capsules number/plant and susceptibility in F₃ generation. While, the cross P₂xP₅ was identified as high tolerant over both generations but not possess high of capsules number/plant. Concerning 1000-seed weight, P3 exhibited high and moderate tolerance over F₂ and F₃, respectively. The two crosses, P₁xP₃ and P₂xP₃ identified as highly stress tolerate over generations coupled with high of 1000-seed weight. On the other hand, four crosses (P1xP2, P1xP4, P2xP4 and P₂xP₅) had low susceptibility, but had not possess high yield potential for 1000-seed weight. For No. of seeds/capsule, three parental genotypes, P₂, P₅ and P_6 had low or moderate susceptibility over both generations, only two parents (P5 and P6) of them possessed high No. of seeds/capsule. Out of 15 crosses, five crosses (P1xP2, P1xP4, P2xP4, P3xP4 and P3xP5) had low susceptibility over all generations, while two crosses (P2xP4 and P3xP5) of them own high No. of seeds/capsule. Although, the cross P₂xP₆ possessed higher seeds number/capsule than other crosses but exhibited high susceptibility. However, two crosses (P₂xP₃ and P₅xP₆) exhibited low susceptibility only in F₃ generation.

It can be concluded that, P_3 exhibited low or moderate susceptibility to salinity for seed weight and its two important components, No. of capsules/plant and 1000-seed weight. However, P_5 and P_6 had high No. of seeds/capsule with high tolerance to salinity. Out of 15 F_2 and F_3 crosses, two crosses (P_1xP_2 and P_2xP_4) exhibited high or moderate tolerant for seed weight and its components. While, the cross P_3xP_5 exhibited high tolerance to salinity for both seed weight and No. of seeds/capsule. However, P_1xP_4 had high or moderate tolerance for both 1000-seed weigh and No. of seeds/capsule.

		F,				F,				F,				F,		
ienotvoe	E.		C.	S	E,	E.	C.	S	E.	F.	C.	S	E,	E.	С.	S
arents	-	- /	Seed we				- ¥I	- Y	-	•	Number o		sules/plan		- 21	Ť
M M	1.91 c	1.21 c	1.56 c	0 01	1.57 c	0.97 c	1.27 0	0 1.05	31.26 b	23.81 ab	27.54 a	0.67	24.85 b	18.60 a	21.73 b	0.67
2	1.62 e	1.39 b		0.36	1.36 d	1.13 b	1.24 (29.68 b	24.38 ab	27.03 a	0.50	24.03 b	17.09 a	20.93 b	0.83
- <u>2</u> 03	2.35 b	1.59 a		0.30		1.41 a			30.06 b	24.30 au 26.29 a	28.18 a	0.30	24.70 b 27.55 b	19.83 a	20.55 b 23.69 a	0.03
rj 14					1.93 0					20.23 a			27.00 0		20.03 8	4.07
P4	2.66 a	1.04 d	1.85 b	1.51	2.19 a	0.95 c	1.57		44.74 a	19.74 bc	32.24 a	1.58	33.57 a	17.66 a	25.62 a	1.27
P5	1.36 c	0.89 e		0.87	1.06 e		0.94 e		24.36 c	17.02 c	20.69 b	0.85	19.63 c	9.80 b	14.71 c	1.34
P6	1.72 c	0.82 f	1.27 d	1.30		0.75 e	1.05 (1.23	39.41 a	17.62 c	28.52 a	1.56	19.04 c	10.71 b	14.87 c	1.17
Mean	1.94	1.16	1.55		1.58	1.01	1.29		33.25	21.48	27.36		24.90	15.61	20.26	
Crosses																
P1xP2	2.25 d	2.14 a	2.19 b	0.23	1.86 c	1.73 cd		cd 0.54	42.08 a	41.58 a	41.83 a	0.08	33.20 a	32.32 a	32.76 a	0.11
P1xP3	2.57 a	1.99 b	2.28 a	1.11	2.06 a	1.78 b	1.92 8		34.83 b	30.37 bc	32.60 b-d	0.86	28.85 b-d	26.60 b	27.72 bc	0.31
P1xP4	2.30 cd	1.22	1.76 d	2.29	1.79 d	1.04 i	1.42 (3.20	42.85 a	20.48 fg	31.67 b-e		32.95 a	19.92 de	26.44 bc	1.58
P1xP5	1.66 h	1.27 h	1.46 h	1.15	1.38 g	1.16 h	1.27		28.12 c-e	23.64 d-f	25.88 ef	1.07	24.77 fg	15.69 f-h	20.23 ef	1.46
P1xP6	2.04 e	1.54 f		1.20		1.88 a	1.93 8		37.34 ab	36.61 ab	36.98 ab		21.51 g	14.52 f-h	18.01 fg	1.30
P2xP3	2.34 b	1.78 d		1.18			1.83 (28.30 b-d			32.02 ab	23.01 b-d	27.51 bc	1.12
P2xP4	2.32 cd			0.79				oc 0.65	35.03 b	29.85 bc	32.44 b-d		31.07 a-c	24.56 hc	27.82 bc	0.84
P2xP5	1.80 f	1.42 g		1.04		1.30 q	1.40 (26.31 ef	25.00 b0	25.78 ef		27.43 d-f	26.47 h	26.95 bc	0.14
P2xP6	1.541	0.92 k	1.23 i	1.98	1.28 h	0.83 k	1.40 i		20.31 61 20.36 f	16.69 g	18.53 g	1.21	17.23 h	11.93 h	14.58 g	1.23
P3xP4	1.76 a	1.74 e		0.08		1.62 e	1.63 6		20.30 28.05 c-e	27.86 b-e				16.22 e-g	22.33 de	1.71
						1.02 0	1.00 0				27.30 C-T					
P3xP5	1.86 f	1.80 d		0.16		1.70 d	1.73 0	1 0.25	35.38 b	31.72 b		0.70	27.84 d-f	20.73 CO	24.28 cd	1.02
P3xP6	1.61 h	1.57 f		0.12		1.43 f	1.44 1	fq 0.14	28.24 c-e	27.96 b-e	28.10 c-f		25.24 e-f		20.41 ef	1.53
P4xP5	1.79 q		1.53 q			1.15 h	1.31 H		38.63 ab	30.18 bc	34.41 b	1.47	31.72 a-c		29.41 b	0.58
P4xP6	1.34 j	1.05 j		1.07		0.94 i	0.99 j	0.74	27.57 de	22.50 e-q	25.04 ef	1.24	21.26 q	12.94 qh	17.10 fq	1.56
P5xP6	1.06 k	0.84	0.95 f	1.02	0.88 j	0.76	0.82	(1.10			22.20 fq	1.51		14.95 f-h		1.04
Mean	1.88	1.50	1.63		1.59	1.39	1.44		32.29	27.49	28.41		26.92	20.17	22.37	
Parents			<u>1000-see</u>										ds/capsule			
P1	8.47 b	8.38 c	8.43 c			8.05 c	8.39 (7.23 d	6.10 d	6.67 e	1.43	7.23 d	5.60 d	6.42 d	1.48
P2	8.66 b	8.47 b		1.43		8.13 b	8.44		7.33 d	6.63 c	6.98 c	0.87	6.33 e	6.06 c	6.20 e	0.28
P3					10.20 a	9.73 a	9.97 8		7.77 c	6.03 d	6.90 d	2.04	7.77 c	5.56 e	6.66 c	1.87
P4	7.48 c	7.37 a		0.91	7.58 d	7.07 d	7.33 (1.19	7.93 c	7.13 c	7.53 c	0.92	7.81 c	6.55 c	7.18 c	1.06
P5	6.56 d	6.39 e	6.47 e	1.62	6.33 e	6.13 e	6.23 6	e 0.55	8.50 b	8.19 b	8.35 b	0.33	8.60 b	7.51 b	8.06 b	0.84
				1.00	5.18 f	5.03 f	5.11 f	f 0.53	9.53 a	8.93 a	9.23 a	0.58	8.80 a	8.18 a	8.49 a	0.46
P6	5.25 e	5.14 f	5.20 f	1.33	1 0.101				3.33 a	0.00 0						
P6 Mean	5.25 e 7.76	5.14 f 7.64	5.20 f 7.70	1.33	7.80	7.36	7.58		8.05 a	7.17	7.61		7.76	6.58	7.17	
Mean Crosses		7.64	7.70		7.80	7.36	7.58		8.05	7.17	7.61		7.76		7.17	
Mean Crosses			7.70	1.33					8.05 6.20			0.28		6.58 6.09 h		0.09
Mean	7.76	7.64	7.70	0.58	7.80	7.36	7.58	y 0.89	8.05	7.17	7.61	0.28 1.92	7.76		7.17	0.09
Mean Crosses P1xP2 P1xP3	7.76 8.61 e	7.64 8.46 e 9.96 b 8.09 a	7.70 8.53 e 9.99 b	0.58	7.80 8.63 d	7.36 8.25 e	7.58 8.44 c	d 0.89 a 0.49	8.05 6.20	7.17 6.10 h	7.61 6.15		7.76 6.15 i	6.09 h	7.17 6.12 i 6.75 q 6.86 fg	
Mean Crosses P1xP2	7.76 8.61 e 10.02 b	7.64 8.46 e 9.96 b 8.09 a	7.70 8.53 e 9.99 b 8.12 h	0.58 0.20 0.27	7.80 8.63 d 9.88 a	7.36 8.25 e 9.64 b	7.58 8.44 o 9.76 a	d 0.89 a 0.49	8.05 6.20 7.40 f	7.17 6.10 h 6.57 q	7.61 6.15 6.98 q	1.92	7.76 6.15 i 7.28 e	6.09 h 6.22 q	7.17 6.12 i 6.75 q 6.86 fg	1.40 0.05 1.02
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5	7.76 8.61 e 10.02 b 8.15 i 7.72 i	7.64 8.46 e 9.96 b 8.09 q 7.55 j	7.70 8.53 e 9.99 b 8.12 h 7.63 k	0.58 0.20 0.27 0.72	7.80 8.63 d 9.88 a 8.04 h 7.66 i	7.36 8.25 e 9.64 b 7.76 q 7.24 k	7.58 8.44 (9.76 a 7.90 (7.45 j	d 0.89 a 0.49 a 0.70 1.10	8.05 6.20 I 7.40 f 7.57 e 7.67 d	7.17 6.10 h 6.57 q 7.47 c 7.10 e	7.61 6.15 6.98 q 7.52 d 7.38 e	1.92 0.23 1.26	7.76 6.15 i 7.28 e 6.88 f 7.28 e	6.09 h 6.22 q 6.85 b 6.52 d	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef	1.40 0.05 1.02
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i	0.58 0.20 0.27 0.72 1.41	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i	7.58 8.44 (9.76 a 7.90 (7.45 j 7.81 b	d 0.89 a 0.49 a 0.70 1.10 n 1.18	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q	7.17 6.10 h 6.57 q 7.47 c 7.10 e 7.10 e	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f	1.92 0.23 1.26 0.12	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef 6.99 d-f	1.40 0.05 1.02 1.22
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP4 P1xP5 P1xP6 P2xP3	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a	7.64 8.46 e 9.96 b 8.09 q 7.55 j 7.89 h 10.00 a	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a	0.58 0.20 0.27 0.72 1.41 0.39	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a	7.58 8.44 (9.76 (7.90 (7.45) 7.81) 9.73 (d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h	7.17 6.10 h 6.57 q 7.47 c 7.10 e 7.10 e 6.30 h	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h	1.92 0.23 1.26 0.12 1.02	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.06 h	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef 6.99 d-f 6.23 i	1.40 0.05 1.02 1.22 0.49
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP5 P1xP6 P2xP3 P2xP4	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f	0.58 0.20 0.27 0.72 1.41 0.39 0.14	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f	7.58 8.44 c 9.76 a 7.90 c 7.45 i 7.81 i 9.73 a 8.06 e	d 0.89 a 0.49 d 0.70 1.10 n 1.18 a 0.10 e 0.62	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b	7.17 6.10 h 6.57 q 7.47 c 7.10 e 7.10 e 6.30 h 7.90 a	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b	1.92 0.23 1.26 0.12 1.02 0.21	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.06 h 7.25 a	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef 6.99 d-f 6.23 i 7.44 b	1.40 0.05 1.02 1.22 0.49 0.49
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P1xP6 P2xP3 P2xP4 P2xP5	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.80 d	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d	0.58 0.20 0.27 0.72 1.41 0.39 0.14 0.51	7.80 8.63 d 9.88 a 8.04 h 7.66 j 8.04 h 9.75 a 8.18 q 8.56 e	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d	7.58 8.44 (9.76 (7.90 (7.45 i 9.73 (8.06 (8.44 (d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q	7.61 6.15 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f	1.92 0.23 1.26 0.12 1.02 0.21 2.59	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef 6.99 d-f 6.23 i 7.44 b 6.87 fq	1.40 0.05 1.02 1.22 0.49 0.49 2.16
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP6 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.80 d 8.39 f	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q	0.58 0.20 0.27 0.72 1.41 0.39 0.14 0.51 1.53	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h	7.58 8.44 (9.76 (7.90 (7.45 i 9.73 (8.06 (8.44 (7.96 i	d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36	8.05 6.20 I 7.40 f 7.57 e 7.57 d 7.57 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q 6.53 q	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef 6.99 d-f 6.23 i 7.44 b 6.87 fq 7.74 a	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P2xP6 P3xP4	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.30 d 8.39 f 9.42 c	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h 8.81 c	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q 9.12 c	0.58 0.20 0.27 0.72 1.41 0.39 0.14 0.51 1.53 2.13	7.80 8.63 d 9.88 a 8.04 h 7.66 j 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f 9.25 c	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h 8.46 c	7.58 8.44 (9.76 (7.90 (7.45 i 9.73 (8.06 (8.44 (7.96 i 8.85 (d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36 c 1.73	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a 7.16 q	7.17 6.10 h 6.57 q 7.47 c 7.10 e 7.10 e 6.30 h 7.90 a 6.53 q 6.53 q 6.97 f 7.13 e	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a 7.15 f	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86 0.06	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a 6.57 q	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e 6.53 d	7.17 6.12 i 6.75 q 6.86 fq 6.90 ef 6.99 d-1 6.23 i 7.44 b 6.87 fq 7.74 a 6.55 h	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85 0.05
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.30 d 8.39 f 9.42 c 7.75 k	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h 8.81 c 7.45 k	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q 9.12 c 7.60 l	0.58 0.20 0.27 0.72 1.41 0.39 0.14 0.51 1.53 2.13 1.30	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f 9.25 c 7.56 k	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h 8.46 c 7.15 l	7.58 8.44 c 9.76 a 7.90 c 7.45 i 9.73 a 8.06 c 8.44 c 7.96 i 8.85 c 7.36 i	d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36 c 1.73 < 1.11	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a 7.16 q 7.88 c	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q 6.53 q 6.97 f 7.13 e 7.87 b	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a 7.15 f 7.87 c	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86 0.06 0.03	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a 6.57 q 7.25 e	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e 6.53 d 7.21 a	7.17 6.12 i 6.75 q 6.86 fq 6.99 d-f 6.23 i 7.44 b 6.87 fq 7.74 a 6.55 h 7.23 c	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85 0.05 0.05
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P2xP6 P3xP4 P3xP5 P3xP6	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.30 d 8.39 f 9.42 c 7.75 k 8.08 j	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h 8.81 c 7.45 k 7.45 k 7.74 i	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q 9.12 c 7.60 l 7.91 j	0.58 0.20 0.27 0.72 1.41 0.39 0.14 0.51 1.53 2.13 1.30 1.39	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f 9.25 c 7.56 k 7.99 i	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h 8.46 c 7.15 l 7.43 j	7.58 8.44 c 9.76 a 7.90 c 7.45 i 9.73 a 8.06 a 8.44 c 7.96 i 8.85 c 7.36 i 7.71 i	d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36 c 1.73 < 1.11 1.43	8.05 6.20 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a 7.16 q 7.88 c 7.33 f	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q 6.97 f 7.13 e 7.87 b 7.27 d	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a 7.15 f 7.87 c 7.30 f	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86 0.06 0.03 0.15	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a 6.57 q 7.25 e 7.60 b-d	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e 6.53 d 7.21 a 6.65 c	7.17 6.12 i 6.75 q 6.86 fq 6.99 d-f 6.23 i 7.44 b 6.87 fq 7.74 a 6.55 h 7.23 c 7.12 cd	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85 0.05 0.05 1.22
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5 P3xP6 P4xP5	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.80 d 8.39 f 9.42 c 7.75 k 8.08 j 6.21 n	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h 8.81 c 7.45 k 7.74 i 6.03 m	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q 9.12 c 7.60 l 7.91 i 6.12 n	0.58 0.20 0.27 0.72 1.41 0.39 0.14 0.51 1.53 2.13 1.30 0.95	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f 9.25 c 7.56 k 7.99 i 6.10 m	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h 8.46 c 7.15 l 7.43 j 5.79 n	7.58 8.44 c 9.76 a 7.90 c 7.45 i 9.73 a 8.06 a 8.44 c 7.96 i 8.84 c 7.36 k 7.36 k 7.36 k 7.71 i 5.94 r	d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36 c 1.73 c 1.73 c 1.11 1.43 n 1.03	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a 7.16 q 7.88 c 7.33 f 7.40 f	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q 6.97 f 7.13 e 7.87 b 7.27 d 6.97 f	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a 7.15 f 7.87 c 7.30 f 7.18 f	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86 0.06 0.03 0.15 1.00	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a 6.57 q 7.25 e 7.60 b-d 7.50 cd	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e 6.53 d 7.21 a 6.65 c 6.39 f	7.17 6.12 i 6.75 q 6.86 fq 6.99 d-f 6.99 d-f 6.23 i 7.44 b 6.87 fq 7.74 a 6.55 h 7.23 c 7.12 cd 6.95 ef	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85 0.05 0.05 1.22 1.44
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5 P3xP6 P4xP5 P4xP6	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.80 d 8.39 f 9.42 c 7.75 k 8.08 i 6.21 n 7.04 m	7.64 8.46 e 9.96 b 8.09 q 7.55 j 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h 8.81 c 7.45 k 7.74 i 6.03 m 6.61 l	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q 9.12 c 7.60 l 7.91 i 6.12 n 6.83 m	0.58 0.20 0.27 0.72 1.41 0.39 0.14 1.53 2.13 1.30 1.39 0.95 1.98	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f 9.25 c 7.56 k 7.99 i 6.10 m 6.81 l 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <th1< th=""> <th1< th=""> 1 <</th1<></th1<>	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h 8.46 c 7.15 l 7.43 i 5.79 n 6.35 m	7.58 8.44 (9.76 (7.90 (7.45 i 7.81) 9.73 (8.06 (8.44 (7.96 i 8.85 (7.36) 7.71 i 5.94 r 6.58	d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36 c 1.73 c 1.11 1.43 n 1.03 n 1.03	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a 7.16 q 9.00 a 7.16 q 7.88 c 7.33 f 7.40 f	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q 6.97 f 7.13 e 7.87 b 7.27 d 6.97 f 7.07 e	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a 7.15 f 7.87 c 7.30 f 7.18 f 7.10 fq	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86 0.06 0.03 0.15 1.00 0.17	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a 6.57 q 7.25 e 7.60 b-d 7.50 cd 7.28 e	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e 6.53 d 7.21 a 6.65 c 6.39 f 6.48 de	7.17 6.12 i 6.75 q 6.86 fq 6.99 d-f 6.99 d-f 6.23 i 7.44 b 6.87 fq 7.74 a 6.55 h 7.23 c 7.12 cd 6.95 ef 6.88 fq	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85 0.05 0.05 1.22 1.44 1.07
Mean Crosses P1xP2 P1xP3 P1xP4 P1xP5 P1xP6 P1xP6 P2xP3 P2xP4 P2xP5 P2xP6 P3xP4 P3xP5 P3xP6 P3xP6 P3xP5 P3xP6 P4xP5	7.76 8.61 e 10.02 b 8.15 i 7.72 i 8.24 h 10.12 a 8.30 q 8.80 d 8.39 f 9.42 c 7.75 k 8.08 j 6.21 n	7.64 8.46 e 9.96 b 8.09 q 7.55 i 7.89 h 10.00 a 8.27 f 8.66 d 8.00 h 8.81 c 7.45 k 7.74 i 6.03 m	7.70 8.53 e 9.99 b 8.12 h 7.63 k 8.07 i 10.06 a 8.29 f 8.73 d 8.20 q 9.12 c 7.60 l 7.91 i 6.12 n	0.58 0.20 0.27 0.72 1.41 0.39 0.14 1.53 2.13 1.30 1.39 0.95 1.98	7.80 8.63 d 9.88 a 8.04 h 7.66 i 8.04 h 9.75 a 8.18 q 8.56 e 8.24 f 9.25 c 7.56 k 7.99 i 6.10 m	7.36 8.25 e 9.64 b 7.76 q 7.24 k 7.57 i 9.70 a 7.93 f 8.31 d 7.69 h 8.46 c 7.15 l 7.43 j 5.79 n	7.58 8.44 c 9.76 a 7.90 c 7.45 i 9.73 a 8.06 a 8.44 c 7.96 i 8.84 c 7.36 k 7.36 k 7.36 k 7.71 i 5.94 r	d 0.89 a 0.49 a 0.70 1.10 n 1.18 a 0.10 e 0.62 d 0.60 f 1.36 c 1.73 c 1.11 1.43 n 1.03 n 1.03	8.05 6.20 I 7.40 f 7.57 e 7.67 d 7.15 q 6.70 h 8.00 b 7.70 d 9.00 a 7.16 q 7.88 c 7.33 f 7.40 f	7.17 6.10 h 6.57 q 7.47 c 7.10 e 6.30 h 7.90 a 6.53 q 6.97 f 7.13 e 7.87 b 7.27 d 6.97 f	7.61 6.15 I 6.98 q 7.52 d 7.38 e 7.13 f 6.50 h 7.95 b 7.12 f 7.98 a 7.15 f 7.87 c 7.30 f 7.18 f	1.92 0.23 1.26 0.12 1.02 0.21 2.59 3.86 0.06 0.03 0.15 1.00	7.76 6.15 i 7.28 e 6.88 f 7.28 e 7.46 de 6.39 h 7.64 b-d 7.73 b 9.07 a 6.57 q 7.25 e 7.60 b-d 7.50 cd	6.09 h 6.22 q 6.85 b 6.52 d 6.52 d 6.52 d 6.06 h 7.25 a 6.01 h 6.40 e 6.53 d 7.21 a 6.65 c 6.39 f	7.17 6.12 i 6.75 q 6.86 fq 6.99 d-f 6.99 d-f 6.23 i 7.44 b 6.87 fq 7.74 a 6.55 h 7.23 c 7.12 cd 6.95 ef	1.40 0.05 1.02 1.22 0.49 0.49 2.16 2.85 0.05 0.05 1.22 1.44

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تحليل الهجن التبادلية لبعض التراكيب الوراثية في الكتان تحت ظروف البيئة العادية والملحية حسين مصطفي حسين أبوقايد ، عفاف السيد عبد الواحد زهانة و مهدى محمد مهدى حسين

قسم بحوث محاصيل الألياف - معهد المحاصيل الحقلية - مركز البحوث الزراعية- الجيزة

أجريت هذه الدراسة بهدف تقدير القدرة على الائتلاف والفعل الجيني لمحصىولي القش والبذرة ومكوناتهما في الكتان تحت ظروف البيئة العادية والملحية من خلال تقييم 15 هجين ناتجة من التهجين بين ستة أباء (1= س1/3/3/413، 2= س2/4/4/40، 3= س1/402، 3= جنتيانـا ، 6= دانيال) باستعمال نظام التزاوج النصف دائري . تم تقييم الــــ6 آبــاء، 15 هجين في الجيلين الثاني والثالث في في محطّتي البحوث الزراعية بكل من ايتاي البارود- م البحيرة (بيئة عادية) وتاج العز- م الدقهلية (بيئة ملَّحيةً) في موسمين متتاليين (2006/2005- 2007/2006) في تجربة قطاعات كاملة العشوائية ذات ثلاث مكررات وتشير النتائج إلى أن تأثير العوامل الوراثية المضيفة أكبر من الغير مضيفة في توريث صفات وزن القش وأهم مكونين (الطول الكلي والطول الفعال) وكذلك لصفات وزن البذور ومكوناته في كل من الجيلين الثاني والثالث تحت ظروف البيئة العادية والملحية ، بينما تأثير كل من العوامل المضيفة والغير مضيفة له نفس الأثر في توريث صفة عدد الأفرع القاعدية للنبات، كما تشير نتائج التفاعل بين كلا من القدرة العامة والقدرة الخاصة على الائتلاف مع البيئة أن كلا من العوامل المضيفة والغير مضيفة قد تأثرت بالظروف البيئية، بينما كان تأثر العوامل المضيفة بالظروف البيئية أكبر من الغير مضيفة لصفات وزن القش للنبات وأهم مكوناته. كما تشير النتائج إلى أن الأبويين س 1/402، دانيال أظهر ا قدرة عامة عالية علي الائتلاف لمعظم صفات محصول القش ومكوناته ماعدا صفة عدد الأفرع القاعدية للنبات ، كذلك الأبويين س1/3/413، س 1/402 أظهرا قدرة عامة عالية علي الاستلاف لصفات محصول البذرة ووزن الألف بذرة وعدد الكبسولات/نبات بينما الأب س2/4/4/00 لصفة وزن الألف بذرة فقط. كما تشير نتائج القدرة الخاصة على الائتلاف أن الهجينين (3 x 6 ، 5 x 6) أظهرا قدرة خاصة على الائتلاف لصفات وزن القش ،والطول الكلي ،والطول الفعال وأن أب واحد على الأقل كان لـه قدرة عالية عامة على الائتلاف لتلك الصفات، بينما الهجين 1×2 أظهر قدرة خاصبة على الائتلاف لوزن البذور وكذلك الهجين (1×6) لوزن الألف بذرة وأن اباء هذين الهجينين عبارة عن (عالى ×منخفض) للقدرة العامة على الائتلاف.

كما تشير النتائج الخاصة بتحمل الملوحة أن الأب دانيال أظهر حساسية منخفضة للملوحة مع محصول عالي من وزن القش والطول الكلي والطول الفعال ، كذلك الهجين (3×6)) أعطى محصول عالي من وزن القش ومكوناته بالإضافة الى حساسية منخفضة للملوحة في كل من الجيل الثاني والثالث ، كذلك الهجين (5×6)) أعطى محصول عالي من القش والطول الكلي والطول الفعال مع حساسية منخفضة للملوحة وذلك في الجيل الثالث فقط ، ويستنتج من ذلك أن الآباء المتحملة للملوحة فع كل من الجيل الثاني ولثالث ، كذلك فان هذان الهجينان (3×6) ، 5×6) والتي صنفت على أنها متحملة للملوحة أعطت هجن متحملة للملوحة. كمواد تربية نحصل منها على تراكيب وراثية عالية في محصول القش ومكوناته ومتحملة للملوحة. كما أظهرا الأبوان جنتيانا ودانيال تحمل عالي للملوحة مع قدرة محصول القش ومكوناته ومتحملة للملوحة. بينما الهجينين (1×2 ، 2×4)) أظهر اقدرة عالية أو متوسطة لتحمل الملوحة لصفات محصول وزن البذور ومكوناته، بينما (3×2)) أظهر تحمل عالي للملوحة مع قدرة محصولية عالية لصفة عدد البذور بالكبسولة. بينما ومكوناته، بينما (3×2) أظهر تحمل عالي للملوحة مع قدرة محصولية واز ون البذور وعد الكسولة ون البذور ومكوناته، بينما (3×5) أظهر تحمل عالي للملوحة لكل من صفتي وزن البذور وعدد البذور بالكبسولة.