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STABILITY OF SOME EXOTIC HULL-LESS BARLEY GENOTYPES ACROSS VARIABE INVIRONMENTS IN EGYPT*

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ABSTRACT

This study was conducted at five Agriculture Experimental Stations in two consecutive seasons to study stability of nine hull-less barley genotypes. Estimate of stability parameters for yield and yield components showed that hull-less barley genotypes differed in the stability performance. On the other hand, the study revealed difference among the studied characters in stability performance for each genotype. High estimate of hertiability in broad sense was calculated for 1000 kernel weight (93.7%), number of kernels/spike, (91.3%), spike kernels weight (76.5), and grain yield (73.7%). The study recommended two genotypes to be grown beside the released hull-les barley cultivars and/or used them in the crossing blocs of the breeding program.

Key words: ***Hull-less barley, Stability, Heritability***

INTRODUCTION

Hull-less barley (*Hordeum vulgare* L.) is a new cereal crop gained wide iterest as a human food crop in Egypt. In addition it could be used as deul purpose crop for food and feed. One of the main important issue for any breeding program is increasing the genetic diversity either by exploring the variations by crossing parents with different and wide genetic base or by introducing genetic collections to be evaluated under the local environments and using the adapted and stable genotypes either for developing new cultivars or as new parents in the national breeding program. There for, this study well concentrate on investigating stability and heritability for nine exotic genotypes. In this respect many scientists studed stability and heritability parametars uner different environmental conditions. EL-Sayed *et al* (2003a), found that the average performance over environments and stability parameters of grain yield in irrigated lands for the new hull-less barley varieties (Giza 129 and Giza 130) gave the highest stability. On the other hand, regression coefficient (b) and the mean square of deviation from regression (s^2d) showed that G.129 and G.130 were more stable with b value not significantly different from 1 and s^2d not significantly different from 0 and they had the highest grain yield compared to the other genotypes in the study. EL-Sayed *et al* (2003b), studying the crop stability under fluctuated environment, in rainfed areas of Egypt found that means of grain yields, and their stability parameters i.e. (b) and (s^2d) for the two barley cultivars Giza 130 and Giza 131 were more stable with b value not significantly different from 1 and s^2d not significantly different from 0.

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Deloqa *et al* (1988), in their recurrent selection experiment for grain yield in barley, reported that broad sense heritability for 1000-kernel weight was high, while grain yield had a relatively low heritability value. Abd EL-Moneim and Ammar (1998) evaluated the performance of eleven barley genotypes underrain conditions in North Sinai and estimated the heritability of barley grain yield. They stated that the highest broad sense heritability over three seasons were recorded for number of grains/spike and number of spikes/plant (76.3% and 68.5%, respectively), while the lowest one for 1000-kernel weight was (21.6%). They showed that selection for high number of grains/spike and number of spikes/plant could be effective for improvement of barley genotypes under limited water conditions. Khattab and Afiah (1999), examined twenty-one barley genotypes, six local varieties (hulled grain) and fifteen naked grain exotic genotypes under normal and salinity conditions to study genetic variability and heritability under such stress conditions. They found in hulled grain under the two conditions high broad sense heritability values (83.6%), (83.3%) and (93.3%) for grain yield per plant, number of spikes/plant and grain yield/m^2, respectively. They also found low broad sense heritability (43.3%) and (32.7%) for 1000-kernel weight and plant height, respectively. In addition, they reported moderate broad sense heritability (65.3%) for harvest index only. El-Bawab and El-Hag (2003), evaluated twenty four barley genotypes selected from ICARDA under five various environments at Sakha, Serw, Hamol and Giza (2001/2002) and only at Giza (2002/2003). Estimate of broad sense heritability for all studied traits of 24 barley genotypes showed high heritability for grain yield, heading date, maturity date, plant height, number of kernels/spike and 1000 kernel weight (0.62, 0.92, 0.83, 0.87, 0.97, 0.93), respectively. They also found moderate broad sense heritability for number of spikes/m^2 (0.50).

The main objective of this study were to estimate stability and heritability parameters for nine hull-less barley genotypes to be used as tool for selecting widly adapted varieties

MATERIALS AND METHODS

Ten field experiments were conducted to evaluate nine hull-less barley genotypes obtained from different sources (Table 1) at five locations in two growing seasons 2000/2001 and 2001/2002. The locations were selected to represent most agroclimatological differencess in Egypt i.e., precipitation, mean day temperature, relative humidity, wind speed and soil types (Tables 2 and 3). Three of these sites were in old lands, while the other two sites were in the new lands.

Table 1. Hull-less barley genotypes, names/pedigree and origin.

Entry number	Name / Pedigree	Origin
1	ATACO/ACHIRA // HIGO. (sel.1)	ICARDA/CIMMYT Program
2	ATACO/BERMEJO//HIGO.	ICARDA/CIMMYT Program
3	ATACO/ACHIRA // HIGO.(sel.2)	ICARDA/CIMMYT Program
4	BF891 M-614.	ICARDA Program
5	ICNB93-330.	ICARDA Program
6	CM67-B-CENTENO//CAM-B/3/ROW906.73/4/GLORIA-BAR/COME-B/5/FALCON-BAR /6/LINO.(sel.1)	ICARDA/CIMMYT Program
7	LHB 93/1.(PLAISNT)	ICARDA Program
8	CM67-B/CENTENO//CAM-B/3/ROW906.73/4/GLORIA-BAR/COME-B/5/FALCON-BAR /6/LINO.(sel.2)	ICARDA/CIMMYT Program
9	CM67-B/CENTENO//CAM -B/3ROW906.73 /4/GLORIA-BAR/COME-B/5/FALCON-BAR /6/LINO. (sel.3)	ICARDA/CIMMYT Program

Table 2. Seasonal averages of some agroclimatological data in the tested sites[1].

Locations	Season	Relative Humidity %	Average temp. (C°)	Mean Max. temp. (C°)	Mean Min. temp. (C°)	Mean Night temp. (C°)	Seasonal rainfall (mm)
Old lands							
Sakha	2000/2001	65.8	15.8	21.2	8.4	15.0	50.0
Sakha	2001/2002	68.8	13.8	19.5	8.1	12.9	80.0
Gemmeiza	2000/2001	65.0	17.9	23.6	12.1	15.8	60.0
Gemmeiza	2001/2002	65.2	17.6	22.7	12.6	12.4	77.0
Mallawy	2000/2001	56.3	16	23.4	8.6	13.5	13.5
Mallawy	2001/2002	56.2	16	22.8	9.1	10.3	16.4
New Lands							
Ismailia	2000/2001	59.4	18.3	19.7	11.3	12.3	106
Ismailia	2001/2002	58.2	17.3	21.3	10.4	11.8	122
Nubaria	2000/2001	76.2	16.9	23.0	10.9	10.3	139
Nubaria	2001/2002	75.7	16.1	21.8	10.3	11.6	154

1- Cited after the General Egyptian Authority of Meteorology .

Table 3. Soil physical and chemical analyses of the experimental sites in 2000/2001 and 2001/2002 seasons.

Locations	Available(ppm)			P[H]	Ec mm h/cm	$CaCo_3$	Clay %	Silt %	Fine %	Soil texture[1]
	N	P	K							
Ismailia	28.0	8.0	70.0	7.8	0.66	20.0	5.06	1.44	91.3	Sandy Soil
Nubaria	54.2	2.6	29.0	8.2	0.12	22.8	11.5	24.6	63.9	Sandy Loam
Sakha	66.8	8.0	430	8.1	1.30	1.32	54.4	2.27	36.3	Clay Loam
Mallawy	65.0	8.6	333	7.8	1.15	1.43	75.6	38.3	30.5	Loam
Gemmeiza	53.2	18.6	490	7.7	1.0	3.86	39.6	30.7	18.6	Clay

2- Textural classes according to the triangular diagram .

Each experiment was grown in a randomized complete block design (R.C.B.D.) with three replications. The experimental plot comprises six rows of 3.5 meter long and 20 cm apart. Plots had pathways 50 cm in between. Dates of sowing were through the period from November 15 to December 10 during both seasons. The afeer planting method (dry seeds in dry soil) was used and the cultural practices were followed as recommended for each location. The middle four adjacent rows were used at maturity to collect the vegetative growth characters in the field and estimating the grain yield and its components at harvest.

Statistical analysis and estimating heritability and stability

Regular analysis of variance of RCBD was performed of the data of each experiment. Combined analysis is also done.Variance component, and heritability were calculated as indicated by Mcintoch, 1983. Broadsense heritability for grain yield under different environments were estimated according to Allard 1960, Mcintosh 1983. Grain yield in ardab/fad. and yield components were used for estimating stability of the investigated genotypes according to Eberhart and Russell 1966.

RESULTS AND DISCUSSION

Heritability

Tables (4 and 5) showed variance components for yield and yield components and broad sense heritabilities. Thousand kernels weight (1000 KWT) and number of kernels/spike had the highest broad sense heritability that more than ninety (93.7 and 91.3 % respectively). However, spike kernels weight and grain yield recorded moderate broad sense heritability (76.5 % and 73.7 % respectivily). With this respect, EL-Bawab (2002), found high broad sense heritability for grain yield, 1000 kernels weight and No. of kernels/spike (73.0, 93.1, 98.4 %), respectively.

Table 4. Mean squares of genotypes, seasons X genotypes, loctions x genotypes, seasons X genotypes X locations and error for yield and yield components.

S.O.V	Grain yield	No. of kernels/spike	Spike kernels weight	1000-KWT
Genotypes (G)	29.264**	230.162**	0.384**	217.633**
Seasons (S) X G	15.264**	23.792	0.008	11.789
L X G	8.737	62.128**	0.118*	30.695**
S X G X L	11.527**	37.509**	0.049	13.428
Error.	5.993	17.35	0.069	12.677

* and ** indicate significant at 0.05 and 0.01 levels of probability, respectively.

Table 5. Phenotypic and genotypic variance and hertability for grain yield, number of kernels/spike, spike kernel weight and 1000 kernel weight.

	$\sigma^2 p$	$\Sigma^2 g$	H^2G
Grain yield	**0.758**	**0.559**	**73.74**
No.of kernels / spike	**6.638**	**6.06**	**91.29**
Spike kernel weight	**0.0098**	**0.0075**	**76.53**
1000- KWT	**6.708**	**6.286**	**93.71**

Stability for yield and yield components

High performance over wide range of environments plus stability are two of the most important attributes in determining the wide acciptability of a new genotype. Average performance and stability parameters for grain yield, 1000 KWT and number of kernels / spike are presented in Table 6-a. The data revealed that genotypes numbers 2, 4 and 5 had the highest grain yield, genotypes numbers 6, 7, 8, and 9 had the heaviest grains (1000KWT), mean while genotypes numbers 2, 3, 4, and 6 had the highst number of kernels / spike compared to the over all average.

Regarding to (b) and s^2d, the data indicated that all tested genotypes showed no significant differences from one for (b) for grain yield, 1000 KWT and number of kernels / spike. On the other side, seven genotypes (nos 1, 2, 3, 4, 6, 7, and 9) in grain yield, five genotypes (nos 1, 2 ,5 ,6 and 8) in1000 KWT and also five genotypes (no. 1, 3, 5, 6, and 7) in number of kernels / spike had s^2d did not significant from zero. So, according to the Eberhart and Russell, 1966 method, the highest stable genotype for grain yield was no. 2 followed by no. 4 because these genotypes had b =1 and s^2d = zero. On the other hand, genotypes nos 5 and 8 showed low degree of stability because they had s^2d significantly differed from zero. Concerning the 1000 KWT, the highest stable genotypes were nos 6 and 8 because they had the heaviest grains over all average where b=1 and s^2d = zero. Some of the unstable genotypes i.e, 5 seemed to have high grain yield more than the grand mean over all studied environments. This genotype could not be over looked because its high yield potential was limited to particular locations (site– specific). (Finaly and Wilkinson 1963, Rasmusson, 1968, and EL-Sayed *et al* 2003 a).

Data presented also in tables (6-a,b) also showed stability paramiters for spike kernils weight and number of spikes/m^2. the results revealed that the heanest spikes come from genotypes nos 6 , 7 , 8, and 9 while the highest number of spiks/m^2 come from genotypes nos 2 , 3 , 4 , 5 and 6. On the other side, regard ling (b), all the tested genotypes showed b=1 for spike kernel weight and number of spikes / $m.^2$ Concerning S^2d, the data showed that all the tested genotypes exept no,9 in spike kernel weight and sevens genoyypes (nos 1 , 2 , 4 , 6 , 7 , 8 and 9) had S^2d = 0. Generally, according

to the X· b, and S²d the highest stable genotypses for spike kernel weight were nos 6, 7 and 8 follwed by nos 1, 2, 3 and 4. Nnumber of spikes / m^2 for genotypes nos 2, 4 and 9 had high degree of stability, because they had high mean over all averages with b =1 and S²d = 0. Genotypes nos three and five had the lowest digree of stability because they had S²d segnificant from zero.

Table 6-a. Stability analysis for three traits of nine hull-less barley genotypes.

Genotypes	grain yield (ard/fed)			1000-kernels weight			number of kernels / spike			Number of spikes/m².			Spike kernels weight.		
	Mean	b	S²d	Mean	b	S²d	Mean	b	S²d	Mean	b	S²d	Mean	b	S²d
1	10.5	0.9	0.3	32.4	1.2	0.1	59.3	1.2	6.1	591	0.9	1343.1	1.8	1.0	-0.01
2	13.3	1.2	1.9	27.8	1.0	0.9	66.8	0.9	20.4**	647	1.1	-2573.3	1.8	1.0	-0.004
3	11.7	1.0	0.1	31.8	0.9	3*	62.4	0.9	-1.8	630.8	0.8	6718.8*	1.9	0.5	0.004
4	12.7	1.0	0.1	32.6	0.6	4.2*	62.1	1.2	16.0**	625.8	0.9	1007.7	1.9	1.2	0.01
5	13.5	1.1	1.4	32.2	1.0	1.8	58.3	1.2	3.4	721.1	1.5	8332.2**	1.8	0.8	-0.01
6	12.0	1.1	3.3*	33.9	0.8	0.1	61.9	1.0	-0.6	522.6	0.8	3171.3	2.1	1.1	-0.02
7	11.1	0.9	1.1	36.7	1.4	83**	59.5	0.9	3.0	604.2	1.1	3237.7	2.1	0.9	-0.02
8	11.9	1.0	1.8	35.8	1.1	1.1	57.6	0.9	8.5**	604.5	0.8	2828.8	2.0	1.3	0.004
9	12.0	0.9	2.9*	35.5	1.0	36**	60.8	0.8	16.1**	628.9	1.1	3210.4	2.1	1.1	0.028*
Mean	12.1			33.2			61.0			618.7			1.94		
L.S.D at 0.05	1.52			2.4			3.6			78.1			0.2		
CN%	23.6			10.5			7.1			20.18			14.4		

Table 6-b. Analysis of variance for Stability of yield and yield components of nine hull-less barley barley genotypes

S.O.V	MS					
	d.f	grain yield (ard/fed)	1000-kernels weight	number of kernels / spike	Number of spikes/ m².	Spike kernels weight.
Total	89	9.8**	72.4	76.7	30469.2	0.1
Genotypes	8	32.8	19.8	65.0	67433.8	0.1
Env.+ geno. X Env.	81	2346.7**	1094.8	4140.9	4758167.8	6.3
Environments (Linear)	1	2.2	5.7	13.3	26242.3	0.04
Geno. XEnv. (Linear)	8	3.3	6.4	14.2	6861.6	0.02
Pooled deviation	72	2.6	4.0	6.3	4768.2	0.03
Residual	180					

* and **indicates significant at 0.05 level of probability and 0.01 level of probability, respectively.

CONCLUSION

From the five studed characters grain yield, 1000 KWT, number of kernels/ spike, spike kernels weight and number of kernels / spike the highest stable genotype was no. 6 followed by no.2. There fore, it could be recommended to be grown beside the released hull-les barley cltivars and/or to be used in the crossing blocs of the barley breeding program.

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دراسة كفاءة التوريث والثبات الوراثى لتسع تراكيب وراثية من الشعير العارى بمصر

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نفذ هذا البحث فى خمس محطات بحثية تابعة لمركز البحوث الزراعية بالاسماعيلية والنوبارية وسخا والجيزة وملوي خلال الموسمين الشتويين 2001/2000و2002/2001م. إشتملت الدراسة على تسع تراكيب وراثية من الشعير العارى وكل هذة التراكيب ذو ستة صفوف. وكان التصميم المنفذ هو قطاعات كاملة العشوائية فى ثلاثة مكررات وأشتملت القطعة التجريبية على ستة سطور بطول 3.5 متر والمسافة بين كل سطرين 20سم. كان الهدف من هذه الدراسة هو تحسين محصول الشعير العارى بمساعدة المربى فى التعرف على أفضل هذه التراكيب الوراثية تحت ظروف الإجهادات البيئية المختلفه وتقديركفاءة التوريث والثبات الوراثى لها.

أوضحت النتائج أن كفاءة التوريث بالمعنى الواسع كانت مرتفعة لصفتي الألف حبة وعدد حبوب السنبلة (93.7 % ، 91.3 %) على التوالي أما بالنسبة لصفتي وزن حبوب السنبلة و محصول الحبوب فكانت متوسطة (76.5 %، 73.7 %).

كما أوضحت نتائج تقدير الثبات الوراثي للصفات المدروسة أن التراكيب الوراثية تختلف فيما بينها لكل صفة وكذلك تختلف كل صفة في ثباتها الوراثي عن باقي الصفات للتركيب الوراثي الواحد.

وخلص البحث الى امكانية التوصيه بزراعة التركيبين الوراثيين رقمى 6 و 2 بجانب الأصناف المسجله بالاضافه لامكانية استخدامهما كآباء فى برنامج تربية الشعير العارى بالتهجين الذى أنشأه المشروع حد يثا.

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