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RESISTANCE OF SOME NEWLY BRED WHEAT LINES FOR NET BLOTCH DISEASE UNDER RAINFED CONDITIONS

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ABSTRACT

Two field experiments were carried out at Maryout Research Station of Desert Research Center under rainfed conditions with one supplementary irrigation at sowing date. Ten bread wheat genotypes were used to be tested for net blotch disease resistance, yield and its components under such conditions.

Mean squares for all traits recorded in both growing seasons as well as combined data indicate that, years were insignificant for all cases. Mean squares for the ten genotypes were significant for all traits recorded in both growing seasons and also their combined data. Interaction, genotype x years were significant for spikes / plant, grains / spike and 1000-grain weight. The differences were more pronounced among genotypes. The newly bred lines (Mar. 5 and L- 263) seemed to be the superior genotypes regarding the combined data of grain yield and severity of net blotch disease. Sahel-1 and L- 144 ranked in the second order for yielding ability while, the score of disease severity classified them as moderately resistant for L-144 (3.1 – 5) and moderately sensitive for Sahel-1 (5.1- 7). Severity of net blotch disease negatively associated with yielding capacity over all wheat genotypes tested. Results obtained in both seasons and combined data over them proved the superiority of Gemmeiza 3 for 1ooo grain weight, L – 263 and Sids – 6 for number of grains / spike and Maryout 5 and L – 263 for grain yield / plant and severity of net blotch disease.

Keywords: *Triticum aestivum* L., Rainfed conditions, Net blotch disease, *Helminthosporium teres* **,** Newly bred lines, Correlation.

INTRODUCTION

The importance of wheat as human main-food is the well-known fact. It has maintained its position as the basic staple food in urban areas and mixed with maize in rural areas for bread making. In addition, wheat straw is an important fodder for animal summer feeding.

Egypt's strategy is to minimize the food gap of this crop particular throughout vertical improvement and horizontal expansion. Area productivity could be improved through usage of high yielding varieties and optimum cultural practices through better crop management. In addition tolerant and or resistant genotypes to stresses have been released and proved to be suitable for cultivation in the newly reclaimed areas utilizing new irrigation methods as well as the old cultivated areas especially the North Western Coast region.

This region of Egypt is a stripe of about 0.5 million hectares extended over 450 km along the Mediterranean Sea coast west of Alexandria to the Libyan border with width 15-20 km. Although rainfall in this region is low (average of 50 years ago is 133 mm), wheat production can be successful due to low evapotranspiration resulting from mild temperature, cloudy skies and formation of dew on the plants during growing season. The soil structure varies between sandy and loamy sand, which has a moderate water holding capacity. The government is planning to extend irrigation canals to this region for supplementary irrigations at critical periods.

Irrigation water would be limiting factor for increasing the wheat acreage purposes for some of irrigation water is necessary to future. One way to save water is by the use of agricultural drainage water as an additional water source to meet the demands of these areas with minimum yield reduction.

Over all the world as well as in Egypt, extensive efforts are continuously paid for increasing its productivity by means of vertical and/or horizontal planting. In Egypt, wheat covers about 2.5 million feddan distributed mainly in the old land and partially in the new land (Egypt. Stat. Agric. Rep., 1998). In the light of the present national water policy concerning saving irrigation water, expanding wheat area under rainfall regions needs more searching for wheat genotypes produce high yield under several water resources.

Under such conditions, plants are frequently exposed to partial drought. It is well known that water stress inhibits plant growth through its effect on cell turgidity and division, increased respiration and decreased photosynthesis. Simpson (1981) reported that water stress disturbs most of physiological processes such as photosynthesis; enzyme activity and protein synthesis and this in turn retard transportation of metabolites into the grains. Such low rainfall conditions as in the North Western Coast of Egypt. Limited water availability is one of the most widespread environmental constraints on plant growth and yield.

Wheat breeders broaden the genetic base in their crossing programs and apply severe selection targeted to avoid yield plateau fluctuation from season to another. Singh *et al.* (1982), Sallam and Afiah (1998), Afiah (1999), El-Saied, Farieda *et al.* (1999) and Afiah (2002) have accomplished breeding for stress tolerant wheat genotypes.

To realize the maximum level of yield stability, the Egyptian national wheat program has applied the strategy introduced by Comstock and Moll (1963), regarding separation of macro-environments into closely identified microenvironments with their recommended cultivars. Five main agro-climatic zones are identified in Egypt namely, North Delta, South Delta, Middle Egypt, Upper Egypt and Out Valley. The main characteristics of the first two zones may be their exposure to rust disease, i.e. stripe, leaf and stem rusts caused by *Puccinia striifroms, Puccinia recondite* and *puccinia graminis tritici*, respectively. Middle and Upper Egypt suffer heat stress. Meanwhile, the main stress prevailing in Out Valley new reclaimed areas may be drought, salinity and net blotch disease. One or more of these stresses are to be considered in breeding program in a specific zone.

Since mid-nineties, Egypt has been facing severe problems regarding stripe rust disease. Due to wide exchange of genetic material that led to decreasing genetic variability, break down of active genes of resistance and availability of disease spores all over the year in the neighboring countries (Turkey, Syria, Iran,…. etc). Three attacks with stripe rust occurred in 1995, 1997 and 1998 seasons. This gave the breeders good chances to screen their materials to select the new promising lines having resistant gene (s) to *P. striiformis*, the causing agent for stripe rust especially under newly reclaimed areas. Net blotch caused by *Helminthosporium teres* attacks barley plants mainly, but also recorded on wheat plants grown in different locations in Egypt, influence both quantity and quality of grain (Kararah *et al.*, 1981 a and b). Hence, there is especial need to screen the local newly bred lines of bread wheat for such biotic and abiotic stresses.

MATERIALS AND METHODS

Ten bread wheat genotypes comprised two introduced varieties, four local one's and four newly bred lines through the Desert Research Center (DRC) wheat-breeding program were grown at Maryout experimental farm of DRC. Name, origin, pedigree and / or selection history of all varieties or newly bred lines are presented in table (1). Soil of the experimental site characterized as clay loam, non-saline (ECe 3.1 dSm^{-1}), calcareous (33.4% $CaCO_3$) and 0.6% organic matter. For not late sowing date, supplementary irrigation by agricultural drainage water (EC about 4.6 dSm^{-1}), is given at Oct. 28^{th}, 2000 and Nov. 4^{th}, 2001 after sowing, respectively. The amount of rainfall during each growing season was 120.4 and 144.7mm, respectively.

Table (1): Name, origin and pedigree and/or selection history of ten bread wheat genotypes tested.

Name	Origin	Pedigree and/or selection history
Sahel-1	Egypt	Ns. 732/Pima//Veery "S" # 5 SD735-4SD-1SD-1SD-0SD
Sids 6	Egypt	Maya `S?/ Mon `S?// CMH 74A.592 / 3 / Sakha8*2 SD 1002-4SD-3SD-1SD-0SD
A 305	ACSAD	Bb / Nar 67//Kal 1227 A / Bb /3/ JBE4-Toluca 73
L-144	Egypt	CM 39816 / Sakha 8 Su144 - 16Su – 75u – 45u – 0Su
Gem 3	Egypt	Bb / 7*2 // YsoA / Kal*3 /5/ Skh8 / 4 / Rrv / ww15 /3/ Bj `S?// On*3 / Bon CGm 4024-1Gm-13Gm-2Gm-0Gm
Giza 168	Egypt	MRL/BUC//SERI CM93046-8M-0Y-0M-2Y-0B-0GZ
L- 606	Egypt	RCB-61// (Atlas 66 / Nap Hall) /2* RCB-61 Su606-13Su-2Su-5Su-0Su-18Su
L-263	Egypt	Sids 1 // CM 33204 7Su-26SW-3SW-1SW-0SW
Mar. 5	Egypt	Giza 162 // Bch's /4/ PI-ICW 79 Su5-11Mr-38Mr-1Mr-0Mr
Nesser	CIMMYT/ ICARDA	ICW85-0024-06AP-300AP-300L-1AP-0AP

ACSAD : the Arab Center for the Studies for Arid zones and Dry lands.
CIMMYT : Centro International de Mejoramiento de Maize Y Trigo (Mexico)
= International maize and wheat improvement center.
ICARDA : International Center for Agricultural Research in the Dry Areas.

Each experiment was laid out in randomized complete block design with three replicates. Plot size was 4 x 5 m. Wheat grains were broadcasted at the rate of 40 kg/fed. The experiments were bordered by more susceptible varieties to net blotch disease. All agricultural practices were followed as recommended for rainfed areas. During harvest, data were recorded for a random samples of ten guarded plants in each plot for five traits i.e.; plant height (cm), number of spikes / plant, number of grains / spike, 1000-grain weight (g) and grain yield / plant (g). Severity of net blotch infection was recorded at booting stage on plot bases Disease index (severity of infection) was estimated according to Khan and Boyd (1969) on the scale from 1 to 10 where: 1-3 resistant (R), 3.1-5 moderately resistant (MR), 5.1-7 moderately susceptible (MS) and > 7 highly susceptible (S) as described by Tekauz (1985).

Statistical analysis was performed as outlined by Gomez and Gomez (1984). Comparison between means of all traits studied among genotypes was made using new LSD (Waller and Duncan, 1969). Simple correlation coefficients were calculated between grain yield / plant and each of other traits studied as described by Mode and Robinson (1959). Significance of each association value was determined as shown by Snedecor and Cochran (1980) with Df. = n-2 (where n is the sample size in plot basis).

RESULTS AND DISCUSSION

Mean squares for all traits recorded in 2000/2001 and 2001/2002 growing seasons under Maryout rainfed conditions as well as combined data over growth seasons are presented in table (2 a and b). The data indicated that, year's mean squares were insignificant for all cases. This finding revealed that all studied traits were not subjected to environmental changes in both growing seasons under investigation. Furthermore, mean squares for the ten genotypes were significant for all traits recorded in both growing seasons and also their combined data.

Table (2-a): Mean squares of plant height, spikes / plant and grains / spike.

Source of variation	Df		Plant height			Spikes / plant			Grains / spike		
	Sin.	Com.	Y1	Y2	Com.	Y1	Y2	Com.	Y1	Y2	Com.
Years (Y)	-	1	-	-	4.267	-	-	0.060	-	-	6.868
Reps. or Y/ reps.	2	4	4.804	2.300	3.552	0.005	0.014	0.009	0.252	3.044	1.648
Genotypes (G)	9	9	65.7**	58.9**	117.2**	0.695**	0.796**	1.409**	27.02**	6.1**	24.36**
Y x G	-	9	-	-	7.386	-	-	0.082**	-	-	8.765**
Error	18	36	7.791	3.849	4.320	0.025	0.005	0.015	3.430	1.382	2.406

Table (2-b): Mean squares of 1000-grain weight, grain yield / plant and severity of infection.

Source of variation	Df		1000-grain weight			Grain yield / plant			Severity of infection		
	Sin.	Com.	Y1	Y2	Com.	Y1	Y2	Com.	Y1	Y2	Com.
Years (Y)	-	1	-	-	5.766	-	-	0.001	-	-	0.635
Reps. or Y/ reps.	2	4	3.792	0.849	2.321	0.003	0.001	0.002	0.406	0.648	0.527
Genotypes (G)	9	9	30.84**	19.2**	44.61**	0.142**	0.122**	0.247**	3.281**	2.035**	4.862**
Y x G	-	9	-	-	5.429*	-	-	0.017	-	-	0.454
Error	18	36	2.808	1.171	1.989	0.011	0.013	0.012	0.318	0.147	0.233

Y1, Y2 and Com. : refer to 2000/2001, 2001/2002 growing seasons and the combined data over them, respectively.
*** and ** denote significant at 0.05 and 0.01 probability levels, respectively.**

Interaction, years x genotypes were significant for spikes / plant, grains / spike and 1000-grain weight as shown in table (2 a and b). The differences were more pronounced among genotypes. These findings are in harmony with those obtained by Afiah and Abdel Sattar (1998). Also, Sabry *et al.* (1994) reported that the differences in yielding ability and most of its attributes did not affect by the growing seasons under rainfed conditions.
The insignificance of YG interaction indicates that the relative performance among genotypes was approximately the same for each of growth seasons under rainfed conditions with changeless rank among entries in all traits except yield / plant and severity of net blotch infection.

There were fluctuations in grand means of the exceptional cases across years. This may be due to the amount and distribution of rainfall. The mean values in the first growing season (2000/2001) ranged from 1.38 to 2.13 g and from 2.9 to 8.2 for grain yield / plant and severity of infection in the genotypes Mar. 5 and Sids 6, respectively.

For grain yield /plant, the mean values in the first season (2000/2001) ranged from 2.13 to 1.38 g for Mar. 5 and Sids 6, respectively with grand mean over all genotypes equal 1.73g. In the second season most of the tested genotypes increased in its yielding capacity. The newly bred lines (Mar 5 and L- 263) seemed to be the superior genotypes regarding the combined data of grain yield and less severity of net blotch disease. Sahel-1 and L- 144 ranked in the second order for yielding ability while, the score of disease severity classified them as moderately resistant for L-144 (3.1 – 5) and moderately sensitive for Sahel-1 (5.1- 7) according to Teqauz (1985). Zaki and Afiah (2002) differentiated several barley genotypes under similar conditions for net blotch disease and found wide range of the genetic variations in biotic and abiotic resistance. It is worthy to note that, severity of net blotch disease negatively associated with yielding capacity over all wheat genotypes tested in the first season, second season and combined data (Table 3 a and b). The ten bread wheat genotypes tested differed significantly concerning number of spikes/plant in both growing season as well as combined analysis. The newly bred line L- 263 gave the highest number of effective tillers followed by Giza 168 and L-144. The two local varieties, Sahel-1 and Sids-6 had the lowest mean values for number of spikes/plant as shown in table (3 a). Significantly simple correlation coefficients between this trait and grain yield/plant in both seasons and combined data indicated that number of spikes/plant considered to be selection criteria for grain yielding ability (Afiah, 1999). There were significant different between the tested wheat genotypes in plant height, number of spike and 1000- grain weight.

Giza 168 and L – 263 gave the highest significant values for plant height while, Gemmmeiza 3 followed by ACSAD 305 had the heaviest grains (1000-grain weight, g). These results are more or less in line with the previously reports of El – Kalla *et al.* (1992), Fayed (1992) and El – Kalla *et al.* (1994).

Table (3-a): Mean performance of plant height, number of spikes / plant and number of grains / spike.

Genotypes	Plant height (cm)			No. of spikes / plant			No. of grains / spike		
	Y1	Y2	Com	Y1	Y2	Com	Y1	Y2	Com
Sahel-1	73.8	70.7	72.3	1.89	1.78	1.84	31.50	28.57	29.88
Sids 6	63.7	63.4	63.6	1.38	1.30	1.34	32.80	29.70	31.25
A 305	70.9	69.3	70.1	2.43	2.56	2.50	29.37	27.70	28.53
L-144	76.5	76.0	76.2	2.80	2.55	2.68	28.93	27.40	28.17
Gem 3	78.3	73.9	76.1	2.35	2.43	2.39	24.13	25.63	24.88
Giza 168	78.0	78.4	78.2	2.88	2.78	2.83	27.17	29.63	28.40
L- 606	68.7	71.0	69.8	1.89	2.13	2.01	26.73	29.23	27.98
L-263	77.3	74.8	76.1	2.84	2.97	2.91	33.10	29.60	31.35
Mar. 5	71.6	69.5	70.6	2.28	2.17	2.23	25.63	27.13	26.38
Nesser	72.3	72.7	72.5	2.36	1.78	2.07	28.33	26.63	27.48
New L.S.D. :									
0.05	4.79	3.37	2.92	0.27	0.12	0.14	3.18	2.02	1.82
0.01	6.56	4.61	3.93	0.37	0.17	0.19	4.35	2.76	2.44
r.	- 0.228	- 0.066	- 0.157	0.364*	0.361*	0.368*	- 0.042	- 0.159	- 0.141

Table (3-b): Mean performance of 1000-grain weight, grain yield / plant and severity of infection.

Genotypes	1000-grain weight (g)			Grain yield / plant (g)			Severity of infection		
	Y1	Y2	Com	Y1	Y2	Com	Y1	Y2	Com
Sahel-1	27.17	29.07	28.12	1.87	1.90	1.88	5.6	4.9	5.25
Sids 6	28.33	28.27	28.30	1.38	1.42	1.40	8.2	7.4	7.80
A 305	30.83	32.77	31.80	1.68	1.54	1.61	7.4	6.5	6.95
L-144	26.90	26.70	26.80	1.86	1.84	1.85	4.5	4.9	4.70
Gem 3	35.60	34.40	35.00	1.57	1.74	1.66	7.8	7.3	7.55
Giza 168	30.97	29.90	30.43	1.56	1.68	1.62	6.3	6.8	6.55
L- 606	31.77	29.80	30.78	1.67	1.77	1.72	6.7	6.4	6.55
L-263	28.13	31.87	30.00	1.93	2.01	1.97	2.8	2.3	2.55
Mar. 5	32.90	33.10	33.00	2.13	2.07	2.10	2.9	2.6	2.58
Nesser	25.03	27.97	26.50	1.63	1.74	1.69	8.0	7.3	7.65
New L.S.D. :									
0.05	2.87	1.86	1.65	0.18	0.20	0.13	0.97	0.66	0.57
0.01	3.94	2.54	2.22	0.25	0.27	0.17	1.33	0.90	0.76
r.	- 0.023	0.206	0.102	—	—	—	-0.89**	-0.85**	-0.91**

Y1, Y2 and Com. refer to 2000/2001, 2001/2002 growing seasons and the combined data over them , respectively.
*** and ** denote significant at 0.05 and 0.01 probability levels, respectively.**
r. : simple correlation coefficient between grain yield / plant and each of the other studied traits.

Results obtained in both seasons and combined data over them proved the superiority of Gemmeiza 3 for 1ooo grain weight, L – 263 and Sids – 6 for number of grains / spike and Maryout 5 and L – 263 for grain yield / plant and less severity of net blotch disease. Accordingly selecting more than one genotype for a given environment or region to release maximum yield is good strategy. However, differences among genotypes could be mainly due to their different genetic constitutions and / or the prevailing environmental conditions (Mahgoub, Hayam and El-Sayed, 2000; Sadek, Iman, 2000 and Afiah, 2002).

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مقاومة بعض سلالات القمح المرباة حديثا لمرض التبقع الشبكى تحت الظروف المطرية

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***قسم وقاية النبات و **قسم الاصول الوراثية النباتية – مركز بحوث الصحراء – المطرية – القاهرة – مصر**

أجريت تجربتين حقليتين فى محطة بحوث مريوط وذلك تحت الظروف المطرية مع أضافة رية تكميلية عند الزراعة . وتم اختيار عشرة مصادر وراثية من قمح الخبز للتقييم على اساس مقاومتها لمرض التبقع الشبكى والمحصول ومكوناتة الاساسية وقد اوضحت النتائج ما يلى:-

كان تباين تأثير السنوات لكافة الصفات تحت الدراسة غير معنوى أما تباين التراكيب الوراثية فقد كان عالى المعنوية فى كل الحالات (كلا الموسمين والتحليل التجميعى) كما حقق التفاعل بين التراكيب الوراثية المختبرة والسنوات فروقا معنوية لصفات عدد سنابل النبات و عدد حبوب السنبلة ووزن ١٠٠٠ حبة.

ابدت اثنين من السلالات المرباة حديثا (مريوط ٥ والسلاله رقم ٢٦٣) تفوقا ملحوظا فى محصول الحبوب ومقاومة مرض التبقع الشبكى وكان الصنف ساحل – ١ والسلالة رقم ١٤٤ فى المرتبة الثانية بالنسبة لمحصول الحبوب مع ترتيب السلالة ١٤٤ فى مجموعة التراكيب الوراثية متوسطة المقاومة (٣,١ – ٥) والصنف ساحل ١ فى المجموعة متوسطة القابلية للاصابة (٥,١ - ٧) بالنسبة لمرض التبقع الشبكى.

كان الارتباط بين شدة المرض و الكفاءة الانتاجية عكسيا مع تفوق الصنف جميزة ٣ فى وزن الحبوب والسلالة ٢٦٣ وكذلك الصنف سدس ٦ فى عدد حبوب السنبلة.