GENETIC BEHAVIOUR OF SOME AGRONOMIC AND PHYSIOLOGICAL TRAITS IN BARLEY DIALLEL CROSSES UNDER MARYOUT CONDITIONS

By

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B.Sc. Agric. Sc. (Agronomy), Ain Shams University, 2005

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ABSTRACT

Soad Sayed Abo El-Fotoh: Genetic Behaviour of Some Agronomic and Physiological Traits in Barley Diallel Crosses Under Maryout Conditions. Unpublished M.Sc. Thesis, Department of Agronomy, Faculty of Agriculture, Ain Shams University, 2015.

The main objectives of this study were to evaluate the performance of barley genotypes for some agronomic and physiological traits under well watered and rainfed conditions in order to identify the best genotypes which can be grown under drought stress conditions and to estimate some genetic parameters as a basis of improving barley under rainfed conditions at Maryout region. Six parents of barley (*Hordeum vulgare* L.) namely: the cv. G126(P_1), L Su12303(P_2) (are local genotypes), L 105/20(P_3), L105/27(P_4), L105/32(P_5) and L 105/36(P_6) (are introduced from ICARDA) were chosen to achieve the present study. In 2008/09 season, the six parents were crossed in a 6×6 diallel matting design (excluding reciprocals) and seeds of the 15 F_1's were obtained. In 2009/10 season, two adjacent field trials each included the 15 F_1 crosses and their respective parents (21 genotypes) were conducted in a randomized complete block design with three replications at Maryout Agriculture Experiment Station of Desert Research Center (North Western Coast of Egypt). Each experiment was devoted for one of the two following irrigation treatments: a) rainfed treatment (drought stress treatment) and b) rainfed + 2 supplemental irrigations given at sowing date and flowering stage (well watered treatment). The following traits were measured: heading date, maturity date, plant height, flag leaf area, flag leaf angle, no. of spikes/plant, spike length, no. of spikelets/spike, no. of grains/spike, 100-kernel weight, grain yield/plant, straw yield/plant, harvest index, relative water content (RWC), proline content, chl. "a" content, chl. "b" content and carotenoids content. Data of all traits recorded from each experiment were subjected to the ordinary analysis of variance and estimates of combining ability effects were made by applying **Griffing**'s **(1956)** method 2 and model 1. Drought susceptibility

index (S) for grain yield\plant and phenotypic correlation coefficients were also estimated.

The results of analysis of variance indicated that all traits were significantely affected by soil moisture deficit and presence of sufficient genetic variability among genotypes. Drought stress caused significant reduction in all traits, except proline content which was significantly increased when plants were subjected to drought stress. Overall genotypes, harvest index recorded the lowest reduction percentage (6.06%) followed by 100-kernel weight (7.74%) and spike length (8.41%), while carotenoids content recorded the highest reduction percentage (43.32%) followed by chl. "b" content (30.74%) and RWC (30.67%). Generally, 100-kernel weight, spike length, harvest index, straw yield/plant, no. of spikelets/spike, plant height and maturity date recorded reduction percentages less than 15%, suggesting that these traits could be used as selection criteria for screening drought resistant barley genotypes in breeding programs. Results of drought susceptibility index (S) showed that the crosses; P_1xP_3, P_1xP_4, P_2xP_6, P_3xP_4, P_3xP_5, P_4xP_5, P_4xP_6 and P_5xP_6 were the most drought tolerant for grain yield/plant.

Values of heterosis greatly varied under the two irrigation regimes. For better-parent heterosis (heterobeltiosis), the cross P_5xP_6 recorded the highest value of 284.09% under well water conditions, whereas the cross P_2xP_4 recorded the highest value of 94.52% under rainfed conditions for carotenoids content. The crosses showing the best heterobeltiosis under well watered and/or rainfed conditions could be recommended to improve the respective traits. The obtained results also indicated that the five F_1 hybrids; P_2xP_4, P_3xP_4, P_3xP_5, P_3xP_6 and P_5xP_6, expressed higher mid and better parent heterosis under rainfed condition than under well watered condition for grain yield/plant, therefore if the hybrids development is feasible in barley these hybrids are considered more desirable to be grown under water shortage conditions for increasing grain yield per unit area and selection could be exercised in segregating generations for developing drought tolerant genotypes.

The results revealed that mean squares associated with general (GCA) and specific (SCA) combining ability were found to be highly significant for all the studied traits under both irrigation regimes and their combined analysis, indicating that both additive and non-additive genetic effects were involved in the inheritance of these traits. The ratios of k^2GCA/k^2SCA were less than unity under the two irrigation treatments and combined data, suggesting that the studied traits were mainly controlled by the non-additive gene effects. The interactions of GCA and SCA with irrigation treatments were also highly significant for all the studied traits. The two parental lines 105/32 and 105/36 appeared to be good general combiners for grain yield/plant and one or more of its components and physiological traits under normal and/or drought stress conditions. While the cross P_5xP_6 was good specific cross-combination for grain yield/plant and most of its components and the physiological traits under drought stress conditions.

Broad sense heritability estimates were obtained which ranged from 62.85% for flag leaf angle to 99.83% for chlorophyll "b" content under well watered conditions and from 38.68% for flag leaf angle to 99.86% for spike length under rainfed conditions. Significant and positive phenotypic correlation coefficients were found between grain yield/plant and each of no. of spikes/plant, no. of spikelets/spike, no. of grains/spike and RWC under the two irrigation treatments.

Key words: Barley (***Hordeum vulgare*, L.**), Rainfed, Supplemental irrigation, Drought stress, Drought tolerant, Stress susceptibility index, Heterosis, Combining ability, Broad sense heritability and Phenotypic correlation.

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