Genetic studies on some quantitative characters in broad wheat (triticum aestivum, l.)

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The aim of this investigation was to determine the extent of heterosis andtypes of gene action and their interaction with two environments (The first normaltreatment five irrigations and 70 kg N/ fed, and the second, one irrigation + 30 kgN/fad) for some growth and yield characteristics, i.e. heading date, physiologicalmature date, plant height, peduncle length, spikelets per spike, spike length,number of grains per spike, 1000- kernel weight, grain yield per plant, straw yieldper plant, number of spikes per plant and harvest index. The susceptibility index(SI) was calculated for each season (the first and second experiments in eachseason) from origin data for yield and its components before using a generalizedformula [Fischer and Maurer 1978].Also, the three drought measurementsleaf temperature (LT), stomatal resistance (SR) and transpiration rate (TR) wereestimated in the second season.Seven parental varieties of wheat representing wide range of variability inmost of the studied traits were utilized These varieties were Gemmiza 3(Pl),Sakha 61 (P2), Giza 162 (P3), Sakha 8 (P4), Sids 9 (P5), Sids 6 (P6) and Sids 4(P7). Crossing among the parental materials by means of diallel system wasinitiated at 1995/96 season" In 1996/97 season, half diallel set of crosses involvingseven parents and 21 F1 hybrids were evaluated under two environments (twoexperiments). Each experiments was sown on 7-12-1996 in a randomizedcomplete block design with three replications. The two experiments were plantedin two adjacent fields. The first experiment was fertilized and irrigated with therecommended treatment i.e. five irrigations and 70 kg NI fad. applied in threeequal doses, at planting, first and second irrigations. The second one fertilized 30kg N 1 fad in two equal dose first with sowing and the second with the firstirrigationat. In 1997/98 season, the same two experiments in the previous seasonwas repeated. In both seasons each experiment was designed in randomizedcomplete block design with three replications in the experimental farm at SakhaAgric. Res. Sta, Kafer EI-Sheikh Governorate . In both seasons of evaluation,each plot consisted of one row, each row was 4 m long and 30 cm apart. Plantswithin row were 20 em apart. The dry method of planting was used in thisconcern. Data were recorded on seven to ten chosen at random from each plot. -The data were genetically analysis by the procedures by Griffing (1956) andHayman (1954).The results obtained can be summarized as follows:I-Growth,yield and its components:A:Analysis of variance, means and heterosis :-1-Environment mean squares were significant for all traits except number ofspikelets per spike in the second season and number of spikes per plant in thefirst season .2- Significant genotypes mean squares were obtained for all traits except numberof spikelets per spike in both environments as well as the combined analysis inthe second season and under stress environment in the first season and pedunclelength at the stress environment in the second season.3-Significant genotypes x environments mean squares were obtained for allstudied traits in both seasons except plant height and number of spikelets perspike in both seasons, peduncle length, spike length and number of kernels perspike in the second season.4-Mean squares due to parents were significant for all traits except for number ofspikelets per spike in both environments as well as the combined analysis overthem, in the second season number of spikelets per spike and peduncle lengthin stress environment in the first season . Significant mean squares due tointeraction between parental varieties and environments in both seasons weredetected for all the studied traits except peduncle length, plant height, numberof spikelets per spike and straw yield in both seasons, spike length,

number ofspikes / plant number ofkemels / spike, grain yield / plant and maturity date inthe second season and heading date in the first season.5-The varieties Sids 9, 6, 4 behaved as the earliest ones. The parental varietiesSakha8, Giza 162 gave the highest values for grain yield per plant6-Significant crosses mean squares were detected for all the studied traits exceptnumber of spikelets per spike under both environments in the second season andpeduncle length and number of spike lets / spike in stress environ ment in thefirst season .Significant mean squares due to interaction between crosses andenvironments were detected for all the studied traits except peduncellength,spike length and number of spikes per plant in the second seeason ,straw yieldin the frrst season and plant height and numer of spikelets / spike in bothseasons. The four crosses (l x 2), (2 x 6), (2 x 4) and (2 x 7) had the heighestgrain yield per plant .7-Mean squares for parent vs crosses were significant in both environments aswell as the combined analysis for all investigated traits except spike length inboth environments as well as the combined analysis in both seasons; number ofspikelets per spike and number of spikes per plant in both environments and thecombined analysis in the second and first seasons irrespectively. For maturitydate, the crosses (2 x 3) and (3 x 7) expressed significant negative heteroticeffects relative to better parent. Also, the crosses (1 x 2), (1 x 6) and (2 x 7) hadthe highest heterotic effects relative to better parent for grain yield per plant.B-Combining ability8-The mean squares associated with general combining ability were significant forall traits. Specific combining ability (SeA) mean squares were significant forall studied traits except maturity date and number of spikelets per spike in thecombined analysis in the first season, maturity date under stress environmentand the combined data in the second season, peduncle length under stressenvironment in both seasons, and spike length at normal and stressenvironments in the second season. It is evident that additive and additive byadditive types of gene action were the more important part of the total geneticvariability for maturity date and number of spikelets / spike in the combinedanalysis in the first season maturity date in stress environment and thecombined data in the second season, peduncle length under stress environmentin both seasons and spike length in both environments in the second season. Forthe other studied cases • both additive and non- additive gene effeits wereinvolued in determining the performance of single cross progeny.9- The mean squares of interaction between environments in separate season andboth types of combining ability were significant for maturity date and harvestindex in both seasons, peduncle length, spike length, number of spikes / plant •IOOO-kernel weight, grain yield / plant and straw yield / plant in the first season, and heading date in the second.lO-The parental varieties Sids 9, 6 and 4 for spike length and number of kernelsper spike; parental variety Gemmiza 3 for 1000- kernel weight and Sakha61 fornumber of spikes / plant, grain yield per plant and harvest index, gave thehighest desirable (Qi) effects for traits.II-The parental combinations (3 x 4) and (3 x 7) for maturity date, (I x 5) and(2x7) for number of spikes per plant and (2 x 6) and (2 x 7) for grain yield perplant had the desirable (Sij) effects for these traits.C-Genetic components12- Significant (D) valves were detected for all traits under both environments inboth seasons except pudencle length under normal environment in the firstseason and harvest index in stress environment in the second season. Significalvalues for the dominance component (Hl) were obtained for all the studiedtraits in both environments in both seasons, except spike llength in bothenvironments and peduncle length in stress environment in the second season.Values of (Hl) were large in magnitude, than the respective (D) ones for mosteases.l3-Studies on degree of dominance revealed the existence of overdominance forall traits except heading date spike length, number of spike / plant and numberof kernels / spike at both environments in the first season spike length andnumber ofkemels / spike at both environments in the second season, maturitydate under normal environment in the first season and maturity date andpeduncle length under normal and stress environment, res pectiwly in thesecond season.14.High to moderate heritability values in narrow sense were detected for all traitsexcept maturity date and peduncle length at stress environment in the secondseason, and peduncel length at normal environment in both seasons 1000-kernel weight at normal environment in the second. season and at stressenvironment in both seasons and harvest index in both environments in bothseasons.1832-Sosceptibility indexA-Analysis of variance, means and heterosisIS-Environments mean squares were insignificant for SI for all the studied traitexcept maturity date, harvest index, number of spikelets per spike and spikelength.16-Significant genotypes

mean squares were significant for most cases .Also,significant mean squares of interaction between genotypes and seasons wereobtained for heading date, peduncellength, spike length, number of spikes perplant, 1000- kernel weight, grain yield, straw yield and harvest index.17-The parent Giza 162 gave the desirable SI for earliness, harvest index andpeduncel length . However the parental Sakha8 showed the desirable Sf forgrain yield and maturity date.18-Mean squares for parents vs. Crosses as an indication to average heterosisoverall crosses were significant for SI in maturity date, number of spikes perplant, grain yield in separate season as well as the combined data, 1000-Kernel weight, straw yield and peduncle length in the first season and headingdate and SR and TR in the second season. The best crosses for SI of grainyield per plant were (1 x 3), (1 x 7), (2 x 4), (2 x 5) and (4 x 7) in the first,and second seasons.B- Combining ability19-The mean squares associated with general and specific combining ability(GCA and SCA) were highly significant for most casses. High GCA / SCAratio which largely exceed the unity was obtained ofSI for most studied traits.Low GCA / SCA ratio less than unity was detected for number of spikes perplant and harvest index in the combined analysis, and number ofkemels perspike and heading date in the first season.20-The mean squares of interaction between seasons and both types of combiningability were significant for SI for heading date, peduncle length, number ofspikes per plant, 1000- kernel weight, grain yield per plant, straw yield andharvest index, indicating that the magnitude of all types of gene action variedfrom season to another.21-The parental variety Sakha 61 seemed to be the best combiner for SI in numberof spikes per plant, straw yield / plant and grain yield / plant in both seasons aswell as the combined analysis, and heading date, harvest index andtranspiration rate in the second season and it, gave insignificantly (91) effectsfor SI of most other traits .22-The desirable SeA values were recorded by fire crosses (1 x 7), (2 x 6) and (5x 6) for SI in number of spikes per plant and three crosses (I x 7), (2 x 6), (2 x7), and (2 x 5) of SI for grain yield per plant in the combined analysis.C-Genetic com.,ponents23-Significant values for the dominance and additive component (HI) and (0) ofSI were obtained for all traits except (0) component for heading date in bothseasons, peduncle length, straw yield, harvest index and LT in the secondseason.24-Studies on degree of dominance revealed the existence of overdominance formost traits.25-Low heritability values in narrow sense were detected of SI for all traits,indicating that most of genetic variance may be due to non- additive geneticeffects1853-Drought measurements:A-Analysis of variance, means and heterosis26-Environment mean squares were highly significant for the three droughtmeasurements, indicating an overall differences between the stress and normalconditions. LT and SR, mean values of stress condition were generally higherthan of normal. Meanwhile for TR in normal condition were generally higherthan those of stress condition.27-Significant genotypes, parent, and FI hybrids mean squares were detected forall the studied measurements in separate environment as well as the combinedanalysis. Also genotypes x environments and crosses x environmentsinteractions were significant for the three measurements28-Mean squares for parents vs. crosses as an indication to average heterosis overall crosses were significant for all measurements in both environments as wellas the combined analysis.B- Combining ability:29-General and specific combining ability mean squares were significant for thethree drought measurements except GCA mean squares under stress and thecombined analysis for LT. Low GCA / SCA ratio of less than unity wereobtained for all the studied traits, except TR at normal enviromnent indicatingthat the predominance of non- additive gene action in the inheritance of suchcases.30-The mean squares of interaction between environments and both types ofcombining ability were significant for the three drought measurc:~ments.31-The parental cv. Gemmiza 3 expressed significant desirable (g.) effects for TRin stress environment, the parental cv. Giza 162 gave insignificant (gr) effectfor the three drought measurements. The parental cv. Sakha 61 had significantdesirable (g.) effect for LT in the normal environment, where the parental cv.Sakha 8 had significant positive (gi) effect for SR in stress environment.32-The parental combinations (6 x 7), (3 x 5) and (1 x 7) for LT, (1 xl), (1 x 5),(2 x 6), (2 x 7), (3 x 4) and (4 x 6) for SR, (l x 2), (l x 5), (2 x 6) , (3 x 4)and (4 x 7) for TR, appeared to be the most promising for breeding for thesemeasurements.C-Genetic components33-Significant values for the dominance and additive components (HI) and (D)were obtained for all traits except (D) component for LT at stress environmentand SR at normal environment Significant (h2) values were detected for alltraits except

LT at strees environment and TR at normal environment.34- Low heritability values in narrow sense were detected for all measurements