Determination of genetic variance components under different environmental conditions in wheat

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SUMMARYThe main objective of this investigation was to determine the genetic variance components of wheat under three locations (Ismailia, Nobaria and Gemmeiza stations). Six bread wheat varieties (4 local varieties; Sakha 69, Giza 157, Giza 160 and Sakha 92 and two exotic varieties from Mexico; Agent and Baart) were chosen for this study on the basis of their variabilities in yield and yield components and stem rust disease reaction.This study was conducted during the three seasons of 1989/90, 1990/91 and 1991/92.The Fl and F2 generations from a half diallel set 6X6 in addition to their parents were studied for plant height, spike length. number of spikes/ plant, number of spikelets/spike, number of grains/spike ,plant weight, grain yield/plant, 100-grain weight and stem rust reaction.The results of this study were divided into five parts and summarized as follows:-1- COMBINING ABILITY:-1-The general and specific combining ability were significant for all the studied traits in the two generations.2-The best general combiners seemed to be the parents Agent and Sakha 69 in Fl and F2 for plant height in the three locations, Ismailia, Nobaria and Gemmeiza, besides thecombined between these locations .For spike length the parents Agent (P4), Sakha 92 (P5) and Giza 157(p2)seemed to be good combiners for Fl and F2 generations in the three locations and the combined ones.For number of spikes / plant Giza 157 Seemed to be the best parent in both Fl and F2 generations only at Gemmeiza location while Agent (P4), Sakha 69 (P1) and Giza 157 (P2) showed goodresults in the combined data.For number of spikelets/spike. Baart (P6) and Sakha 69 (P1) seembed to be the best combiners in both Fl and F2 in all locations as well as in combined analysis.For number of grains/spike Sakha 92 (P5), Baart (P6) and Sakha 69 (P1) were good combiner for this trait in both Ft and F2 generations in all locations and also from the combinedanalysis.For plant weight only Giza 157 (P2) and Sakha 69 (P1), were good combiners in both Fl and F2 generations in all locations andin the combined data.For grain yield /plant Baart (P6), Sakha 69 (P1) and Sakha 92 (P2) seemed to be the best combiners in both Fl and F2 in the three locations and combined between them.For 100-grain weight Giza 160 (P3) and Agent (P4) showed the best results for this trait in both Fl and F2 in all locations and in combined between them.For stem rust reaction Baart (P6) and Giza 160 (P3) gave highly significant values for resistance in both Fl and F2 inall locations.3- The results of specific combining ability effectsrevealed highly significant values with desirable direction in the cross 7 (Giza 157 x Agent) for plant height in all locations except at Gemmeiza and in the combined analysis for Fl. While for F2 the cross 11 (Giza 160 X Sakha 92) showed promising values un all locations except in Ismailia, also the combined datashowed a good results.For spike length in Fl the crosses 11 (Giza 160XSakha 92) and 15 (Sakha 92 X Baart) showed highly significant values in all locations and in combined data. For F2 data the crosses 2 (Sakha 69 X Giza 160) and 3 (Sakha 69XAgent) showed good results at Ismailia and combined analysis while the croos 9 (Giza 157 XBaart) showed highly significant values in Gemmisa and incombined case.For number of spikes /plant, the cross 13(AgentXSakha 92) showed good results at Nobaria. Gemmeiza and in the combined data for Fl,while the cross 1 (Sakha 69 X Giza 157) and 10 (Giza 160 X Agent) have a highly significant values at Ismailia location. F2 data showed that the cross 15 (Sakha 92 X Baart) had the bestpromising results at Ismailia, Nobaria and in the combined data.For number of spikelets /spike the cross 5 (Sakha 69X Baart)and 12 (Giza 160 x Baart) showed highly significant values for Fl in all locations and in the combined data ,while for F2

the cross (Sakha 69 x Baart)is the best one in all locations, except at Gemmeiza where the cross 2 (Sakha 69 X Giza 160) is thebest.For number of grains/spike, all locations gave different results. Only the cross 5 (Sakha 69XBaart) gave highly significant values for Fl at Ismailia and for F2 at Nobaria and Gemmeiza.The best cross for Fl was No.1 (Sakha 69 X Giza 157) and for F2 was No. 15 (Sakha 92XBaart).For plant weight. The cross 15 (Sakha 92XBaart) showed the best result in Fl and F2 for combined data, while the cross 8 (Giza 157XSakha 92) showed highly significant values in both Fl and F2 at Ismailia.For grain yield/plant the cross 11 (Giza 160XSakha 92) showed highly significant values for Fl in all locations and in combined data while for F2 the cross 5 (Sakha 69X Baart) had a highly significant values at Nobaria and combined data.For 100-grain weight the cross 1 (Sakha 69XGiza 157) showed a good result in all locations and combined for Fl, while for F2 the cross 4 (Sakha 69XSakha 92) showed highly significant result at Ismailia and in the combined data, while the cross 9 (Giza157YBaart) showed a good result at Gemmeiza and combined case.For stem result reaction the cross 8 (Giza 157XSakha 92) showed highly significant result at Ismailia for Fl. The cross 3 (Sakha 69XAgent) showed a good result at Gemmeiza and combined in both Fl and F2.11 HETEROSISThe results of heterosis over mid and better parent demonstrated highly significant values with desirable direction in the hybrids 7 (Giza 157XAgent) and 15 (Sakha 92XBaart) at Ismailia; in the hybrids 2 (Sakha 69XGiza 160) and 8 (Giza 157XSakha 92) at Nobaria; and in the hybrid 11 (Giza 160XSakha 92) in both Gemmeiza and combined analysis for plant height.For spike length the hybrids 12 (Giza 160XBaart) and 15 (Sakha 92 X Baart) were the best hybrids for M.P. and B.P.at Ismailia, the hybrid 9 (Giza 157XBaart) was the best hybrid for M.P. and B.P. at Nobaria, while at Gemmeiza the hybrids 13. (Agent X Sakha 92) and 12 (Giza 169 X Baart) were the best in the combined data the hybrids 11 (Giza 160XSakha 92) and 15 (Sakha 92XBaart) have a good result.For No. of spikes/plant the hybrid 1 (Sakha 69XGiza 157) at Ismailia was the best one for M. P. and B. P., the hybrid 11 (Giza 160 X Sakha 92)was the best at Nobaria The hybrids 3 (Sakha69 X Agent) and 1 (Sakha 69 X Giza 157) and the hybrids 6 (Giza1571(Giza 160) and 12 (Giza 160XBaart) had the highly heteroticeffects at Gemmeiza and combined analysis, respectively.For No. of spikalets/spike the hybrids 12 (Giza 160XBaart) and 5 (Sakha 69XBaart) had highly significant values at Ismailia; The hybrid 13 (AgentXSakha 92) at Nobaria and the hybrid 11 (Giza 160XSakha 92) at Gemmeiza had the best result.Also the hybrids 12 (Giza 160XBaart) and 5 (Sakha 69 X Baart) from the combined datashowed highly heterotic effects.For No. of grains/spike the hybrid 5 (Sakha 69XBaart) at Ismailia,and the hybrid 15 (Sakha 92XBaart) at Nobaria showed the best results for M.P.and B.P. The hybrids 11 (Giza 160 X Sakha 92) and 2 (Sakha 69XGiza 160) at Gemmeiza and the hybrid 8 (Giza 157XSakha 92) from the combined analysis showed highly results.For plant weight the hybrids 8 (Giza 157XSakha 92) at Ismailia,11 (Giza 160 X sakha 92) at Nobaria and combined data and the hybrid 10 (Giza 160 X Agent) at Gemmeiza showed highly significant heterotic values for M.P. and B. P.For grain yield/plant the hybrids 4 (Sakha 69XSakha 92) and 11 (Giza 160XSakha 92) at Ismailia, the hybrids 11 (Giza 160XSakha 92) and 2 (Sakha 69XGiza 160) at Nobaria; the hybrid 12 (Giza 160XBaart) at Gemmeiza and the hybrids 11 (Giza 160XSakha 92) in the combined analysis showed the best results forM.P.and B.P.For 100-grain weight the hybrid 3 (Sakha 69XAgent) at Ismailia, the hybrid 1 (Sakha 69XGiza 157) at Nobaria an in the combined data, and the hybrids 15 (Sakha 92 X Baart) and 9 (Giza 157 X Baart) at Gemmiza showed the best heterosis values.For stem rust reaction only the three hybrids 8 (Giza 157 X Sakha 92) at Ismailia and Nobaria, 3 (Sakha 69XAgent) at Gemmeiza and the hybrid 14 (AgentXBaart) in the combined analysis showed good results for resistance to stem rust.III Nature of genetic variance components:-1-The results of the genetic variance components of the various traits studied from the diallel analysis indicated that the differences among the six studied parents were highly significant and confirmed the validity of the assumptions for the diallel analysis in Fl and F2 generations.2-All the characters influenced by both additive and dominance gene effects in all locations in both Fl and F2 .This may be due to the different locations . For the number of spikes /plant only additive gene effect was observed at Gemmeiza in both Fl and F2 ,whereas the dominance effects was significant in all locations in Fl and only at Gemmeiza in F2.3-Unequal allel frequency was observed of the parents in the studied characters in all locations in both Fl and F2.4-The proportion of positive and negative alleles were asymeteically di-tributed among the parents in both Fl and F2 in all locations in

all characters studied. Some traits showedambidirectional dominance.5-The most studied characters were mainly controlled by overdominance case in both Fl and F2 in all locations.However,partial dominance was exhibited in some traits at differentlocations .6-One to two or more pair of genes controlled the inheritance of all the studied traits at the three locations (Ismailia, Nobaria and Gemmeiza) in both Fl and F2 generations meanwhile stem rust reaction seemed to be inherited are a polygeniccharacters.7-The ratio of dominant to recessive alleles in the parents was greater than unity in Fl and F2 , indicating the excess of dominant genes for recessive gemes in the parents for all traits in all locotious except for stem rust where recessive alleles exceeded the effect of dominance alleles .8-Narrow sense heritability was high for each of plant height and number of spikeletes/spike at Ismailia, for grainyield/plant at Nobaria and for number of spikes / plant and plant weight at Gemmeiza for Fl. High heritability values were observed in F2 only for number of grains/spike at Ismailia and plant weight at Gemmeiza . For stem rust reaction heritability values were high in both Fl and F2 in all locations except at Gemmeiza location in both Fl and F2 .9-The correlation coefficient r values were insignificant in almost characters in Fl and F2 in all locations suggested that non of parental lines was completely dominant or recessive for genes controlling any of these characters.10-from graphs (Wr,Vr) the parents showed variation in the dominance or recessive positions for all studied traits in all loc-itions in both Fl and F2 . These variations agree with those-results which obtained from the statistical analysis Forexample, the parents P5 (Sakha 92) at Ismailia and Nobaria in Fl possess an excess of genes, behaved as a dominant for plant height, while the same parent P5(Sakha 92) showed dominant alleles in both Fl and F2 for number of spikelets/spike at Ismailia and Gemmeiza locations .For stem rust the parents 2(Giza 157) and P5(Sakha 92) have dominant alleles in Fl and F2 at Ismailia .while the parents P1 (Sakha 69) and P4 (Agent)in both Fl and F2 at Nobaria exhibited a dominant alleles.At Gemmeiza the parent P3 (Giza 160)showed dominant alleles for stem rust in Fl .while the parents P4 (Agent) and P6(Baart)showed the same result in F2.The parents P3(Giza 160) and P6(Baart)localized in the recessive position at Ismailia and Nobaria in both Fl and F2. phenotypic and genotypic correlation coefficients Grainyield/plant in Fl appeared to be phenotypically and genotypically** **correlated with each of plant weight (0.377 and 0.187) at** **Nobaria location ; number of spikes/plant, (0.215 and 0.193)** **and 100 - grain weight (0.452- and 0.213) at Gemmeiza location;respectively. Comparing with F2.grain yield/plant was**phenotypically and genotypically correlat with plant height(0.327** ** **and 0.228), number of spikes/plant (0.378 and 0.317), number of** ** **spikelets /spike (0.360 and 0.427) and with plant weight (0.701** **and 0.494) at Ismailia location; number of spikes/plant (0.409** **and 0.343),number of grains/spike (0.596** **weight (0.669 and 0.785)**and 0.593), plant** **and 100-grain weight(0.347 and 0.253) at** **Nobaria location and number of spikes/plant(0.412 and 0.365) atGemmeiza location; respectively.Stem rust reaction:-The stem rust infection for parents ranged from (0.0 to43.33) with an average of (16.833) at Ismailia;with an average of 15.90 33.330) with anat Nobaria; (0.067 toaverage of (21.122) at Gemmeiza; and ranged from (0.044 to 37.778) with an average (17.952) in the combined data. The least and Sakha 92 at Ismailiaand Nobaria; and Agent and Sakha 69 at Gemmeiza; and also in the combined data. On the other hand Giza 160 and Baart showed the highest infection score in all locations, and in the combineddata.For Fl the crosses which involve Agent or Sakha 69 as common parents exhibited lower infection score than the other crosses. While the crosses which involve Giza 160 and Baart commen parentsshowed the highest infection score.For F2, the crosses involving Agent as common parents exhibited lower infection score than the other crosses-While, the crosses which have Baart and Giza 160 as common parentsshowed the highest infection score.The resistance to stem rust races 11 and 34 for F2 in seedling stage was dominant and that two pairs of genes controlling the genetic behaviour of resistance to stem rust, one of them has an epistatic effect or both genes act in a complementary manner. In the case of resistance X susceptible for the race 34 may be one pair of genes governing resistance.(0.067 to 36.66)infection score wasobserved in Agent