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Genetic analysis of lower plant height, peduncle length and other moisture stress tolerance traits in bread wheat (*Triticum aestivum* L. emend. Fiori & Paol)

G P SINGH & H B CHAUDHARY

Indian Agricultural Research Institute, New Delhi 110 012

ABSTRACT

For inheritance study, all 15 F1's alongwith six parents were evaluated in randomized block design (RBD) with three replications. Data were recorded on peduncle length PL (cms), ear length EL (cms), lower plant height LPH (cms), PL/PH index, LPH/PH index, PL/LPB index. The diallel cross analysis revealed that importance of non additive gene action in expression of PL/LPH index, PL/PH index, LPH/PH index and grain yield per plant. However, additive gene action was observed for peduncle length and lower plant height. The effective selection can be carried out for the improvement of peduncle length.

Key words: Peduncle length, Lower plant height, Bread wheat, Moisture stress

Food supply for the continuously increasing population is a major concern in India. The solution to the food problem largely depends on the increase and stabilization of grain productivity and the improvement of its quality. Wheat constitutes one of the five major crops of the world and the second most important cereal crop in India after rice. It has been used as a major source of food since prehistoric times. Many of the crops characteristics were probably well known 2000 years ago when it evidently was grown for food. The area under cultivation of wheat crop in India is 26.6 M ha with the production of 72.1 M tones. A major part of area under wheat cultivation is under moisture stress condition, where productivity has not witnessed any significant increase despite the success of green revolution. The ideal genotype for moisture stress condition must combine a reasonably high yield potential under varied environmental conditions with specific plant characters which could buffer yield against severe moisture stress (Blum 1983).

Moisture stress itself is a complex phenomenon and several morpho-physiological parameters influencing it were found to be under genetic control. Information on genetic parameters particularly related to moisture stress tolerance in wheat is very limited. Utilization of some effective morpho-physiological traits like longer peduncle with semi dwarf plant height will enhance physiological efficiency of the wheat plant for synthesis, storage and translocation of photosynthates from source to sink and will enable it to respond to higher inputs of fertilizer and irrigation. It is therefore, essential to study and understand the genetic mechanism, like nature of gene action, pattern of inheritance and association of peduncle length and other moisture stress tolerant traits. Such understanding will enable the breeder to formulate efficient breeding strategies which will aid to evolve varieties tolerant to moisture stress, on sound scientific basis. Thus this study was undertaken to inheritance pattern of peduncle length and other moisture stress tolerant traits in diverse moisture regimes.

MATERIALS AND METHODS

The experimental material for inheritance study was generated by crossing six diverse genotypes in all possible combinations (excluding reciprocals) in a diallel during Rabi 2003-04. The parents used were

IB 2K1-80-1	Mendos/Pissi local/C 306// PBW 175//HW 2038
RR 19	SAPPO/HD 2310//HW 2004/C 306//HW 2002
RR 40	IWWPN-XIV-201/HW 888//HD 2329/ MARISDOVE/K 68/BHU375/2* KAVKAZ
RR 57	OGOSTA/SEL 111//HW 2002/HW 2007
RS 871	PARA 2/JUP/BJY/4/3/VEE #5/JUN/4/ ATTILA
RR 14	MENDOS/HINDI 62//DL 153-2

Field experiments were conducted at Experimental Farm, Division of Genetics, Indian Agricultural Research Institute, New Delhi, India (28° 41' North latitude and 77°13' East latitude, 228 m above mean sea level). The area is semi arid, sub tropical climate with alluvial soil which is slightly alkaline with clay loam texture and low organic matter. The experiment was sown in two planting dates during 2003-04 and 2004-05 crop season.

For inheritance study, all 15 F1's alongwith six parents were evaluated in randomized block design (RBD) with three replications. Each entry was planted two meter long four row plot. The rows were spaced 23 cms apart. The data were recorded on ten randomly selected competitive plants in each of the plot. Normal cultural practices were followed. peduncle length PL (cms), ear length EL (cms), lower plant height LPH (cms) (LPH=PH-PL-EL), PL/PH index (PL/PH x 100), LPH/PH index (LPH/PH X 100), PL/LPB index (PL/LPH X 100) The diallel analysis was carried out as per Griffing (1956a) Method 2, Model I. The estimation of the components of genetic variance was done as per Griffing (1956b). The allied genetic parameters like degree of dominance and ratio of additive to total genetic variance were respectively estimated as per Kempthorne and Curnow (1981).

RESULTS AND DISCUSSION

ANALYSIS OF VARIANCE AND COMBINING ABILITY

The analysis of variance for lower plant height, peduncle length and other traits are presented in the Table 1. The analysis of variance for combining ability indicated that both general and specific combining ability were highly significant for all the characters except lower plant height. The general combining ability and specific combining ability for lower plant height, peduncle length and other traits are given in Table 2 and 3. For peduncle length RR 19 was found to be a good combiner for long peduncle and RS 871 for short peduncle. Values of gca effect and sca effect were not significant for any of the parents and crosses for lower plant height. None of the parents were found to be good general combiner for higher value of PL/PH index. Crosses RR 40 x RS 871 and RR 19 x RR 14 were good specific combiners for PL/PH index. For the character PLP/PH index, none of the parents gca effects were significant. However, RR 19 x RR 40 and IB2K1-80 x RS 871 were good specific combiner having positive value of sca effect. Similarly, for PL/LPB index crosses RR 40 x RR 57, RR 40 x RR 14, IB2K1-80-1 x RR 19 and RR 19 x RR 14 has significant gca effects. RR 57 was found to be a good combiner for grain yield having positive and significant gca effect. Three best crosses were RS 871 x RR 14, IB 2K1-80-1 x RS 871 and RR 19 x RR 40.

ANALYTICAL ESTIMATION OF COMPONENTS OF GENETIC VARIANCE

The estimates of variance due to general combining ability (2gca) and specific combining ability (2 sca) are presented in the Table 4. It is clear from the table that variance due to sca was more important than variance due to sca for PL/PH index, LPH/PH index and grain yield per plant indicating the importance of overdominance. For peduncle length and lower plant height, variance due to gca was important which shows the importance of additive gene action. Diallel cross analysis revealed the importance of non-additive gene action in the expression of PL/LPH index, LPH/PH index PL/LPH index and grain yield. Tandon *et al.* (1989), Mishra e*t al.* (1994) and Senapati *et al.* (2000) reported that in bread wheat the sca effects were higher than gca effects. On the other hand Sheikh *et al.* (2000) indicated GCA was major component of variation for yield contributing traits. The findings of Rajaram and Maheswari (1996) emphasized that both GCA and sca effects were important.

For peduncle length and lower plant height, variance due to GCA was important which shows the importance of additive gene action (Table 5). Based on the general combining ability effects some of the good general combiners are identified for the different traits studied like RR 19 for peduncle length and biological yield, RR 40 fro PL/LPH index, RR 57 for PL/LPH index, grain yield per plant. Therefore, effective breeding and selection programme like biparental mating or diallel selective mating could be useful to improve the peduncle length in bread wheat. These breeding approaches could be helpful in developing bread wheat populations which upon selection could yield in to an efficient high yielding dwarf/semi dwarf wheat varieties with longer peduncle length, which could give respectable yield even under severe moisture stress conditions through a new plant type. Long peduncle length and lower plant height with other related traits will help plant to utilize more sunlight. It also increases the total photosynthetic are and ultimately the grain yield. It is conclude that for the peduncle length, lower plant height and other related traits, an appropriate choice of environments should be made in such a way that character show relatively simple inheritance for further improvement of grain yield in the bread wheat.

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