MORPHOGENETIC EVALUATION FOR LEAF CHARACTERISTICS IN F_3 SEGREGATING POPULATIONS OF BREAD WHEAT

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Five single crosses between four abscisic acid lines and two varieties were analysed to ascertain broad sense heritability and genetic advance of drought related leaf characteristics in F_3 populations of bread wheat. Heritability and genetic advance values were moderate to high for all the characters studied. High heritability estimates were recorded for stomatal frequency (90.36%), stomata size (90.22%) and epidermal cell size (90.36%) in the cross High ABA 16 x Pak, 81. Results indicated that selection should lead to a fast genetic improvement of the material.

INTRODUCTION

Heritability is the extent to which the variation in the successive generations is predictable and-reflects the extent to which a given character 'Yould be transmitted to next generation. Heritability estimates thus provide much needed confidence in selection procedures. Shah id (1987) reported medium to high heritability estimates from 21.70 to 80.25% for nag leaf venation. Martin (1970) reported heritability estimates in broad sense up to 60% for number of stomata, whereas Shahid (1987) reported heritability values for number of stomata ranging from 66.60 to 93.98% in 9 wheat crosses. Boromotov and Smirnova (1981) reported heritability in broad sense from 44 to 56% for size of stomatal guard cells..Abid (1987) reported heritability estimates in broad sense ranging from 84.55 to 93.90% for epidermal cell size of flag leaf. The present study adds further information in this regard.

MATERIALS AND METHODS

The present research work was undertaken in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during crop season 1991-92. The following 5 crosses served as the experimental material for the study:

1. High ABA 11 x Pak. 81
2. High ABA 15 X Pak. 81
3. High ABA 16 X Pak. 81
4. High ABA 20 X Pak. 81
5. High ABA 20 x LU 26S

Single seed descent method was followed for these studies. Single seed was harvested from individual plants of F_2 populations to raise F_3 populations. Seeds along with their parents were space planted in the field with the help of a dibble keeping inter-plant and inter-row distance of 15 and 30 cm, respectively. The' experiment received normal agronomic and cultural treatments during the growing. season. The size of F_3 populations ranged from 290 to 350 plants cross". At maturity, all the plants from F_3 populations of each cross and 20 plants randomly selected from each parent were taken and the data were recorded of the following leaf traits:

1. Flag leaf venation: The selected plant leaves were dipped in Cornoy's solution. After 48 hours, these were washed with al-

cohol and were examined under a microscope at 3.5 x magnification to count the number of parallel veins microscopic field-[1].

2. Stomatal frequency: The leaf strips were examined under microscope at 40 x microscopic field to count the number of stomata.

3. Stomata. size: Stomatal size was measured under 40 x objective of microscope. Stomatal length and breadth were measured in microns from the upper surface of flag leaf strips. A stage and an ocular micrometer were used for this purpose.

4. Epidermal cell size of flag leaf: A fine peal from a leaf strip was used to estimate length and breadth of epidermal cells in microns using a compound microscope. A stage and ocular micrometers were used for the estimation of epidermal cell size by multiplying length and breadth.

Heritability estimates in broad sense were computed by using the formula delineated by Cahancr and Hill (1980):

$$h^2F_3P = \frac{VF_3 - \overline{VP}}{VF_3}$$

where

h^2F_3P = The estimation of broad sense heritability from F_3 population and the original purebred parental lines.

VF_3 = Phenotypic variance of a character in F_3 population.

$\overline{VP}$ = Average variance of a character within purebred parental lines,

Genetic advance was calculated by us. ing the following formula:

$$GA. = S.D. \times h^2 \times i$$

where

GA. = Genetic advance

S.D. = The phenotypic standard deviation

h^2 = The estimates of heritability in fraction

i = Constant value that reflects the selection intensity. The value for i = 1.755 in this study at 10% se-. lcction pressure.

RESULTS AND DISCUSSION

The means {X), broad sense heritability (h^2) and genetic advance (GA) for all the characters studied in 5 crosses of wheat are obvious from Table 1. Moderate to high values of heritability and genetic advance were observed in all the characters.

Heritability estimates in broad sense and genetic advance values for flag leaf venation ranged from 53.80 to 79.21 and 0.84 to 2.33% in the crosses High ABA 20 x Pak. 81 and High ABA 16 x Pak. 81, respectively. results are in close agreement with the findings of Shahid (1987) and reveal that the higher number of veins on leaf helps in moisture economy through its judicious distribution. So, selection for higher number of veins can be fruitful in appropriate cross combinations. Range of heritabilityestimates for stomatal frequency was from 78.57 to 93.46% for the crosses High ABA 11 x Pak. 81 and High ABA 20 x Pak. 81, respectively. The genetic advance values for these crosses also ranged from 1.37 to 2.88, respectively. These results are in confirmation with those of Shahid (1987) and reflect a stability in the character. Results reflect the need for effective selection for appropriate parents. High heritability coupled with genetic advance values for stomata size were observed in the crosses High ABA 11 x Pak. ~1 and ABA 16 x Pak. 81. Similar results have already been reported by Boromotov and Smirnova (1981). Under low moisture conditions, stomata size play very important

Table 1. Morphogenetic evaluation for leaf characteristics in F_3 segregating populations of bread wheat

Cross		Flag leaf venation	Stomatal frequency	Stomata size (JJ.)	Epidermal cell size of nag leaf (JJ.)
High ABA 11 X Pak. 81	$\bar{X}$	12.8	5.1	2132	4628
	h^2	61,2	78.6	62	89
	GA	1,1	1,4	204	715
High ABA 15 X Pak. 81	$\bar{X}$	13.7	5,4	1993	4980
	h^2	69.2	81,8	62	91
	GA	1,3	1,6	208	777
High ABA 16 X Pak. 81	$\bar{X}$	12.9	5.8	2161	5302
	h^2	79.2	90,4	90	90
	GA	2,3	2,5	398	732
High ABA 20 X Pak. 81	$\bar{X}$	11,5	5.1	2089	5607
	h^2	53.8	93,5	69	91
	GA	0.8	2.9	237	741
High'ABA 20 X LV 26S	$\bar{X}$	12.1	SQH	2290	5X7(,
	h^2	64.2	90,3	80	IJ2
	GA	1,1	2,4	362	831

ABA = Abscisic acid, X = Mean, h^2 = Heritability (%), GA = Genetic advance.

role and effective selection for this character is useful for evolving wheat varieties for arid areas. Heritability estimates in broad sense and genetic advance values for epidermal cell size of flag leaf ranged from 88.85 to 92.39% and 714.69 to 831.05 for the crosses High ABA 11 X Pak. 81 and High ABA 20 X LV 26S, respectively. Results confirm the findiilgs' of Abid (1987) and reveal that effective selection for this character is possible in 'advance generations.

All the' characters studied are related to drought. More number of veins on flag leaf and less number of stomata are favourable traits for wheats of low moisture areas. Further more smaller epidermal cells with stomatas small in size are also desirable for arid areas. The mean values for the characters studied reflect that the cross High ABA 15 X Pak. 81 is particularly of interest when flag leaf venation and stomata size are of consideration. The mean value (5.15) was same for stomatal frequency in two crosses viz. High ABA 11 x Pak. 81 and High ABA 20 X Pak. 81 but the later exhibited high heritability and genetic advance values. The cross High ABA 11 x Pak. 81 is important for epidermal cell size of flag leaf.

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