

## GENETIC PARAMETERS AND CORRELATION AMONG FLORAL CHARACTERS IN LOCAL FINE RICE

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### ABSTRACT

The experiment was conducted to study variability, genetic parameters and correlation between seven out crossing floral traits in fine rice genotypes. Significant variations were observed in the genotypes for all the characters studied viz. duration of open floret (DOF), angle of open floret (AOF), stigma length (SL), stigma breadth (SB), anther length (AL), anther breadth (AB) and filament length (FL). Considering genetic parameters high genotypic coefficient of variation (GCV) value was observed for FL followed by SL and SB. High broad sense heritability with high genetic advance in percent of mean (GAPM) was observed for FL followed by SL and SB also. Anther length (AL) showed lowest broad sense heritability with lowest GAPM. The Correlation analysis among seven floral traits (inter character association) revealed that anther length vs stigma length had highest positive correlation coefficient value ( $r$ ) and it was followed by Anther breadth vs, stigma length, stigma breadth vs. duration of open floret and anther length vs. stigma breadth.

**Key words:** Genetic variability, Correlation, Fine rice, Heritability, Genetic advance

### INTRODUCTION

Rice is an autogamous plant with a special floral architecture appropriate for selfing. Rice plant produces large number of bisexual spikelet on a large panicle. Being a self pollinated crop rice shows limited out crossing ranging from 0% to 6.8% (Butany, 1957), and several wild specie significantly high out crossing rate (Oka, 1988). Variability upon the extent of natural out crossing of male sterile lines could be attributed to differentiate in flower behavior like floral characteristics of male sterile and pollen parents in relation to environmental factors. Several characteristics, viz. plant height, flag leaf length or angle, panicle exertion affect natural out crossing. A good panicle exertion in the parent would expose a higher number of spikelets for out crossing compared to male sterile lines, showing incomplete panicle exertion. Synchronization of flowering in seed and pollen parents is the key to attaining good out crossing on the seed parent (Yuan, 1985). An ideal female parent in the commercial hybrid rice seed production program should have early flowering along with a long duration of blooming.

The success of hybrid seed production depends on the deposition of sufficient number of alien pollen grains in the stigma tie surface of each spikelet of the seed parent. This is achieved through a series of conditions offered by environment and the plant itself. Different floral traits in rice offering out crossing conditions were duration of open floret, angle of open floret, stigma size, style length, stigma exertion rate, anther size and filament length. Oka (1988) stated that out crossing in rice depends on the capacity of stigma to receive pollen and this capacity was built up by changing out crossing floral traits. In a hybrid breeding program, selection of component lines with desirable floral traits is very important. For this purpose variability and correlation study of floral traits is helpful to select component lines for hybrid production. Variability and correlation study on rice floral traits, especially in fine rice is rare; in these circumstances, this piece of study is very relevant for identification of maintainer lines in Bangladeshi fine rice.

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## MATERIALS AND METHODS

The experiment was conducted at the field laboratory, Department of Genetics and Plant Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, during Amon season in 2004. The trial consisted of ten identified maintainer of local fine rice collected from different location of the country (Table 1)

Table 1. List of identified aromatic local maintainers of rice used in the experiments

Sl. No.	Name of genotype	Type	Place of collection
1	Doergura	Transplant Aman	Khulna
2	Premful	Transplant Aman	Satkhira
3	Elai	Transplant Aman	Dhaka
4	Badshabhog-3	Transplant Aman	Dhaka
5	Kalijira-2	Transplant Aman	Dhaka
6	Kalijira-3	Transplant Aman	Dhaka
7	Radhunipagal-1	Transplant Aman	Dhaka
8	Radhunipagal-2	Transplant Aman	Dhaka
9	Uknimadhu	Transplant Aman	Kurigram
10	Dubshail	Transplant Aman	Satkhira

The entries were grown in a Randomized Complete Block Design (RCBD) with three replications. Twenty five days old seedlings were transplanted in 3.60 m<sup>2</sup> plots with a spacing of 20 cm x 15 cm, using single seedling per hill. Fertilizers were applied @ 130, 50, 60, 33 and 5 kg N, P, K, S and Zn per hectare. All the fertilizers except urea were applied at final land preparation. Total urea was applied in two installments, at 20 DAT (days after transplanting) and 50 DAT. Intercultural operations and pest control measures were done as and when necessary. Data on seven floral characters viz. , duration open floret in min.(DOF), angle of open floret in degree (AOF), stigma length in  $\mu$  (SL), Stigma breadth in  $\mu$  (SB), anther length in  $\mu$  (AL), anther breadth in  $\mu$  (AB) and filament length in  $\mu$  (FL) were recorded from 5 random plants of each plot. Duration of open floret recorded from the time of opening of the first spikelet on a panicle to the complete closure of all spikelets in that panicle in the same day. The angle of open floret was measured with protractor. The stigma and anther characters were measured under microscope using stage and ocular micrometers. Genetic variance ( $S^2_g$ ) environmental variance ( $S^2_e$ ), phenotypic variance ( $S^2_p$ ), genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) heritability in broad sense (Hb), genetic advance in percentage of mean (GAPM) and correlation coefficients (r) analysis were performed following Singh and Choudhury (1985). The estimate of GCV and PCV were classified as low, medium and high (Sivasubramanian and Madhavamenon, 1973). The heritability was categorized as suggested by Robinson *et al.* (1949). Again, genetic advance was classified by adopting the method of Johnson *et al.* (1955)

## RESULT AND DISCUSSION

### Genetic parameters

The analysis of variance revealed highly significant variations among the identified maintainers of local fine rice germplasm for all the characters studied (Table 2).

The duration of floret opening ranged from 88.00 to 130.00 min among the tested fine maintainer rice. Sharma (1991) reported that the longer duration of floret opening enhance seed set. The variation for floret opening in indica rice varieties had been observed from 52 to 93 min. Singh and Singh (1998) also reported similar result for this floral trait in maintainer lines. Angle of floret opening ranged from 20.60 to 34.60°. Bassi *et al.* (1992) indicated sufficient variability among CMS lines for angle of floret opening ranging from 33.16 to 45.00°. Stigma length ranged from 144.50 to 505.00  $\mu$  and stigma breadth ranged from 365.00 to 155.00  $\mu$ . The rate of exerted

Table 2. Genetic parameters for seven floral characters in ten identified maintainers of local fine rice

Character s	Range	MS	S <sup>2</sup> g	S <sup>2</sup> e	S <sup>2</sup> p	GC V	PCV	Hb	GAP M
DOF (min)	130.00 -88.00	427.65**	141.54	3.04	144.57	10.4 4	10.5 5	97.9 0	21.28
AOF (degree)	34.60- 20.60	44.46**	14.00	2.45	16.45	13.8 3	14.9 9	85.0 9	26.28
SL (μ)	144.50 -505.0	178722.97**	59303.82	811.51	60115.33	30.9 2	31.1 3	98.6 5	63.27
SB (μ)	365.00 - 155.00	10004.87**	3272.20	188.27	3460.47	24.4 4	25.1 3	94.5 6	48.96
AL (μ)	2665.0 0- 1825.0 0	128302.14**	29445.49	39965.6 8	69411.17	8.04	12.3 5	42.4 2	10.79
AB (μ)	515.00 - 340.00	6425.58**	2078.15	191.13	2269.28	10.7 6	11.2 4	91.5 8	21.21
FL (μ)	1575.0 0- 585.00	409926.30**	136445.3 7	590.19	137035.5 6	32.7 6	32.8 3	99.5 7	67.33

\*\* Significant at 1% level of significance. DOF = Duration open floret (min), AOF = angle of open floret (degree), SL = Stigma length (μ), SB = Stigma breadth (μ), AL = Anther length (μ), AB=Anther breadth (μ) and FL = Filament length (μ), S<sup>2</sup> g = Genetic variance, S<sup>2</sup> e = environmental variance, S<sup>2</sup> p = phenotypic variance, GCV = genotypic coefficient of variation, PCV = phenotypic coefficient of variation, Hb = heritability in broad sense and GAPM = genetic advance in percentage of mean

stigma and stigma length correlate with ranges from 0 to 90% (Taillebois and Guimaraes, 1986). Anther length and breadth are the important components that attributed to proper pollen quantity and pollen shedding (Parmar *et al.*, 1979). The anther length ranged from 2665.00 to 1825.00 μ and breadth ranged from 515.00 to 340.00 μ (Table 2). Amount of pollen and pollen shedding which depend on the anther size and filament elongation respectively, are as important as size and position of stigma for facilitating enhancing percentage of cross pollination (Parmar *et al.*, 1979). The length of filament at full blooming ranged 585.00 to 1575.00 μ. Thus the degree of elongation can be used an index to decide the fitness of pollen parents.

The phenotypic variance was partitioned into genotypic and environmental variances for a clear understanding of the pattern of variations. The highest genotypic and phenotypic variances were found in filament length (FL) in micrometer followed by stigma length (SL), anther length (AL) and stigma breadth in micrometer (SB). The lowest magnitude of genotypic, phenotypic variances were recorded in angle of open floret (AOF) in degree. Environmental variance was also highest for anther length in micrometer (AL) and lowest for angle of open floret (AOF) in degree. The variability of the characters was measured by range, GCV and PCV. The highest GCV and PCV were obtained from filament length (FL) followed by stigma length (SL), stigma breadth (SB) angle of open floret (AOF), anther breadth (AB), duration open floret (DOF) and anther length (AL). Phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the evaluated characters indicating presence of environmental influence to some degrees in the phenotypic expression of the characters. PCV was slightly higher than GCV in case of filament length, duration of open floret and stigma length. On the other hand anther breadth (AB), stigma breadth (SB), angle of open floret (AOF) and anther length (AL) showed PCV considerably higher

than GCV which indicated marked influence of environment on the expression of these characters. The findings were supported by Saravanan and Senthil (1997).

Broad sense heritability was relatively high except anther length (42.42%) for all the characters. Although high heritability estimates are to be helpful in making selection of superior genotypes rather than the basis of phenotypic performance and heritability estimates along with genetic gain would be more useful in predicting the effect for selecting the best individual. High heritability associated with high genetic advance estimates were found in filament length, stigma length and stigma breadth which indicated that the character were simply inherited in nature and controlled by a few major genes or possessed additive gene effects. Similar results were reported by Singh and Singh (1998). The heritability estimates with low genetic advance indicated that non additive type of gene action and genotype x environment interaction played a significant role in the expression of the traits as observed in anther length, percent panicle exertion and anther breadth. Stigma length and filament length had moderate to high genotypic and phenotypic coefficient variations, high heritability and high genetic advance making these two characters most effective in the selection for hybrid rice.

### Character association

Correlation coefficient analysis among seven floral traits in rice is shown in the (Table 3). Stigma length (SL) exerted significant positive correlation (r-value

Table 3. Correlation coefficient (r) among seven floral characters in ten identified maintainers of local fine rice

Characters	DOF (min)	AOF (degree)	SL ( $\mu$ )	SB ( $\mu$ )	AL ( $\mu$ )	AB ( $\mu$ )
AOF(deg.)	0.084					
SL( $\mu$ )	0.236	0.367*				
SB( $\mu$ )	0.560**	-0.049	0.455**			
AL( $\mu$ )	0.315	0.169	0.848**	0.559**		
AB( $\mu$ )	0.463**	0.522**	0.562**	0.314	0.482**	
FL( $\mu$ )	0.528**	-0.453**	-0.216	-0.025	0.071	-0.012

\*\*Significant at 1% level, \*Significant at 5% level,  $\mu$  : Micrometer =0.367) with angle of open floret (AOF).

Stigma breadth (SB) showed highly significant positive correlation coefficient (r) value (.560) with duration of open floret (DOF). Stigma breadth (SB) again showed highly significant positive correlation (0.455) with stigma length (SL). Anther length (AL) had highly significant highest positive correlation (0.848) with stigma length (SL). Anther length also showed significant positive correlation with stigma breadth (0.559). The correlation of anther breadth (AB) with duration of open floret (DOF) was highly significant and positive (0.463). Like this highly significant positive correlation was found AB vs. AOF (0.522), AB vs. SL (0.562), AB vs. AL (0.482), FL vs. DOF (0.528) and highly negative and significant correlation was observed in FL vs. AOF (-0.453). It indicated floral characters are correlated among themselves. All significant correlations were positives except correlation between filament length and angle of open floret. Biswas et al (2000) reported significant negative and positive correlation between different traits of rice and supported these findings.

Results of the study suggested that a wide variation exists among the floral characters of the tested local fine maintainer which might be helpful in breeding program for selecting better parent making better hybrid combination.

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