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Estimation of Euclidean Distance for Different Morpho-physiological Characters in Some Wild and Cultivated Rice Genotypes (*Oryza sativa* L.)

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Abstract: The pattern of genetic diversity and relation was studied in 2 wild and 3 cultivated rice genotypes of Bangladesh. Euclidean Distance among Jhora (Wild) 4325, Wild 4855, Dular, Hab. Aman 2 and Jagliboro was measured. Comparatively lower distance was found among Jhora 4325 and Jagliboro in comparison with other cultivated genotypes. Overall low distance was found among Jhora 4325, Jagliboro, Hab. Aman 2 and Dular, respectively than Wild 4855. Jhora 4325, Dular, Jagliboro and Hab. Aman 2 were close to each other in respect of different combinations which indicated strong relationship among these four genotypes and in reverse way with Wild.

Key words: Rice (*Oryza sativa* L.), euclidean distance, divergence, morphophysiological characters

INTRODUCTION

Genetic distance and proximity in the population for different characters of any crop are very important to determine their phylogenetic relationship as well as their evolutionary patterns. Sometimes it becomes necessary to find out the actual relationship between parents. Morphological, ecological and population characteristics were studied in wild and cultivated rice by Euclidean distance (Counts and Lee, 1987; Pang *et al.*, 1995). Different qualitative and quantitative characters were also studied by this method in rice (Fatokun *et al.*, 1986; Wu and Huang, 1988). The pattern of genetic diversity in wild and local rice cultivars were also determined by Euclidean cluster analysis (Iglesias *et al.*, 1986; Gonzalez and Ramirez, 1999; Gupta *et al.*, 1999; Ogbonnaya *et al.*, 2001). Before hybridization and without getting F₁ generation some time it is difficult to find out the relation between parents. So, Euclidean distance is a suitable method to measure the distance between the parents. The main objectives of the present study were to find out the divergence and distance among the 5 rice genotypes selected from different ecotypes of Bangladesh and the suitability of these materials for hybridization purpose for genetic study.

MATERIALS AND METHODS

Genetic divergence and distance among the rice genotypes viz. Wild 4855, Jhora 4325, Jagliboro, Dular and Hab. Aman 2 for different quantitative traits were estimated. Genotypes were grown during Boro 2001-2002 using Randomize Complete Block design with three replications in the field laboratory of Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh.

Observations were made from the middle rows. Ten plants were selected at random from each replication for taking data on days to heading, days to maturity, plant height, tiller number plant⁻¹, flag leaf length, flag leaf width, panicle length, panicle weight, No. of primary branch panicle⁻¹, No. of secondary branch panicle⁻¹, total spikelet panicle⁻¹, No. of filled grain, No. of unfilled grain, grain length, grain width of the five rice genotypes. Analysis of variance (ANOVA) was done following Singh and Chaudhury (1985). Diversity among the 5 rice genotypes for 15 characters was assessed by estimating Euclidean Distance as formula suggested by Shfrics and Sacks, (1980).

$$\text{Euclidean Distance} = \sum_{k=1}^7 \left(\frac{X_{ik} - X_{jk}}{S_k} \right)^2$$

Where

- X_{ik} = Performance of the *i*th parent for *k*th character
- X_{jk} = Performance of the *j*th parent for *k*th character
- Sk = Standard deviation of the *K*th character

RESULTS AND DISCUSSION

Significant values from variance analyses of 15 characters of 5 rice genotypes (Table 1) suggested the presence of genetic variations between and among the genotypes. The mean performance data of 15 characters those have used for Euclidean distance are presented in Table 2. The variations in the studied characters were analyzed through estimation of Euclidean distance between and among the genotypes. The Euclidean distance values (Table 3) ranged from 13.853 to 56.985. The lowest distance (13.853) was found between Dular

and Hab. Aman 2. The distance between Jhora 4325 and Wild 4855 was highest (56.985). Jhora 4325 showed lowest distance with Jagliboro (20.447) and Hab. Aman 2 (22.120), medium distance with Dular (32.447) and highest distance with Wild 4855. On the other hand, Wild 4855 showed medium distance with Jagliboro (42.291), Hab. Aman 2 (32.545) and Dular. Jagliboro showed lower distance with Dular (20.601) and Hab. Aman 2 (21.594). Hab. Aman 2 showed lower distance with Dular.

Jhora 4325 and Jagliboro showed comparatively lower distance in combination with other rice genotypes. Overall low distance was found among Jhora 4325 Jagliboro, Dular and Hab. Aman 2 than Wild 4855. Jhora 4325, Jagliboro, Dular and Hab. Aman 2 were found to be close with each other in respect of different combinations, which indicate apparent strong genetic relationship among these genotypes. Beside this Jagliboro was more

Table 1: Analysis of variance of 15 quantitative characters of 2 wild and 3 cultivated rice genotypes (Boro season 2001-2002)

Characters	Replication (n-1) = 2	Genotype (n-1) = 4	Error (n-1) (n-1) = 8	CV (%)
Days to heading (d)	0.867	534.0**	0.2	0.38
Days to maturity (d)	0.600	792.90**	0.1	0.2
Plant height (cm)	0.265	1590.51**	1.115	0.8
Tiller No. plant ⁻¹	11.400	42.6**	0.15	2.93
Flag leaf length (cm)	2.766	203.877**	0.157	1.15
Flag leaf width (cm)	0.001	0.162**	0.005	5.79
Panicle length	0.119	3.615**	0.15	1.61
Panicle weight	0.030	2.207**	0.003	2.35
No. of primary branch panicle ⁻¹	0.925	7.037**	0.05	2.58
No. of secondary branch panicle ⁻¹	18.067	463.76**	0.067	0.97
Total spikelet panicle ⁻¹	11.400	4432.17**	7.57	2.12
Filled grain spikelet panicle ⁻¹	5.000	2668.43**	7.33	2.77
Unfilled grain spikelet panicle ⁻¹	1.400	339.77**	3.07	5.44
Grain length	0.005	2.72**	0.02	1.76
Grain width	0.007	0.163**	0.002	1.31

** Significant at 1% level of probability

Table 2: Mean, range, standard deviation and standard error for 15 characters of 2 wild and 3 cultivated rice genotypes grown in Boro season' 2001-2002

Characters	Mean	Range	SD	SE
Days to heading (d)	117.330	106.33-136.33	13.340	5.967
Days to maturity (d)	156.600	137.33-175.00	16.260	7.270
Plant height (cm)	131.811	113.98-170.30	23.020	10.297
Tiller Number plant ⁻¹	13.200	9.0-17.00	3.760	1.865
Flag leaf length (cm)	34.436	27.00-45.02	8.244	3.687
Flag leaf width (cm)	1.256	1.00-1.54	0.232	0.104
Panicle length	24.000	22.82-25.28	1.098	0.491
Panicle weight	2.310	0.96-3.12	0.858	0.384
No. of primary branch panicle ⁻¹	8.630	7.20-11.20	1.532	0.685
No. of secondary branch panicle ⁻¹	26.533	17.00-48.00	12.433	5.560
Total spikelet panicle ⁻¹	130.000	88.00-192.67	38.437	17.189
Filled grain spikelet panicle ⁻¹	97.800	59.66-142.33	29.824	13.338
Unfilled grain spikelet panicle ⁻¹	32.200	23.33-50.33	10.642	4.759
Grain length	8.027	7.35-9.70	0.951	0.425
Grain width	3.204	2.83-3.48	0.233	0.104

Table 3: Divergence (Euclidean distance) in selected 2 wild and 3 cultivated rice genotypes grown in Boro season 2001-2002

	Jhora 4325	Wild 4855	Jagliboro	Hab. Aman 2	Dular
Jhora 4325	0	56.985 (H)	20.149 (L)	22.12002 (L)	32.447 (M)
Wild 4855		0	42.291 (M)	32.54525 (M)	37.26 (M)
Jagliboro			0	21.59415 (L)	20.601 (L)
Hab. Aman 2				0	13.853 (L)
Dular					0

close to Dular than Hab. Aman 2, which indicated that Jagliboro played major role as a key genotype among the studied five rice genotypes regarding the evaluation of cultivated rice (traditional) genotypes from wild rice genotypes. Euclidean distances measured from the mean performance data of different quantitative characters, which established a strong relationship among the wild and cultivated rice genotypes. This study also in agreement with the findings of other researchers where they have estimated divergence between parents in cereals and other crops using Euclidean distance and found significant result in respect of genetic distance and selection of plant materials for breeding purpose (Shifriss and Sacks, 1980; Shamsuddin, 1990; Ogbonnaya *et al.*, 2001).

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