SHORT COMMUNICATION

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Study of genetic diversity among different rice varieties using quantitative characters

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ABSTRACT

Eighteen rice varieties which are mostly grown in Bihar state of India were studied for genetic diversity on the basis of sixteen quantitative characters using numerical taxonomic approach. Eighteen varieties were grouped into nine different clusters revealing sufficient amount of variability among the varieties. Hybridization involving Rajendra Shweta and Dhan Lakshmi with Sudha, Rajendra Bhagwati and Rajshree with Satyam, Rajendra Suwasni and Super Katarni with Nata Mahsuri, Rajendra Bhagwati and Satyam with Sudha were found to be more suitable parents for increasing the grain yield.

Key words: *rice, genetic diversity, quantitative characters*

A successful breeding programme will depend on the genetic diversity of a crop for achieving the goals of improving the crop and producing high yielding varieties. Study of genetic diversity assists the plant breeders in selecting appropriate materials for further genetic improvement of cultivars and effective management of rice genetic resources. Morphological characterization is the first step in classification and evaluation of the germplasm (Smith *et al*., 1991). In order to develop high yielding varieties it is essential to select parental lines which have high yielding traits. Hence, the present investigation was attempted to assess the genetic diversity of different rice varieties on the basis of different quantitative traits.

Eighteen rice varieties were evaluated at Rajendra Agricultural University, Bihar, India during wet season of 2011. The experiment was laid out in a randomized block design with three replications of 3m length. Row to row and plant to plant spacing were maintained at 20×15 cm. All the recommended agronomic practices were followed to raise a good crop. Observation were recorded for sixteen quantitative traits viz., leaf blade length, leaf blade width, days to 50% flowering, flag leaf length, flag leaf width, panicle length, number of effective tillers plant^{-1}, plant height, days to maturity, 100-grain weight, grain length, grain width, grain shape index, grain yield plant^{-1}, biological yield plant^{-1}, harvest index. Five random plants/ replication/ variety were tagged for recording observations. Using numerical taxonomic approach (Sneath and Sokal, 1973) for assessing genetic divergence, dissimilarity coefficients were computed on the basis of simple matching. Similarity matrices were generated using software NTSYS-pc version 2.1 (Rholf, 2000). The resultant dissimilarity matrix data was employed to construct dendrogram by using sequential Agglomerative Hierarchical Nesting (SAHN) based on un-weighted pair-group method with an average (UPGMA) to inter genetic relationship and phylogeny among varieties using software NTSYS-pc version 2.1 (Rholf, 2000).

The analysis of variance indicated highly significant differences between the varieties for all the traits under study (Table 1 and Table 2). Eighteen rice varieties were grouped into nine clusters at 30 dissimilarity units in the phenogram (Table 3, Fig 1). Maximum number of varieties (four) was included in cluster I and III. Cluster II, V and VIII are di-genotypic, while cluster IV, VI, VII and IX are monogenotypic. The clustering pattern did not reveal that geographic diversity is a reasonable index of genetic diversity. Many earlier research workers (Joshi *et al*., 2008; Seetharam

Table 1. Analysis of variance for different quantitative characters in locally adapted rice

Characters	Replication (MSS)	Genotype (MSS)	Error (MSS)
d.f	2	17	34
Leaf blade length (cm)	9.829	140.058**	3.534
Leaf blade width (cm)	0.002	0.107**	0.002
Days to 50% flowering	3.500	352.441**	2.833
Flag leaf length (cm)	5.840	45.561**	3.208
Flag leaf width (cm)	0.003	0.115**	0.001
Panicle length (cm)	0.361	22.140**	0.470
Number of effective tillers plant^{-1}	0.113	23.926**	2.371
Plant height (cm)	5.815	2049.364**	14.594
Days to maturity	0.797	413.705**	3.110
100-Grain weight (g)	0.003	1.217**	0.001
Grain length (cm)	0.001	0.064**	0.001
Grain width (cm)	0.001	0.004**	0.001
Grain shape index	8.190	1.308**	0.160
Biological yield plant^{-1} (g)	58.179	1971.867**	139.340
Grain yield plant^{-1} (g)	16.605	257.201**	23.261
Harvest index	4.150	210.010**	33.293

** Significant at 1% probability level

et al., 2009 and Mohanty *et al*., 2010) also did not find any relationship between geographic diversity and genetic diversity in rice. Since hybridization between the varieties falling in divergent cluster is likely to generate wide range of variability in segregating generations. The varieties belonging to distantly related clusters could be used in hybridization programme for obtaining a wide spectrum of variation among the segregates. It was noticed that Cluster I contained the varieties which were, in general characterized by medium plant height, medium leaf length, medium maturity period and medium grain yield. The di-genotypic Cluster II included the varieties which recorded medium plant height, medium leaf length, medium maturity period and lesser grain yield. Cluster III contained the varieties which generally had short plant height, medium leaf length, shorter maturity period and lesser grain yield. The mono-genotypic Cluster IV accommodated the variety which had short plant height, short leaf length, shorter maturity period and lesser grain yield. The bi-genotypic Cluster V contained the varieties which recorded shorter plant height, medium leaf length, longer maturity period and higher grain yield. The mono-genotypic Cluster VI contained the variety which had medium plant height, medium leaf length, longer maturity period and medium grain yield. Similarly, the mono-genotypic Cluster VII contained the variety which had medium plant height, medium leaf length, longer maturity period and higher grain yield. The di-genotypic Cluster VIII contained the varieties characterized by taller plant, long leaf length, longer maturity period and medium to higher grain yield. The mono-genotypic

Table 2. Variability parameters for sixteen quantitative characters in rice

Character	Range	General mean	SD	SE (m)	CV (%)
Leaf blade length (cm)	27.43-56.39	44.08	6.83	1.09	15.50
Leaf blade width (cm)	0.65-1.45	1.08	0.19	0.02	17.49
Days to 50% flowering	80.0-121.0	105.00	10.75	0.97	10.37
Flag leaf length (cm)	25.57-39.61	31.55	3.90	1.03	12.35
Flag leaf width (cm)	0.89-1.69	1.31	0.20	0.02	14.92
Panicle length (cm)	19.39-28.48	23.71	2.72	0.40	11.45
Number of effective tillers plant^{-1}	8.40-18.40	13.22	2.82	0.89	21.36
Plant height (cm)	69.79-160.32	103.56	26.14	2.21	25.24
Days to maturity	117.0-156.0	139.35	11.74	1.02	8.43
100-Grain weight (g)	1.32-3.32	2.24	0.64	0.02	28.36
Grain length (cm)	0.69-1.24	0.96	0.15	0.02	15.18
Grain width (cm)	0.21-0.32	0.26	0.04	0.02	14.36
Grain shape index	2.43-5.11	3.71	0.66	0.02	17.80
Grain yield per plant (g)	8.33-42.47	28.15	9.26	2.79	32.89
Biological yield (g)	21.73-109.73	65.49	25.64	6.82	39.15
Harvest index (%)	28.81-55.22	44.93	8.37	3.33	18.62

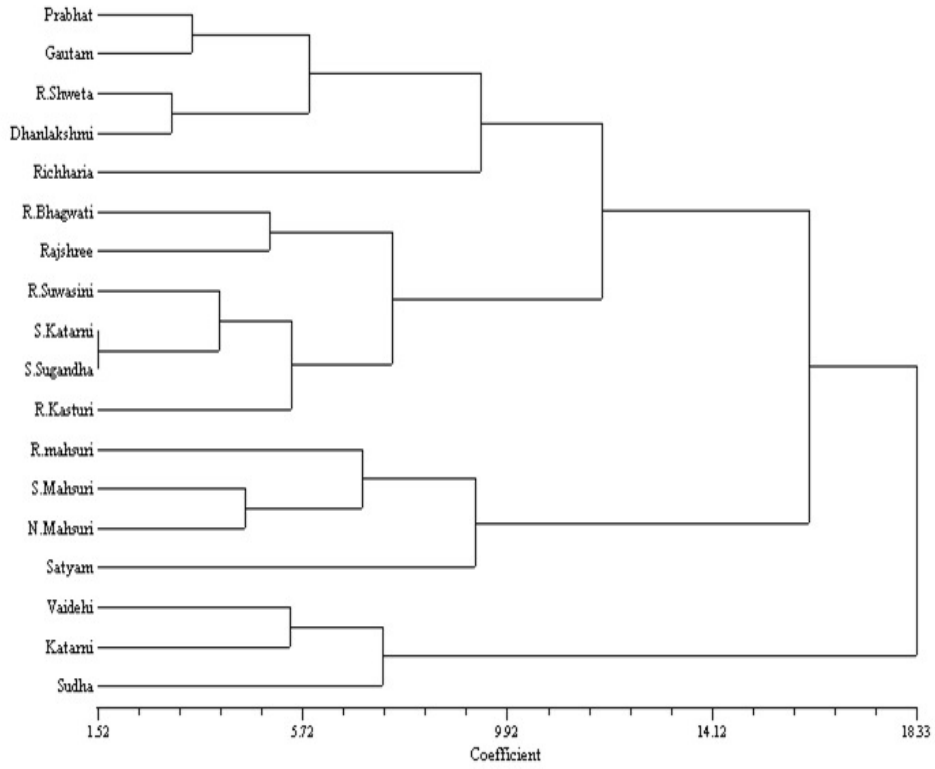

Fig. 1. Dendrogram based on average taxonomic distance for sixteen quantitative traits among eighteen rice varieties.

Cluster IX contained the variety which had taller plant, longer leaf length, longer maturity period and medium grain yield.

Considering mean performance for grain yield and component characters in conjunction with clustering pattern, it appeared that hybridization involving Rajendra Shweta and Dhanlakshmi with Sudha, Rajendra Bhagwati and Rajshree with Satyam, Rajendra Suwasni and Super Katarni with Nata Mahsuri, Rajendra Bhagwati and Satyam with Sudha could be predicted as superior combinations for their further utilization in genetic enhancement programme. The evidences suggest that earlier researchers have also used more or less similar criteria as the basis for selection of promising genotypes as parent lines before effecting actual crosses (Singh *et al*., 2008; Ubarhande *et al*., 2009; Binodh *et al*., 2010; Singh *et al*., 2010).

Table 3. Composition of clusters based on average taxonomic distance for sixteen quantitative characters in eighteen varieties of rice

Cluster	Number of varieties	Composition of cluster
I	4	Super Katarni, Super Sugandha, Rajendra Suwasni, Rajendra Kasturi
II	2	Rajendra Bhagwati, Rajshree
III	4	Rajendra Shweta, Dhanlakshmi, Prabhat, Gautam
IV	1	Richharia
V	2	Sambha Mahsuri, Nata Mahsuri
VI	1	Rajendra Mahsuri
VII	1	Satyam
VIII	2	Vaidehi, Katarni
IX	1	Sudha

The result of present study indicates that there is wide genetic variation among the rice varieties grown in Bihar and they have much potential to be used in breeding programme.

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