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GENETIC DIVERGENCE ANALYSIS USING YIELD AND QUALITY TRAITS IN RICE (*Oryza sativa* L.)

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ABSTRACT

Genetic divergence was studied for different yield and quality traits in 41 rice genotypes. These genotypes were collected from different rice eco-geographical regions of India.The analysis of variance revealed significant differences among the genotypes for all the characters studied. Based on the genetic distance all the 41 genotypes were grouped under thirteen different clusters. The mode of distribution of genotypes from different eco-regions into various clusters was at random indicating that geographical diversity and genetic diversity were not related. The maximum inter-cluster distance was recorded between clusters III and XIII and the maximum intra-cluster distance was found in cluster XI followed by VI. The characters like number of grains per panicle, plant height, grain length and grain breadth contributed maximum towards genetic diversity. Hence these characters could be given due importance for selection of genotypes for further crop improvement programme.

INTRODUCTION

A population with more diverse genotypes is of considerable value as the success of any breeding programme lies on the fact that the parents involved in any particular cross should be genetically divergent. Even though self pollinated crops are highly homozygous there is every possibility of genetic variation among the parents collected from different eco-geographical regions. Genetic variability present in the base population should be useful for effective selection and recombination breeding. In the present study an attempt was made to assess the genetic divergence using Mahalanobis D^2 statistics and different clustering procedures, based on yield and quality characters. Genetic divergence among the genotypes plays an important role in the selection of parents having wider variability for different yield and quality characters (Sarawgi and Rita Binse, 2007)

MATERIALS AND METHODS

The material taken for this study consisted of 41 rice genotypes from different rice eco-geographical regions of India. All the genotypes were grown in randomized block design with three replications during 2008-2009. Thirty days old seedlings were transplanted to main field 20cm apart between rows and 15cm within the row. Recommended agronomic practices and need based plant protection measures were taken up. Observations were recorded on nine traits including biometrical and quality characters *viz.*, days to first flower, plant height, number of productive tillers per plant, number of grains per panicle, thousand grain weight, grain length, grain breadth, grain L/B ratio and grain yield per plant. Genetic diversity analysis was done following the D^2 statistics proposed by Mahalanobis (1936).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all the characters indicating existence of variability among the genotypes for the characters studied. Based on the relative magnitude of D^2 values, 41 genotypes were grouped into thirteen clusters (Table 1). The cluster I was the biggest consisting of 9 genotypes followed by 6 in cluster III, 5 in cluster II, 4 in clusters IV, V and VI, 2 in clusters VII and XI. The clustering pattern of genotypes revealed that there was no parallelism between clustering pattern and geographical distribution of genotypes. Similar results were observed by Vanaja *et al*., 2003 and Nayak *et al*., 2004.

The maximum intra-cluster distance was observed in cluster XI (158.95) followed by cluster VI (99.67) indicating limited genetic diversity among genotypes representing these clusters (Table 2). The clusters VIII, IX, X, XII, XIII (0.00) consisted of only one genotype hence, they lack intra -cluster distance (0.00). The relative divergence of each cluster from other cluster (inter-cluster distance) indicated greater divergence between cluster III and XIII (17948.88), followed by cluster III and XII (17211.74). The minimum inter-cluster distance was recorded between cluster I and II (211.10). The selection of divergent genotypes from above cluster would produce a broad spectrum of variability for yield and quality traits,

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which may enable further selection and genetic improvement.

The average cluster wise mean values for different characters were presented in Table 3 used to assess the superiority of clusters, which could be considered in the improvement of various characters through hybridization programme. Cluster VIII showed early flowering and desirable mean for thousand grain weight. Cluster VII recorded shortest plant stature with highest number of productive tillers per plant. Cluster X had the desirable mean for number of grains per panicle. Cluster IX exhibited superior mean performance for grain length and grain yield per plant. Cluster XIII showed the lowest grain breadth and highest value for grain L/B ratio.

Among the nine characters studied, number of grains per panicle contributed maximum of 37.44 per cent, followed by plant height (16.46 per cent), grain length (14.51 per cent), grain breadth (10.49 per cent) towards genetic diversity. Similar result was observed by Sandhyakishore *et al*., 2007. Hence, these characters could be given due importance for selection of genotypes for further improvement (Table 3).

Table 1 Distribution of rice genotypes in different clusters

Cluster No.	No. of genotypes	Name of the genotypes
I	7	AD 95137, MDU 5, IR 50, AD 95157, ASD 20, AUR 7, ADU 8, ASD 17
II	5	ASD 16, CO 46, IR 47686-30-2, ADT 36, AUR 14
III	6	AUR 1, AUR 13, ADT 39, ADT 43, IR 42, PY 5
IV	4	AD 95128, AD 95134, TKM 9, MDU 4
V	4	AUR 12, AUR 6, AUR 10, IR 272-25
VI	4	IR 55423-01, IR 55408-01, White Ponni, Pokkali
VII	2	CO 43, TKM 11
VIII	1	ASD 8
IX	1	IR 55419-04
X	1	IR 36
XI	2	AUR 9, BPT 5204
XII	1	TKM 12
XIII	1	Jeeraga samba

Table 2 Intra and inter cluster distances of 41 rice genotypes

Clusters	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
I	88.06 (9.38)	211.10 (14.53)	699.95 (26.46)	1321.54 (36.35)	1522.25 (39.01)	2061.39 (45.40)	4830.03 (69.50)	10211.11 (101.05)	10386.23 (101.91)	10963.45 (104.71)	6180.99 (78.62)	12877.19 (113.48)	14362.87 (119.84)
II		97.39 (9.86)	244.18 (15.62)	1070.34 (32.72)	1345.26 (36.68)	1821.00 (42.67)	4001.27 (63.25)	8647.63 (92.99)	8900.81 (94.34)	9297.92 (96.42)	4922.08 (70.16)	10062.46 (100.31)	10867.06 (104.24)
III			73.67 (8.58)	1325.00 (36.40)	2110.16 (45.94)	3176.50 (56.36)	6996.73 (83.65)	15403.92 (124.11)	16083.66 (126.82)	16224.75 (127.38)	8343.25 (91.34)	17211.74 (131.19)	17948.88 (133.97)
IV				54.35 (7.37)	337.14 (18.36)	1073.55 (32.77)	3437.96 (58.63)	7388.46 (85.96)	7751.07 (88.04)	9093.67 (95.36)	6091.97 (78.05)	13265.34 (115.17)	15808.75 (125.73)
V					79.53 (8.92)	222.79 (14.93)	908.88 (30.15)	2031.16 (45.07)	2166.58 (46.55)	3208.56 (56.64)	2304.25 (48.00)	4939.17 (70.28)	6203.52 (78.76)
VI						99.67 (9.98)	258.88 (16.09)	661.02 (25.71)	887.74 (29.79)	2374.48 (48.73)	1893.09 (43.51)	4070.03 (63.80)	5078.25 (71.26)
VII							44.98 (6.71)	517.71 (22.75)	961.20 (31.00)	2070.13 (45.50)	1290.62 (35.93)	2716.76 (52.12)	3066.06 (55.37)
VIII								0.00	325.65 (18.05)	2107.27 (45.90)	2158.30 (46.46)	4834.57 (69.53)	6370.85 (79.81)
IX									0.00	881.18 (26.68)	1062.30 (32.59)	2452.90 (49.53)	3682.50 (60.68)
X										0.00	535.07 (23.13)	1956.08 (44.23)	3269.65 (57.18)
XI											158.95 (12.61)	245.67 (15.67)	535.01 (23.13)
XII												0.00	464.70 (21.55)
XIII													0.00

Table 3 Cluster mean and contribution of various characters towards diversity in rice

Character	Clusters														Contribution towards divergence (%)
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	Grand mean	
Days to first flower(days)	70.22	75.60	75.17	62.25	81.50	75.75	75.50	62.00	76.00	64.00	83.00	87.00	87.00	74.99	0.85
Plant height(cm)	74.33	84.54	77.79	70.13	90.06	109.53	56.95	108.43	87.13	63.43	98.38	101.50	118.50	87.73	16.46
Number of productive tillers per plant	15.17	13.84	17.79	13.91	13.67	14.96	19.24	14.01	18.84	14.12	18.77	11.00	14.67	15.23	6.95
Number of grains per panicle	91.33	109.79	134.52	61.69	81.38	81.36	107.87	64.50	87.00	138.12	131.49	108.15	138.00	102.71	37.44
Thousand grain weight(g)	19.73	20.58	19.46	21.33	19.27	18.19	22.15	22.57	13.45	21.45	18.87	16.50	12.10	18.90	3.78
Grain length (mm)	8.36	7.79	8.16	8.53	8.44	8.57	7.44	7.78	8.61	8.83	8.06	5.71	5.63	7.84	14.51
Grain breadth (mm)	2.55	2.64	2.19	2.44	2.38	3.01	2.63	3.03	3.20	3.03	2.52	3.24	1.41	2.64	10.49
Grain L/B ratio	3.36	2.81	3.62	3.51	3.49	2.87	2.87	2.57	2.70	2.91	3.73	1.76	3.99	3.09	3.66
Grain yield per plant(g)	21.15	20.64	23.05	22.28	16.10	25.05	28.38	15.08	31.01	23.01	24.11	21.05	23.62	22.27	5.85

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