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Short Communication

GENETIC DIVERGENCE IN HIGH IRON AND ZINC GENOTYPES OF RICE (*Oryza sativa* L.)

[a*]Ramya Rathod, Madhu Babu Pulagam, Sanjeeva Rao D., D Srinivasa Chary, Bharathi M, and [b]Ravindra Babu, V.
[a]Department of Genetics and Plant Breeding CoA, (PJTSAU), Rajendranagar, Hyderabad - 500030,
[b]Crop improvement section, Indian institute of rice research, Rajendranagar, Hyderabad - 500030,
*Corresponding author Email id: ramyarathod.5@gmail.com

ABSTRACT
In the present study, fifty six high iron and zinc genotypes of rice were evaluated to study the genetic diversity for yield and quality traits. Based on the relative magnitude of D^2 values, the genotypes were grouped into six clusters. Out of six clusters, cluster I was the largest comprising of forty five genotypes, maximum intra-cluster distance was observed in cluster II (13.91) indicating greater genetic divergence between the genotypes belonging to this cluster. Grain yield per plant, days to 50% flowering, plant height, number of filled grains per panicle, grain iron concentration, grain zinc concentration together contributed 88.45% towards total divergence Maximum inter-cluster distance was recorded between clusters III and V (28.05) followed by clusters V and VI (24.17) indicating wide genetic diversity and it may be used in rice hybridization programme for improving grain yield**.**

KEY WORDS: Rice, D^2 statistics, Genetic Diversity, Cluster distance.

INTRODUCTION

Rice is one of the top five major cereal crops and is a major staple food supporting more than three billion people and represents 50 to 80% of their daily calorie intake (Khush, 2005). From poorest to richest person in this world consume rice in one or other form. Genetic diversity is a fundamental characteristic without which breeders are very limited and powerless in plant breeding. It is pre-requisite for any crop improvement programme as it helps in the development of superior recombinants. The crosses between parents with maximum genetic divergence are generally the most responsive for genetic improvement (Arunachalam, 1981).

MATERIALS & METHODS

The experimental material comprised of fifty six genotypes of rice having high iron and zinc were grown during *kharif*, 2014 at Indian institute of Rice Research Farm, Ramachandrapuram, Hyderabad in two replications in Randomized Block Designwith a spacing of 20 x 15cm.All the recommended package of practices was adopted besides providing necessary prophylactic plant protection measures to raise a good crop.Observations were recorded for yield, yield attributing characters and nutritional characters on five randomly selected competitive plants for each entry in each replication. The mean data obtained at each location was considered for final statistical analysis. Days to 50% flowering was recorded on plot basis. Based on genetic distances (D^2 values), the genotypes were grouped into clusters of genetically closer related groups following the Tocher's method (Rao, 1952).

RESULTS & DISCUSSION

The analysis of variancerevealed significant differences among the genotypes for all the characters represented in Table 1. Fifty six genotypes were grouped into six clusters based on D^2values presented in Table 2 and out of six clusters, cluster I was the largest comprising of forty five genotypes followed by clusters IIwith six genotypes, cluster III with two genotypes, cluster IV, V and VI with single genotypes. Average intra and inter cluster D^2 values are presented in Table 3, Cluster mean values for different characters presented in Table 4 and contribution of different traits towards genetic divergence in fifty six genotypes presented in Table 5 respectively.

The maximum inter cluster distance observed between III and V (28.05) followed by cluster V and VI (24.17)indicating genotypes from these clusters can be utilized in hybridization programme for improvement of rice. Maximum intra cluster distance was observed in cluster II (13.91), followed by cluster I (11.54) and cluster III (6.82) indicating that some genetic divergence still existed among the genotypes.Crosses involving parents belonging to the most divergent clusters would be expected to manifest maximum heterosis and wide variability of genetic architecture (Souroush *et al*., 2004).The cluster VI is having highest mean value for days to 50% flowering, plant height, grain yield per plant and grain iron concentration, cluster V for grain iron concentration, cluster IV for 100 grain weight and cluster III number of productive tillers per plant, panicle length, number of filled grains per panicle. The selection and choice of parents depends on contribution of characters towards genetic divergence (Nayak *et al.*, 2004). In the

present study Grain yield per plant (18.44%), days to 50% flowering (18.31%), plant height (14.55%), number of filled grains per panicle (14.29%), grain iron concentration(12.34%) and grain zinc concentration (10.52%) together contributed 88.45% towards total divergence. The results were in conformity with Ramya and Kumar (2008) for number of filled grains per panicle and grain yield per plant, Vennila et al. (2011) for number of filled grains per panicle and plant height.

TABLE 1. Analysis of variance for grain yield, its components and quality traits in rice genotypes

S.No.	Characters	Mean sum of squares		
		Replications (d.f.=1)	Treatments (d.f.=55)	Error (d.f.=55)
1	Days to 50 % flowering	1.28	123.56**	4.358
2	Plant height (cm)	12.96	763.35***	15.45
3	Number of productive tillers per plant	0.01	8.96**	0.87
4	Panicle length (cm)	0.03	1.95**	0.08
5	Number of filled grains per panicle	72.32	5871.78***	151.84
6	1000 grain weight (g)	0.65	33.26**	0.93
7	Grain yield per plant (g)	0.025	15.08**	0.24
8	Grain iron concentration (ppm)	0.01	18.68**	0.43
9	Grain zinc concentration (ppm)	0.50	24.14**	1.82

** Significant at 1% level , * Significant at 5% level

TABLE 2. Clustering pattern among 56 rice genotypes (Mahalanobis D^2analysis)

Cluster No.	No. of genotypes	Names of the genotypes
I	45	Raga-binni(sticky rice), Rangabhokjaha (local), Mima, Minilna,singket, Khisore, Silgothi(local), Hathidatgipok(local), Maigothi, Hathidatgitchak, Minilgisim, Minilgitchak, Miniljaha(local), Khosa-r ii, Nielhi-r ii, Vinhatsa, Hanyii-a-keeho, Ngobanyo red cover, Teviirii, Dzuluorhe, Thevuruu, Kelhrie cha, Keklrvie, Nedu, Sare, Saponyo, Rosho, Sirarakhongmeryonmaa, Sirarakhongashangmaa, Ringuimaa, Teinemruishengmaa, Sirarakhongmanui, Heimangphaoungain, Haoshirukhrul, Eroplane, Rasham, Mapum, Phungcham, Sayao, Ching chiroi, Paoreima-ukhrul, Ngapum ma-ukhrul, Jazum(local name), Ayaar, Aazo, Mipya emo.
II	6	Taker am, Rutte, Amkei, Kewelhilolu-r I, Kongkoi, Arunachal pradesh-1
III	2	Kala jirajaha, Jahagisim(local)
IV	1	Hati bandha
V	1	Porameunya
VI	1	Khusoi-risareku

TABLE 3. Intra (Bold values) and inter-cluster average of D^2 values of 56 rice genotypes

Clusters	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V	Cluster VI
Cluster I	11.54	16.51	18.14	15.30	20.20	19.91
Cluster II		13.91	21.00	16.69	22.82	20.51
Cluster III			6.82	20.97	28.05	18.27
Cluster IV				0.00	15.45	14.57
Cluster V					0.00	24.17
Cluster VI						0.00

TABLE 4. Cluster means for 9 characters in fifty six rice genotypes (Mahalanobis D^2 analysis)

Cluster No.	DFF	PH	PT	PL	GPP	TW	GY	Fe	Zn
I	96.28	136.19	11.04	26.54	141.10	23.37	11.55	17.11	28.75
II	98.17	93.16	9.73	25.02	111.25	22.87	12.19	15.57	29.37
III	101.50	141.25	15.25	26.98	298.25	13.40	18.40	18.80	25.83
IV	101.00	135.40	10.00	25.85	159.00	36.80	16.06	16.80	30.55
V	91.00	120.75	9.00	24.65	83.00	34.70	12.92	27.70	26.63
VI	103.50	157.50	13.00	26.89	133.00	25.55	23.36	16.00	33.54

DFF – days to 50% flowering, PH – plant height (cm), PT – number of productive tillers, PL – panicle length (cm), GPP – number of filled grains per panicle, TW – 1000-grain weight (g), GY – grain yield per plant (g), Fe – grain iron concentration (ppm), Zn – grain zinc concentration (ppm).

TABLE 5. Relative contribution of different characters to genetic diversity in rice genotypes

S. No	Characters	Times ranked first	Contribution (%)
1.	Days to 50 % flowering	282	18.31
2.	Plant Height (cm)	224	14.55
3.	Number of productive tillers/ plant	18	1.17
4.	Panicle length (cm)	47	3.05
5.	Number of filled grains/ panicle	220	14.29
6.	1000 Grain Weight (g)	113	7.34
7.	Grain Yield/ Plant (g)	284	18.44
8.	Grain iron concentration (ppm)	190	12.34
9.	Grain zinc concentration (ppm)	162	10.52

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