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Identification of Genetically Distant Rice Genotypes for Selection Based Crop Improvement from Rice Landraces of Red and Lateritic Region of West Bengal Through Cluster Analysis

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Abstract: Study of interrelationship and genetic variability between rice landraces is an important pre-criterion for the selection based crop improvement programs. Individual's genotypes with vast genetic distance are mostly suitable for the hybridization process for crop improvement. Inter relationship of fifty five traditional rice varieties of Lateritic Region of West Bengal were studied with the help of eighteen agromorphic characters through cluster analysis. Five clusters had been found, cluster I consist of 50 genotypes, cluster III consist of two and cluster II, cluster IV and V consist of only one variety respectively. It was observed that Variety Daharlagra, Neta, Kelesh and Vutmuri were genetically dissimilar than the rest of 51 varieties, these varieties may be utilized for selection of parents for production of new improved variety.

Key words: Rice landraces · Lateritic region · West Bengal · Inter relation · Cluster analysis

INTRODUCTION

World population has been gradually increasing. There is a vice-versa relationship between the population growth and demands of food grain. To meet the gradually expanding demands for the food grain new improved rice variety with higher production is a basic requirement, because rice is a staple food for the one and half of the total World population. To overcome this situation we have to improve our existing varieties in terms of their production. Not only yield potentiality new variety should comply with present aberrant weather condition, pathogenic attack etc. For production of new improved variety top most priority should be given for parental selection. Identifying the parental combination to create segregating progenies with maximum genetic variability for further selection is an important pre-criterion for plant breeding [1]. Parents with important agro-morphic characters (drought resistant, salt tolerant, resistant to pathogenic attack etc.) and wide genetic relationship among inbreed line or pure lines are useful for planning crosses [2]. Red and Lateritic region of West Bengal is one of the important agro-climatic region of West Bengal is a home land of so many landraces of rice. Landraces are gradually evolved with the response of various environmental stress consist of various spectacular agro-morphic characters [3]. Among the 22 wild genus of rice *O. nivera* and *O. rupifogon* are widely distributed over Eastern India and used as donors for major pest, environmental stress, disease and yield attributing traits [4]. Indo-gangetic area of West Bengal also home land of so many wild rice varieties growing it is natural habitat [5]. Some variety are drought resistant, some are consist of fine aroma, some varieties are resistant to various pathogenic attack, some are water resistant etc. but most of the cases these varieties are low yielding. The knowledge about genetic variability of yield contributing traits, interrelationship among them and their relation with yield are necessary for a successful breeding program [6]. Knowledge of heritability is essential for parental selection for crop improvement, as it indicates the extent of transmissibility of a trait into future generations [7]. If we select landraces of rice with wide genetic variation and important agro-morphic characters for hybridization programme we may achieved new improved variety with high yield and drought resistant or resistant to pathogenic attack. Keeping in mind the above facts the present investigation was carried out to find interrelationship among the traditional rice variety of red and lateritic region of West Bengal and selection of parents with vast genetic diversity for crop improvement programme.

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MATERIALS AND METHODS

The Study Site: Study of inter-relationship was carried out using 55 traditional lowland and upland rice cultivars, collected from the lateritic region of West Bengal, during kharif season of 2011-2012. The *In-Situ* cultivation of collected landraces of traditional rice variety from various remote village of these district was conducted at the village of Ranbahal (22?38´N latitude and 86?36´E-87°47¨E longitude with an altitude of 78 meters above sea level).

Methods and Morphological Characterization: The materials were grown using completely randomized block design with six replications. Each variety was transplanted (45 day's old seedling) in a plot of $6m^2$ with a spacing of 25cm. between rows and 20cm. between plants in a row. A random sample of five competitive plants was used for observations on 18 agromorphic under study. No synthetic nutrients were applied. During the crop period the water depth of the field was 40-50cm.

Variables considered in the descriptive and cluster analyses were morphological i.e. plant height, leaf length, leaf width, leaf length width ratio; phenological i.e. days to 50% flowering and days to harvest maturity, both measured from the day of sowing; and grain traits i.e. panicle length, no. of primary branch^{-1}, number of panicle, grain length, grain width, grain length width ratio, Kernel length, kernel width, kernel length width ratio, weight of 5 panicles, primary branch^{-1}panicle and weight of 100 grains.

Cluster analysis was done by according to the Bray and Curtis Distance/similarity measure with nearest neighbour cluster method to yield a dendrogram depicting the morphological relatedness of the 55 landraces of rice cultivars. All analyses were done using the StatisticXL-verson1.8 statistical package.

RESULTS AND DISCUSSION

The Mean, Standard deviation, Standard error, Minimum value and Maximum value of 18 quantitative agro-morphic characters of 55 landraces of rice was calculated and computerized are presented in Table 1.

Relationship between 55 landraces of rice revealed cluster analysis is represented in Fig. 2. Distribution of genotypes of rice among various cluster on the basis of person cluster analysis is given in Table 2. There are 5 clusters which could be framed from cluster analysis.

Table 1: Mean, Standard Deviation Standard error and minimum and maximum value of 18 agro-morphic characters of 55 landraces of rice variety

Variable	Mean	Std Dev.	Std Err	N	Min	Max
LB	58.228	8.557	1.154	55	34.86	78.12
WB	1.298	0.252	0.034	55	0.9	1.76
LL/LW	46.557	10.698	1.443	55	22.34	73.88
50% FL	104.018	20.720	2.794	55	51	134
STLN	137.130	26.657	3.594	55	66.5	194
PL	25.871	2.755	0.372	55	18.76	31.5
PN	14.800	5.133	0.692	55	7	28
TM	140.964	18.675	2.518	55	97	168
1000 GW	21.978	5.618	0.758	55	10.1	33.6
GL	8.208	1.063	0.143	55	5.6	11.2
GW	2.708	0.475	0.064	55	1.8	4
GL/GW	3.111	0.561	0.076	55	2.15	4.45
KL	5.815	0.873	0.118	55	3.95	8.3
KW	2.684	2.707	0.365	55	1.6	3.1
KL/KW	2.548	0.539	0.073	55	1.56	4.11
SPI/P	185.873	62.946	8.488	55	343	71
PB/P	11.545	2.035	0.274	55	7	17
Wt/5P	16.027	4.783	0.645	55	6.65	27.07

Table 2: Distribution of genotypes of rice among clusters on the basis of person cluster analysis

Cluster	No. of genotypes	Genotypes
I	50	Agniban, Bachi, Badshabog, Badamsaru, Bahurupi, Baskamini, Bhuri, Byamajhupi, Barani, Chandrakanta, Chotodidi, Danarguri, Dharansal, Dudherswar, Fulkhar, Fulpagri, Gangajali, Jamainadu, Kaksal, Kakua, Kalamkati, Kalobhat, Kalojira, Kanakchur, Kartiksal, Khuch, Khajurchari, Lalbadshabhog, Laltipa, Langalmura, Malabati, Malsira, Marichsal, Nagrasal, Narkeljhopa, Nikunja, Nonabogra, Nugembaro, Patnai-23, Radhatilak, Raghusal, Rupsal, Sidurmukhi, Sitasal, Suakalma, Talmugurdhan, Tulsibhog, Valki
II	1	Daharlagra
III	2	Bhadoi, Vutmuri
IV	1	Neta
V	1	Kelash

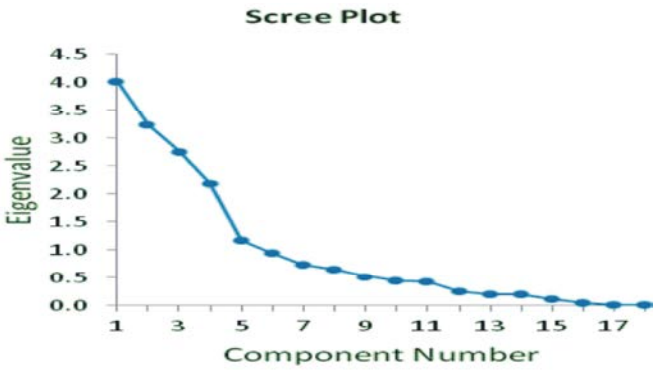

Fig. 1: Screen plot of 55 landraces of rice used in the experiment from quantitative agro morphological traits.

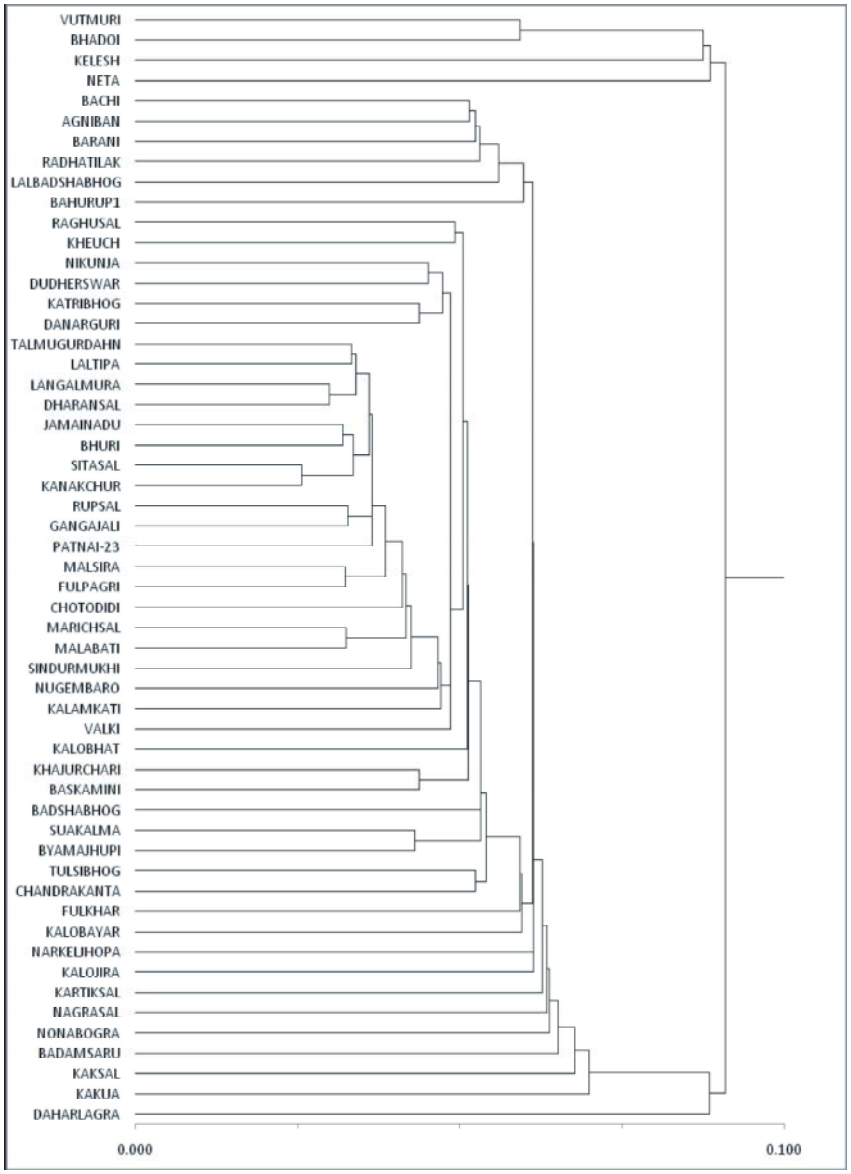

Fig. 2: Dendrogram of 55 Landraces of rice cultivars of Bankura District derived by UPGMA from 18 morphological traits (according to the Bray and Curtis Distance/similarity measure with nearest neighbour cluster method).

Out of 55 landraces Daharlagra (V25), Neta (V3) and Kelash (V22) alone formed cluster II, cluster IV and cluster V respectively. Variety Vutmuri (V9), Bhadoi (V27) together form cluster III and rest of the 50 landraces formed cluster I which shows highest value of leaf blade length, highest time to maturity is days, highest value of grain length, 100 grain weight and highest stem length etc. (Fig. 2). Cluster II, IV and V was characterized by lowest length of blade, lowest stem length, lowest panicle length, lowest panicle number and lowest maturity time. Vutmuri (V3) and Bhadoi form cluster III as this variety shows second lowest blade length, lowest duration of 50% flowering in days and maximum number of panicle per plant, variety Bhadoi possesses only light purple basal leaf sheath colour.

Relationship among 55 landraces of rice revealed by UPGMA cluster analysis is presented in Fig. 1 and Fig. 2. Clustering of 55 landraces showed that variety Daharlagra, Neta and Kelash are distinct from other varieties and form 3 separate clusters. Variety Bhadoi and Vutmuri together form a distinct group and rest of the landraces formed a separate group.

From the cluster analysis it was found that genetic variation was present among these landraces of rice and which is irrespective of geographical distribution. Five cluster groups were obtained from the 18 agro-morphological characters using multivariate analysis. From the cluster analysis and Euclidean distances among different landraces of rice, it was observed that variety Kelesh, Neta, Bhadoi, Vutmuri and Daharlagra possess vast genetic difference and form 4 different clusters and rest of the variety form one single cluster. Plant breeders may easily select these five varieties for parental material for plant breeding programme because of their vast genetic differentiation with the other variety.

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