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Study of variability and genetic diversity (D^2) in rice (*Oryza sativa* L.)

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Abstract

The present investigation was conducted during *Kharif* 2023 at the Agricultural Research Farm, S.M.M. Town PG. College, Ballia. A wide range of variation in mean performance of genotypes was observed for all the characters; the highest grain yield per plant was obtained in MTU-1155. The high magnitude of PCV was observed for panicle-bearing tillers per plant. High heritability coupled with high genetic advance was observed for disease lesion length. all the 132 *Indica* rice cultivars were grouped under ten (10) different clusters. The maximum number of genotypes was grouped under cluster I (68) and the minimum number of genotypes cluster II, IX and X (1).

Keywords*:* Rice, *Oryza sativa*, correlation, path analysis.

Introduction

It is well known that rice (*Oryza sativa* L.) is most important staple foods of Indian subcontinent. About 90% of the world's rice is grown in South East Asia. India is the world's second-largest producer of rice after China, accounting for 20% of the world's rice production. During 2023-24, the global rice production was 520.65 million Metric Tons. However, India ranked second in rice production after China by producing 137 million metric tons. Rice is a self-pollinated crop species and rich source of Carbohydrates, good source of protein, Calcium, Phosphorus, Iron and minerals, which are concentrated in outer brown layer known as husk and germ. Brown rice is a type of rice from which only husk has been removed is the most nutritious type of rice. Rice contains less protein 6-8 % in white rice and 8-10 % in brown rice and contains 2 to 2.5% fats, which is lost during milling and polishing.

Now-a- days, dwarfing varieties of rice cultivars are high fertilizer responsive and require adequate irrigation, have tillering abilities, photo-insensitive, as well as lodging resistance and disease resistance plant types, making them highly productive and with a high harvest index, along with good cooking quality and better aroma content. But enhanced productivity along with more commercial value is the need of day. However, rice production is constrained by a considerable number of biotic and abiotic stresses. Among biotic stresses, many insect pests and diseases have caused severe losses to rice crop.

Materials and methods

The experiment was carried out at the Agricultural Research Farm, S.M.M. Town PG. College, Ballia. during *Kharif* season, 2023. The soil was rich in potash and low in organic carbon, nitrogen, phosphorus and balanced in micronutrients required for a good and healthy crop. The experimental materials comprising of 128 genotypes along with four check varieties *viz*., Rajendra Sweta, BPT-5204, Tetep and MTU-7029, were grown in these genotypes exhibiting a wide spectrum of variability and diversity for various morphological and quantitative characters. The experimental material was planted in an augmented block design along with four check varieties *viz*, Tetep, Rajendra Sweta, BPT-5204 and MTU-7029 in irrigated conditions in clay loam soil. The experimental field was divided into 8 blocks of equal size, with 3 meters length and each block had 20 plots. Out of 16 plots in a block the test germplasm which were not replicated, while the remaining four checks were distributed *viz*., Tetep, Rajendra Sweta, BPT-5204 and MTU-7029. The four checks were randomly placed along with the test genotype in a block.

Results and discussion

A wide range of variation in mean performance of genotypes was observed for all the characters under study. The comparison of mean performance of 132 genotypes for 16 traits using least significant differences revealed the existence of a very high level of variability in the germplasm collections. The highest grain yield per plant was obtained in MTU-1155 followed by MTU-1155, CR Dhan-306, MTU-1075, BRR-2110, BRR-2141. The high magnitude of PCV observed for panicle bearing tillers per plant while, (>20%) magnitude of PCV observed for disease lesion length, number of unfilled grains per panicle, number of grains per panicle, disease rating scale, kernel length and kernel breadth ratio. The moderate estimate of PCV along with GCV was recorded for test weight, grain yield per plant, plant height**,** kernel breadth, kernel length, days to panicle initiation**,** and days to 50 per cent flowering. This indicated a greater scope of improvement through selection in the environment, which showed high GCV and PCV values. Lower estimates of PCV and GCV were recorded for spikelet fertility, number of effective tillers per plant, panicle length and days to maturity showing low estimates (less than 10%) of PCV and GCV. Similar results were reported by Islam *et al.* (2015), Yadav *et al.* (2017), Kumar *et al.* (2020), Mersha Tezera (2021), Anuhya and Lavany (2022), Vadodariya *et al.* (2023).

High heritability was observed for all traits. It means these traits are highly heritable in nature in so these traits should be taken into consideration. Similar reports were reported by Tuwar *et al.* (2013), Islam *et al* (2015), Islam *et al.* (2016), Yadav *et al.* (2017), Anuhya and Lavany (2022). High heritability coupled with high genetic advance were observed for disease lesion length, followed by number of unfilled grains per panicle, number of grains per panicle, kernel length and breadth ratio, disease rating scale, test weight, grain yield per plant, plant height, and kernel breadth. Moderate genetic advance in per cent of mean was observed for days to panicle initiation, days to 50 per cent flowering, days to maturity and panicle length. However, spikelet fertility and number of effective tillers per plant show low genetic advance in percent of mean. Similar reports were reported by Islam *et al.* (2016), Yadav *et al.* (2017), Longjam and Singh (2019), Vadodariya *et al.* (2023). Based on the genetic distance, all the 132 *Indica* rice cultivar/ germplasm/ lines were grouped under ten (10) different clusters. Maximum number of genotypes were grouped under cluster I (68), III (37) and minimum number of genotypes cluster IV (8), cluster VI

and VIII (5), cluster V (4), and cluster VII (2). The cluster II, IX and X single genotypes are mono-genotype. The clustering pattern revealed that the genotypes from different sources clustered together indicated that there was no association between eco geographical distribution of genotypes and genetic divergence. The inter-cluster distances were recorded as highest between cluster IX and VIII. This indicates that, in general, selection has been towards the same goal in the different centers of origin of these genotypes and yet, there is sufficient genetic variability, which distinctly differentiates them into 10 clusters. On the other hand, our study has also revealed that genotypes from the same center of origin were distributed in different clusters, which may be due to differential adaptation to varied agroecosystems. Similar results were observed by Kumar *et al.* (2014), Kumari *et al.* (2018), Kumar *et al.* (2015), Prakash *et al.* (2019).

Table-1: Analysis of variance (ANOVA) for 16 yield contributing characters in rice (*Oryza sativa* L.)

Characters Sources of variation	D.f.	Days to panicle initiation (day)	Days to 50% flowering (day)	Days to maturity (day)	Plant height (cm)	Number of effective tillers/ plant	Panicles length (cm)	Number of spikelets/ panicle (Nos)	Number of filled grains/ panicle (Nos)	Spikelet fertility (%)	Grain yield/ Plant (g)
Block	7	1295.30**	1166.44**	1325.02**	6449.89**	1.95**	9.98**	6422.48**	144.49**	45.13**	40.39**
Check	3	1294.70**	1360.06**	1268.63**	1452.97**	14.17**	16.86**	5362.32**	79.80**	30.25**	103.44**
Error	21	4.03	3.29	7.78	0.65	0.29	0.161	60.71	2.36	0.67	0.15

Characters Sources of variation	D.f.	Test Weight (sg)	Kernel length (mm)	Kernel breadth (mm)	Length/ Breadth Ratio (%)	Disease lesion length (cm)	Disease Rating scale
Block	7	41.67**	4.03**	0.41**	2.99**	28.07**	12.45**
Check	3	88.78**	0.61**	0.49**	2.06**	63.20**	19.38**
Error	21	0.189	0.074	0.004	0.042	0.867	0.591

Table 2: The mean performance of genotypes

Sl.no	Check	Days to panicle initiation (day)	Days to 50% flowering (day)	Days to maturity (day)	Plant height (cm)	Number of effective tillers/ plant	Panicles length (cm)	Number of grains/ panicle (Nos)	Number of unfilled grains/ panicle (Nos)	Spikelet fertility (%)	Grain yield/ plant (g)	Test weigh t (g)	Kernel length (mm)	Kernel breadth (mm)	Length/ breadth ratio (%)	Disease lesion length (cm)	Disease ratting scale
1	Tetep	82.2	90.0	121.0	129.2	10.8	24.6	154.1	20.6	86.5	23.5	20.0	5.3	1.7	3.1	7.8	7.8
2	BPT-5204	108.6	116.6	144.7	102.5	13.0	23.9	157.4	17.3	88.9	26.0	20.4	5.3	1.6	3.4	5.4	5.5
3	RajendraSweta	107.1	115.1	143.7	99.1	13.2	23.7	210.1	20.7	90.2	24.9	16.7	5.0	1.5	3.4	5.5	5.8
4	MTU-7029	107.0	116.4	148.8	109.0	13.8	26.9	180.6	25.0	86.1	31.7	24.8	4.7	2.0	2.3	11.4	8.7
1	DRR Dhan-53	107.0	115.0	144.3	86.6	12.0	23.5	138.2	18.2	86.4	23.0	16.4	5.2	1.4	3.6	10.0	7.0

2	DRR Dhan-60	105.0	113.0	143.3	95.7	12.0	23.8	161.4	22.4	86.2	29.1	16.9	5.5	2.3	2.4	5.0	4.3
3	DRR Dhan-62	90.0	98.0	126.0	81.5	11.0	27.9	112.6	18.0	84.1	25.1	20.0	5.5	1.5	3.6	11.0	7.7
4	DRR Dhan-59	101.0	109.0	138.3	119.5	11.8	26.2	109.6	18.8	82.9	29.6	30.3	5.8	2.8	2.1	1.7	2.3
5	Impr. SambhaMansuri	103.0	111.0	139.7	86.5	14.0	23.2	157.8	21.8	86.0	27.4	16.1	5.6	1.7	3.4	6.7	6.3
6	DRR –Dhan-50	100.7	109.0	138.0	126.6	11.8	24.4	178.4	37.6	78.6	24.8	15.8	5.9	2.2	2.7	7.3	7.7
7	CG.Devbhog	106.0	114.0	145.0	118.7	11.6	23.4	180.8	27.0	85.1	28.9	20.8	5.8	1.7	3.4	7.3	7.0
8	MLR-5001	77.7	84.0	112.0	151.7	10.6	28.9	245.4	39.2	84.3	23.9	16.6	6.0	1.6	3.7	7.7	7.7
9	TelaganaSona	112.0	119.0	150.0	108.3	11.8	24.6	225.2	36.2	83.3	27.1	16.6	6.2	1.6	3.9	2.0	2.3
10	Bina Dhan-11	86.7	92.3	120.0	126.0	11.6	25.8	114.8	28.2	75.2	20.1	30.0	7.4	2.3	3.2	6.7	6.3
11	CR-1009 Sub-1	103.0	111.0	139.3	118.3	12.0	26.3	155.0	28.6	81.6	18.0	20.5	4.9	2.4	2.1	4.0	4.3
12	CR Dhan -909	88.0	96.0	125.0	126.0	12.0	27.7	157.0	27.6	82.3	25.1	26.8	6.8	1.9	3.7	8.0	8.3
13	DRR Dhan-70	87.0	95.0	124.0	137.3	12.2	28.7	137.0	23.0	82.7	25.5	19.9	6.4	1.6	4.0	6.3	5.7
14	CR Dhan-515	126.0	134.0	165.0	117.1	12.0	29.6	174.2	31.8	81.7	27.8	28.3	7.0	2.4	2.9	5.3	6.3
15	CR Dhan-803	110.0	120.0	152.0	111.6	13.0	27.5	156.8	25.0	84.2	19.6	22.0	5.8	2.0	3.0	7.3	5.7
16	CR Dhan-411	81.0	89.3	117.0	120.7	12.4	28.5	153.4	12.2	91.9	24.6	22.1	6.6	2.6	2.6	7.7	6.3
17	CR Dhan-310	101.0	109.0	137.0	108.0	11.0	23.8	135.0	23.8	82.2	17.9	22.0	6.6	1.6	4.2	6.7	6.3
18	CR Dhan-315-2 Sel	99.3	107.3	135.3	114.6	11.0	26.5	162.4	26.8	83.3	19.3	24.2	6.5	1.8	3.7	6.0	6.3
19	BPT-5204 Sub-1	99.3	109.0	138.7	108.7	14.2	26.6	145.0	13.0	90.9	20.7	21.4	5.5	1.6	3.5	7.3	7.7
20	CR-Dhan-306	123.0	131.0	161.0	105.9	10.0	27.4	245.2	29.8	87.9	39.7	18.1	6.2	2.4	2.7	6.0	6.3
21	MTU-1223	123.0	131.0	159.0	104.7	10.2	28.0	251.4	43.0	82.4	33.6	17.9	6.1	2.1	2.9	3.3	3.7
22	CR Dhan -312	82.7	90.7	119.0	137.4	10.4	26.7	139.4	18.4	86.9	22.9	27.2	6.5	2.3	2.8	8.0	7.0
23	CR Dhan -203	83.0	91.0	119.0	113.5	11.4	26.5	149.8	20.6	86.1	30.9	28.5	7.1	1.8	3.9	9.3	8.3
24	MTU-1155	114.0	122.0	150.0	124.8	13.0	27.0	149.4	20.6	86.3	40.7	29.2	6.3	2.6	2.4	8.0	5.0
25	CR Dhan -317	86.0	94.0	124.0	117.8	12.0	22.9	131.2	16.0	88.0	28.2	25.0	6.6	2.5	2.7	4.7	5.0
26	CR Dhan -209	85.0	93.0	124.0	128.1	12.6	25.4	117.0	24.4	78.5	17.9	38.5	6.8	2.5	2.7	2.0	2.3
27	CR Dhan -308	101.0	109.0	139.0	131.1	12.2	27.0	220.2	27.0	87.6	29.1	18.4	5.7	1.9	3.0	2.0	2.3
28	MTU-1075	116.0	124.0	150.0	109.1	12.4	27.8	259.8	38.0	85.3	38.0	25.3	6.7	1.8	3.9	3.0	3.7
29	MTU-1001	110.0	119.3	141.3	126.8	11.8	25.9	142.0	33.2	76.2	26.4	28.2	6.6	2.5	2.6	3.7	4.3
30	CR Dhan-307-Sel.	102.0	112.0	144.0	127.5	12.0	25.8	159.6	19.2	88.0	33.5	32.2	5.5	2.7	2.0	9.3	7.0
31	Pusa-1460 Sel-2	101.0	109.0	139.0	117.2	12.8	28.5	129.6	21.8	83.2	18.9	23.1	7.8	1.8	4.3	5.7	4.3
32	Pusa-1460 Sel	98.0	106.0	140.0	110.9	12.6	29.2	114.4	23.6	79.3	18.1	24.8	7.6	1.7	4.6	6.7	5.7
33	2PST-4 Sel	122.0	130.0	160.0	132.0	12.2	25.9	249.0	50.4	79.8	36.2	22.3	6.5	2.5	2.6	8.7	9.0
34	RajendraBhagwati	80.0	88.0	118.0	122.3	10.4	27.4	147.6	33.2	77.5	27.2	22.3	7.6	1.7	4.5	4.5	5.0
35	Rajendra Mansuri-1	112.0	120.0	153.7	124.4	11.8	28.8	149.0	12.0	91.7	31.5	24.3	5.4	2.7	2.0	3.3	3.7
36	HUR-156	100.0	107.0	136.3	128.4	13.4	27.6	213.6	35.4	83.2	28.9	22.0	6.2	1.5	4.1	2.7	3.0
37	HUBR-2-2/2-2-1	84.0	92.0	122.7	127.4	11.6	27.1	181.2	38.8	78.6	21.6	16.9	7.1	1.5	4.6	4.0	4.3
38	HUBR-10-9	90.3	98.0	129.0	127.4	10.2	26.7	144.0	25.8	81.8	18.2	24.8	7.6	2.1	4.0	6.0	5.0
39	HUR-4-3	89.0	97.0	127.0	95.8	10.8	26.3	115.4	22.0	81.2	19.8	19.2	6.8	1.8	3.7	7.7	7.0
40	HP-5	79.0	87.0	115.0	109.9	11.4	26.5	147.0	26.4	81.9	23.2	17.1	6.4	1.6	4.1	3.0	3.7
41	HUR-105	89.0	97.0	128.0	120.2	12.4	26.5	110.0	20.2	81.7	29.0	27.2	6.9	1.8	3.9	4.0	4.3
42	Pusa Basmati-1-2	87.7	97.0	128.0	129.1	11.2	28.8	128.8	25.4	80.3	22.1	23.0	7.2	1.5	4.7	6.5	6.3
43	IR-64	81.0	89.0	117.0	115.0	12.6	26.8	145.6	25.8	82.5	22.4	27.1	6.9	1.6	4.5	4.7	5.0
44	DRRDhan –44	82.0	90.0	121.0	128.7	12.0	27.4	115.0	16.4	85.7	25.0	24.2	6.9	2.7	2.6	5.0	5.7

45	HUR-917	93.7	101.0	139.3	104.2	13.0	22.8	188.4	23.0	87.7	23.4	16.6	5.2	1.6	3.3	3.0	3.3
46	BRRI-Dhan-64	87.0	95.0	126.0	122.5	9.8	27.3	92.6	12.4	86.3	24.3	28.2	7.0	2.1	3.6	5.0	5.7
47	CRHR-145	102.0	110.0	131.3	115.2	10.4	23.1	122.0	20.8	83.1	24.8	24.0	6.3	1.5	4.3	5.0	5.7
48	CRHR-150	116.0	124.0	154.0	99.2	12.0	23.5	124.2	21.6	82.5	29.8	26.2	6.6	2.3	3.1	4.3	5.0
49	MTU-1010	89.0	97.0	124.7	121.7	11.6	27.3	108.2	13.0	87.9	22.3	27.8	6.9	1.8	3.8	3.7	4.3
50	PVS-5	84.7	92.0	121.0	114.4	11.0	27.0	108.8	11.6	89.5	23.3	20.7	6.4	1.7	3.9	8.0	8.3
51	IRBB-66	92.0	100.0	130.0	119.2	11.2	24.3	103.6	15.4	85.2	21.1	25.7	6.5	2.1	3.1	7.7	8.3
52	HUBR-2-1	96.0	106.0	136.0	110.7	11.0	21.4	134.2	10.6	92.1	32.7	17.6	6.3	2.0	3.2	3.0	3.7
53	CO-39	83.0	89.0	118.0	105.8	11.0	23.6	109.8	28.8	73.9	18.9	21.7	6.0	2.7	2.3	3.3	3.7
54	Jasmine-85	85.0	94.0	124.3	121.8	11.8	31.3	195.8	32.0	83.5	22.4	22.5	7.5	1.5	5.1	6.3	7.0
55	RP-BIO-226	106.3	114.0	144.7	106.8	12.4	26.8	127.6	16.2	87.3	23.8	18.2	4.8	1.8	2.7	8.0	6.3
56	Tequing	80.0	89.0	118.0	97.2	12.0	26.3	105.6	17.2	83.6	21.4	21.1	6.7	1.7	3.9	6.3	5.7
57	CR Dhan-801	105.7	114.7	149.3	111.1	12.2	27.4	136.6	22.4	83.5	31.9	21.1	5.7	2.4	2.4	2.7	3.0
58	CR Dhan-910	112.0	121.0	152.0	115.0	12.4	26.3	195.4	24.6	87.4	23.4	16.6	6.5	1.7	3.8	2.0	2.3
59	RajendraSuhasini	79.0	87.0	115.0	113.9	12.0	26.8	142.0	24.6	82.7	24.7	18.2	7.3	1.7	4.3	12.3	7.0
60	Geetanjali	85.3	94.7	126.3	129.4	12.2	26.2	138.0	20.0	85.4	28.3	18.3	7.3	2.0	3.6	3.0	3.7
61	SwarnaSamridhi	100.0	108.0	139.0	110.1	12.0	24.6	155.6	26.6	82.9	22.8	23.9	6.9	2.2	3.2	7.0	7.0
62	Swarna Shreya	81.0	89.0	117.0	112.0	11.6	26.5	123.2	19.8	83.9	24.9	20.7	6.9	2.2	3.2	4.0	4.3
63	Swarna Shakti Dhan	85.3	94.3	123.0	116.1	10.6	23.9	98.2	14.6	85.1	23.4	35.0	7.4	2.1	3.6	8.7	7.7
64	Sabour Sampan	120.0	128.0	147.0	122.6	13.4	27.7	186.0	20.2	89.2	30.5	23.2	5.4	2.3	2.4	7.7	7.7
65	BRRI Dhan-72	100.0	108.0	139.0	119.5	11.6	25.9	92.8	16.8	81.9	30.9	28.9	6.6	2.6	2.5	2.0	2.3
66	RajendraKasturi	93.0	101.0	132.0	123.6	12.0	24.0	158.6	25.2	84.0	24.9	16.2	5.1	1.9	2.6	3.3	3.7
67	DRR Dhan-48	94.3	103.7	134.3	115.3	11.0	27.1	131.2	25.4	80.4	30.3	30.4	6.9	2.7	2.5	5.3	5.7
68	DRR Dhan-45	106.0	114.7	144.3	107.7	11.6	25.4	125.0	26.8	78.2	28.2	23.4	5.5	1.7	3.3	4.3	4.3
69	Swarna Sub-1	110.0	118.0	149.0	104.7	13.0	25.3	157.8	18.4	88.5	28.6	22.5	5.3	2.7	2.0	7.3	7.0
70	Kalanamak sel.-1	121.0	129.0	160.0	102.9	12.8	23.2	254.8	21.8	91.4	25.4	16.2	4.9	1.7	2.9	2.2	2.3
71	Chittimathyalu	103.0	111.0	143.0	116.4	11.6	23.8	88.6	18.2	79.2	25.1	26.0	6.7	2.5	2.9	5.2	5.7
72	C-101-A-51	98.0	106.0	139.0	122.9	11.2	25.3	214.4	45.8	78.6	23.8	17.3	6.2	2.2	3.0	4.0	4.3
73	Sugandha	118.0	126.0	157.0	140.3	12.2	29.3	191.4	29.6	84.8	26.4	15.0	4.3	1.9	2.2	2.0	2.3
74	Sonachur	113.0	121.0	152.0	140.3	14.6	31.5	265.6	23.0	91.3	26.0	14.8	4.3	1.7	2.5	4.0	4.3
75	Naukala Jeera	126.0	133.0	160.0	150.1	12.4	28.5	205.6	37.4	81.8	20.1	15.0	4.5	2.3	1.9	7.0	6.3
76	CR Dhan-307	105.0	113.0	143.0	127.3	12.8	24.3	183.6	28.6	84.3	34.9	25.9	6.1	2.6	2.3	4.7	5.0
77	CR Dhan-802	110.0	118.0	150.0	112.8	12.0	27.7	93.2	13.4	85.7	32.2	23.1	5.5	1.7	3.2	4.3	4.3
78	Type-3	86.0	94.0	121.0	128.9	13.0	27.7	111.8	35.0	68.5	19.9	20.3	7.8	1.6	4.9	4.3	5.0
79	KetakiJoha	109.0	117.0	138.0	95.9	12.8	23.1	151.6	27.2	82.0	21.2	17.1	5.5	1.9	2.9	5.3	5.7
80	Dhaniya	108.0	116.0	146.0	128.3	11.6	26.4	100.2	9.6	90.4	25.1	16.5	4.6	2.6	1.8	6.3	5.7
81	BadashahBhog	111.0	119.0	147.3	150.5	13.0	28.3	148.6	14.6	90.1	22.9	15.6	4.0	1.7	2.4	6.7	7.0
82	Kalanamak-3131	127.0	101.7	166.0	152.0	11.8	28.8	102.4	23.0	77.4	23.5	18.3	5.0	2.4	2.1	11.7	7.3
83	HUR-BL-135	115.0	123.0	151.0	153.9	12.2	21.2	159.2	15.4	90.3	20.5	17.8	3.9	2.5	1.6	5.7	5.0
84	Adamchini	127.0	135.0	164.0	153.6	12.6	26.0	119.6	18.2	84.3	21.7	15.8	4.7	1.9	2.5	1.7	2.3
84	GeeraSambha	110.0	118.0	149.0	125.2	12.0	24.4	161.2	26.6	83.6	20.4	17.6	4.7	2.6	1.8	4.7	5.7
86	Tax-85-C	130.0	138.0	166.0	152.4	11.2	23.9	199.4	18.6	90.5	26.5	23.8	4.4	2.4	1.8	3.7	3.7
87	Lanjhi	102.0	110.0	141.0	164.7	11.8	29.6	103.8	16.2	84.4	21.8	22.9	7.4	1.7	4.5	2.2	2.3
88	TulshiManjari	125.0	133.0	166.0	158.8	12.4	24.1	199.0	17.6	91.1	28.4	18.1	5.2	2.0	2.6	4.3	5.0
89	K.N-2-3	127.0	135.0	164.0	166.6	11.2	25.7	163.4	17.8	89.2	21.5	19.6	5.6	1.7	3.4	4.0	4.3

90	HUR-ASG-225	120.0	128.0	149.0	167.2	11.4	26.5	117.0	21.4	81.6	31.8	18.1	5.2	1.8	2.9	5.0	5.0
91	Kalanamak-12-3	126.0	134.0	166.0	143.6	11.0	26.4	161.2	29.8	81.2	28.9	21.0	5.7	2.0	2.8	3.7	4.3
92	Kalanamak-2-2	118.0	126.0	154.0	141.2	11.0	24.1	170.4	13.6	92.1	25.0	23.5	6.3	2.0	3.1	4.9	4.3
93	Kalanamak-6-1	107.0	115.0	141.0	171.8	11.6	25.9	142.4	17.0	88.0	18.5	23.6	6.3	2.2	2.9	3.7	7.0
94	HUR-FG-79-56-4-1-1-2	105.0	113.0	149.0	168.9	12.0	24.4	111.8	12.2	88.6	21.7	21.8	6.0	1.7	3.5	10.7	6.3
95	Shyam Jeera	127.0	135.0	166.0	153.7	13.0	30.4	144.6	18.0	87.4	27.2	16.9	4.4	1.8	2.5	5.7	5.7
96	Kalanamak-8-1	117.0	125.0	161.0	173.0	12.6	30.5	118.4	15.8	86.5	18.6	22.5	5.2	2.4	2.2	6.7	5.7
97	Kalanamak-9-1	117.0	125.0	156.0	170.5	11.8	30.1	162.0	15.8	90.4	17.8	25.6	5.4	2.7	2.0	6.0	5.7
98	Kalanamak-10-1	98.0	106.0	137.0	185.5	13.0	29.2	179.2	25.2	85.9	18.9	26.6	5.6	2.6	2.2	7.7	7.7
99	Kalanamak-12-1	127.0	135.0	167.0	185.2	11.0	28.9	143.6	29.4	79.1	19.9	20.7	5.0	2.3	2.3	7.0	5.7
100	Kalanamak-13-1	107.0	115.0	146.0	181.2	11.8	26.0	118.6	15.6	82.6	26.7	22.4	6.3	2.7	2.4	6.7	7.0
101	Kalanamk-18-1	127.0	135.0	166.0	169.4	11.4	29.9	148.8	28.6	80.7	23.7	15.8	5.6	2.6	2.1	11.7	9.0
102	Kalanamak-19-1	125.0	133.0	165.3	170.5	11.2	27.6	253.0	28.0	88.7	33.3	14.5	4.5	2.4	1.9	9.3	8.3
103	Kalanamak-20-1	118.0	126.0	157.0	169.4	11.0	30.2	103.4	8.0	91.9	24.7	21.0	4.6	2.7	1.7	11.0	8.3
104	Kalanamak-21-1	117.0	125.0	155.0	159.7	11.0	27.2	249.0	21.8	91.2	20.5	15.9	4.5	2.8	1.6	8.3	8.3
105	Juhi Bengal-22-1	120.0	128.0	159.0	167.0	11.2	29.4	297.2	13.8	95.3	23.6	16.3	4.6	2.8	1.6	15.0	9.0
106	Juhi Bengal-24-1	118.0	126.0	156.0	166.1	11.0	29.7	134.8	15.6	88.4	18.7	15.9	4.7	2.4	2.0	9.3	8.3
107	Juhi Bengal-25-1	127.0	135.0	166.0	160.8	11.2	27.1	123.2	13.8	88.7	22.2	17.5	5.0	2.5	2.1	11.0	8.3
108	Kanak Jeera-26-1	126.0	134.0	164.7	157.8	10.8	30.9	115.2	14.2	87.9	20.4	25.6	5.3	2.2	2.5	8.0	7.0
109	Kanak Jeera-30-1	117.0	125.0	155.0	177.2	11.4	26.4	164.8	20.4	87.4	19.7	17.1	5.2	2.2	2.3	7.0	7.7
110	Kanak Jeera-30-2	120.0	128.0	157.0	154.2	11.8	27.1	92.2	7.6	91.4	19.1	20.9	5.6	1.9	2.9	8.7	8.3
111	Chiunar	120.0	128.0	154.0	159.1	11.2	25.1	107.0	20.2	80.9	20.6	21.5	7.3	2.2	3.3	8.3	9.0
112	BL-13	122.0	130.0	157.0	164.3	11.0	29.1	115.6	21.4	81.3	20.6	18.2	5.7	1.9	3.0	5.3	5.7
113	Kalanamak(H-110)	123.0	131.0	162.0	89.3	12.8	27.6	139.8	14.0	89.9	19.4	21.2	6.9	1.8	3.9	10.0	8.3
114	Kalanamk(H-110)-3	125.0	133.0	166.0	101.5	12.0	27.0	195.2	27.8	85.6	19.9	17.9	4.5	1.8	2.5	12.3	8.3
115	BRR-2176	87.0	95.0	123.0	108.1	12.0	26.5	208.4	14.2	93.2	27.6	17.1	6.2	1.6	3.9	8.3	5.7
116	Sabour Shree	113.0	121.0	152.0	115.7	13.4	27.2	163.4	24.6	84.8	29.3	23.8	4.2	2.0	2.1	7.0	6.3
117	SabourHarsit	84.0	92.0	120.0	133.1	11.4	23.9	121.0	26.2	78.3	18.5	22.3	7.2	1.7	4.4	6.0	6.3
118	Sawarna	116.0	124.0	146.0	97.8	14.0	26.5	156.8	27.6	82.7	32.7	23.1	5.1	2.7	1.9	13.0	9.0
119	BRR-2228	123.0	131.0	162.0	106.5	14.0	31.7	229.6	20.4	91.0	20.9	27.1	5.4	2.7	2.0	6.0	5.7
120	BRR-2107	91.0	99.0	128.0	93.0	10.8	23.7	211.6	25.6	87.8	27.5	19.6	6.4	1.7	3.7	7.7	5.7
121	BRR-2181	92.0	100.0	127.0	108.2	13.0	31.6	145.0	28.0	80.2	26.3	19.4	7.9	1.6	4.9	5.7	5.7
122	BRR-2178	94.3	99.0	130.3	92.3	11.0	27.9	113.2	17.6	84.7	17.5	22.2	7.6	1.7	4.6	4.3	4.3
123	BRR-2180	83.0	91.0	122.0	112.0	11.0	27.1	216.6	26.8	87.5	26.0	21.7	6.8	1.7	4.1	4.0	4.3
124	BRR-2135	101.0	109.0	135.3	103.9	13.6	24.8	305.0	25.0	91.9	29.7	17.9	5.5	1.5	3.6	3.0	3.7
125	BRR-2108	93.0	101.0	132.0	113.8	12.8	27.4	294.0	26.0	91.2	31.0	19.8	5.8	1.7	3.5	5.0	4.3
126	BRR-2110	113.0	121.0	150.0	112.4	13.0	31.4	302.2	13.8	95.4	36.5	22.7	5.5	1.9	2.8	6.3	5.0
127	BRR-2141	95.0	103.0	134.0	118.3	14.0	32.3	287.8	25.6	91.1	36.2	23.7	5.7	2.0	2.9	6.3	5.0
128	BRR-2186	93.0	101.0	132.0	90.0	13.8	27.3	272.0	22.8	91.6	34.0	21.9	5.5	1.9	3.0	5.0	5.0
	Mean	**103.9**	**111.7**	**141.6**	**126.6**	**11.9**	**26.7**	**160.4**	**22.6**	**85.2**	**25.2**	**21.6**	**6.0**	**2.1**	**3.1**	**6.1**	**5.7**
	Maximum	**130.0**	**138.0**	**167.0**	**185.5**	**14.6**	**32.3**	**305.0**	**50.4**	**95.4**	**40.7**	**38.5**	**7.9**	**2.8**	**5.1**	**15.0**	**9.0**
	Minimum	**77.7**	**84.0**	**112.0**	**81.5**	**9.8**	**21.2**	**88.6**	**7.6**	**68.5**	**17.5**	**14.5**	**3.9**	**1.4**	**1.6**	**1.7**	**2.3**

Table -3 Range, mean, coefficient of variation, heritability, genetic advance and least significant difference (LSD) , yield contributing characters and disease charater in rice (*Oryza sativa.*)

Variability Parameters/ characters	Over all means	Range		Genotypic coefficient of variance (%)	Phenotypic coefficient of variance (%)	Heritability (h^2) Bs (%)	Genetic advance	Genetic advance in % of mean	Range of parameters / Least significance difference (at 5%)			
		Min.	Max.						LSD 1	LSD 2	LSD 3	LSD 4
Days to panicle initiation (day)	103.9	77.7 (MLR-5001)	130.00(Tax-85-C)	13.07	13.217	98.0	27.72	26.64	1.001	2.840	3.176	2.382
Days to 50% flowering (day)	111.7	84.0 (MLR-5001)	138.0 (Tax-85-C)	12.12	12.23	98.0	27.66	24.74	0.907	2.567	2.870	2.152
Days to maturity (day)	141.6	112.0 (MLR-5001)	167.0(Kalanamak-12-1)	9.75	9.95	96.0	27.99	19.70	1.395	3.945	4.410	3.308
Plant height (cm)	126.6	81.5 (DRR Dhan-62)	185.5(Kalanamak-10-1)	17.50	17.51	99.0	45.81	36.03	0.404	1.142	1.277	0.958
Number of effective tillers/ Plant	11.9	9.8 (BRRI-Dhan-64)	14.6(sonachur)	5.94	7.45	64.0	1.16	9.74	0.268	0.759	0.849	0.637
Panicles length (cm)	26.7	21.2 (HUR-BL-135)	32.3(BRR-2141)	7.65	7.80	96.0	4.14	15.47	0.200	0.567	0.634	0.475
Number of grains/panicle (Nos)	160.4	88.6 (BRR-2135)	305.0(Chittimathyalu)	29.16	29.56	97.0	94.74	59.25	3.895	11.019	12.319	9.239
Number of unfilled grains/panicle (Nos)	22.6	7.6 (Kanak Jeera-30-2)	50.4 (2PST-4 Sel)	30.81	31.54	95.0	14.07	61.98	0.767	2.171	2.427	1.821
Spikelet fertility (%)	85.2	68.5 (Type-3)	95.4 (Juhi Bengal-22-1)	4.93	5.02	96.0	8.48	9.96	0.410	1.160	1.298	0.973
Grain yield /plant	25.2	17.5(BRR-2178)	40.7(MTU-1155)	18.83	18.89	99.0	9.73	38.66	0.191	0.542	0.606	0.454
Test weight (g)	21.6	14.5(Kalanamak -19-1)	38.5(CR Dhan-209)	19.06	19.17	99.0	4.43	39.05	0.217	0.615	0.687	0.516
Kernel length (mm)	6.0	3.9(HUR-BL-135)	7.9(BRR-2181)	14.07	14.79	91.0	1.65	27.58	0.136	0.385	0.431	0.323
Kernel breadth (mm)	2.1	1.4(DRR Dhan -53)	2.8(Juhi Bengal-22-1)	17.42	17.66	97.0	0.73	35.39	0.029	0.085	0.094	0.071
Length/ breadth ratio (%)	3.1	1.6 (HUR-BL-135)	5.1 (Jasmine-85)	24.57	25.47	93.0	1.50	48.84	o.102	0.290	0.324	0.243
Disease lesion length (cm)	6.1	1.7 (DRR Dhan-59)	15.0(Juhi Bengal-22-1)	37.98	40.99	86.0	4.38	72.50	0.465	1.316	1.472	1.104
Disease rating scale	5.7	2.3 (DRR Dhan-59)	9.0(Chinnur), (Kalanamak-18-1)	26.41	29.70	79.0	2.73	48.36	0.384	1.086	1.215	0.911

Table 4- Clustering pattern of 132 rice genotype on the basis of non-hierarchical Euclidean cluster analysis

Cluster Number	Number of genotypes	Name of Genotypes
I	68	Tetep, BPT520 4, RajendraSweta, DRR Dhan-60, DRR Dhan-59, Impr. SambhaMansuri, DRR Dhan-50, CG. Devbhog, TelaganaSona, CR-1009 Sub-1, CR Dhan -909, CR Dhan-515, CR Dhan-803, CR Dhan-411, CR-Dhan-310, CR-Dhan-315-2 Sel, BPT-5204 Sub-1, CR Dhan -203, MTU-1155, CR Dhan -317, CR Dhan-307-Sel., Pusa-1460 Sel-2, Pusa-1460 Sel, Rajendra Mansuri-1, HUBR-2-2/2-2-1, HUBR-10-9, DRR-44, HUR-917, BRRI-Dhan-64, CRHR-150, MTU-1010, IRBB-66, HUBR-2-1, CR Dhan-801, CR Dhan-910, Geetanjali, SwarnaSamridhi, Swarna Shreya, Swarna Shreya, Swarna Shakti Dhan, BRRI Dhan-72, DRR-48, Swarna Sub-1, Kalanamak sel.-1, Chittimathyalu, C-101-A-51, Naukala Jeera, CR Dhan-307, KetakiJoha, GeeraSambha, Tax-85-C, TulshiManjari, K.N-2-3, Kalanamak-12-3, Kalanamak-2-2, Kalanamak-6-1, Kalanamk-13-1, Kanak Jeera-26-1, Kanak Jeera-30-1, Kanak Jeera-30-2, Chiunar, Kalanamak (H-110), BRR-2176, BRR-2107, BRR-2178, BRR-2180, BRR-2135
II	1	MTU-7029
III	37	DRR Dhan-53, DRR Dhan-62, MLR-5001, DRR Dhan-70, RajendraBhagwati, CR Dhan -308, HUR-156, HUR-4-3, HP-5, HUR-105, Pusa Basmati-1-2, IR-64, Jasmine-85, RP-BIO-226, Tequing, RajendraKasturi, DRR-45, Sugandha, CR Dhan-802, Dhaniya, BadashahBhog, HUR-BL-135, Adamchini, Lanjhi, Shyam Jeera, Kalanamk-12-1, Kalanamk-18-1, Kalanamk-19-1, Kalanamk-20-1, Kalanamk-21-1, Juhi Bengal-24-1, Juhi Bengal-25-1, BL-13, Kalanamk (H-110)-3, Sabour Shree, SabourHarsit, BRR-2181
IV	8	BINA Dhan11, CR Dhan -209, MTU-1001, CO-39, Kalanamk-8-1, Kalanamk-9-1, Kalanamk-10-1, BRR-2228
V	4	CR Dhan-306, MTU-1223, MTU-1075, 2PST-4 Sel.
VI	5	CRHR-145, Sabour Sampan, Type-3, HUR-ASG-225, Swarna
VII	2	RajendraSuwasini, HUR-FG-79-56-4-1-1-2
VIII	5	Sonachur, BRR-2108, BRR-2110, BRR-2141, BRR-2186
IX	1	Kalanamk-3131
X	1	Juhi Bengal-22-1

Table 5- Estimates of average intra and inter-cluster distances for ten clusters in rice (*Oryza sativa L.*)

Cluster number	I	II	III	IV	V	VI	VII	VIII	IX	X
I	0	29.673	12.927	26.376	100.603	24.951	42.766	125.729	76.428	103.172
II		0	35.317	49.732	77.651	47.370	69.305	107.094	94.921	110.775
III			0	17.320	104.081	18.323	37.435	131.240	66.788	95.305
IV				0	115.474	21.231	28.679	141.179	60.117	88.895
V					0	117.642	139.088	50.918	158.574	114.659
VI						0	33.017	147.025	57.922	88.526
VII							0	161.041	56.624	84.782
VIII								0	190.315	117.381
IX									0	81.128
X										0

References

1. Anuhya, B. and Lavanya, G. R. (2022). Assessment of Heritability, Genetic Advance and correlation analysis for grain yield characters of rice (*Oryza sativa* L.). *International Journal of Plant & Soil Science*. 34(19): 259-266.

2. Islam, M.A., Raffi, S.A., Hossain, M.A., Hasan, A.K. (2015). Analysis of genetic variability, heritability and genetic advance for yield and yield-associated traits in some promising advanced lines of rice. *Progressive Agriculture.* 26:26-31

3. Islam M.Z., Khale quzzaman M., Bashar M. K., Ivy N. A., Haque M.M., And Mian M.A.K. (2016). Variability assessment of aromatic and fine rice germplasm in Bangladesh based on quantitative traits. *The Scientific World Journal. pp*: 14.

4. Kumar B., Gupta B. B, And Singh B. (2014) Genetic Diversity for Morphological And Quality Traits in rice (*Oryza sativa* L.) *An International Quarterly Journal of Life Science* 9(4): 1759-1762.

5. Kumar V. (2015). Genetic Diversity and Character Association Studies for Some Economic Traits In Rice (*Oryza sativa* L.) *An International Journal of Life Science* 910(2): 899-904.

6. Kumar A., Kumar S., Singh S., Prasad, J., Jeena AS. and Upreti, M.C. (2020). Genetic variability, heritability and genetic advance studies for quantitative and quality traits in basmati rice (*Oryza sativa* L.) *J. of Pharmacognosy and Phytochemistry*. 9(4): 2065-2068.

7. Kumari S, Singh, P.K., Bisen P., Loitongbam, B, Rai, V.P. and Sinha, B. (2018). Genetic Diversity Analysis of Rice (*Oryza sativa* L.) *Germplasm Through Morphological Markers IJAEB pp*. 953-957.

8. Longjam S. And Singh N. B. (2019). Assessment of heritability and genetic advance for Yield contributing characters in hill rice (*Oryza sativa* L.) genotypes of Manipur. *The Pharma Innovation Journal*. 8(4), 07-11.

9. Mersha Tezera (2021). Variability, Heritability and Genetic advance of introduced upland rice genotypes at Fogera in North Western Ethiopia. J*ournal of Plant Studies*10, No. 2

10. Tuwar, A. K, Singh, S.K., Sharma, A, and Bhati, P.K. (2013). Appraisal of Genetic Variability for Yield And Its Component Characters In Rice (*Oryza sativa* L.). *An International Quarterly Journal of Biology & Life Science.* 1(3):84-89.

11. Vadodariya, H.P., Patel, R. K. Chandramaniya, C. P., Patel, D. S. and Makwana, D. (2023). Genetic variability, heritability, and genetic advance studies of segregating backcrossed generation (BC1F3) In rice (*Oryza sa*tiva L.). *The Pharma Innovation Journal*. 12(12): 2431-2435.

12. Yadav, R., Rajpoot, P., Verma, O.P., Singh, P.K., Singh, P. and Pathak, V. (2017). Genetic variability, heritability and genetic advance in rice (*Oryza sativa* L.) for grain yield and it's contributing attributes under sodic soil. *Journal of Pharmacognosy and Phytochemistry*. 6(5): 1294-1296.

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