Assessment of Geneticdivergenceandcharacterassociationstudiesongermplasmaccessions of rice (*Oryza sativa* L.)

Abstract

Inthisstudy,fifty-fivericegermplasmaccessionswereusedalongwithfivechecks, namelyIR64,Swarna,Jaya,DRRDhan42andMTU1010,forevaluatinggeneticvariability, heritability and genetic advance during *kharif* 2023. The analysis of variance revealed extremely large genotype differences for each of the 16 traits under investigation. Thehighest heritability measures werefoundin numberoffilledgrains perpaniclefollowed bypaddybreadth,paddylength:breadthratio,brownricelength:breadthratio,100seedweight,paddy length, plant height, brown rice breadth, number of effective tillers per plant, brownrice length, number of unfilled grains per panicle, grain yield per plant, panicle length, andharvestindex.Highheritabilitywithhighgeneticadvanceshownbycharacterssuchasplantheight,numberoffilledgrainsperpanicle,paddylengthandbrownricelengththisindicatesthat the heritability is due to additive gene action and is found least influenced byenvironment. Hence, the desirable characters with high heritability coupled with geneticadvance can be used for selection. Grain yield per plant exhibits a positive and highlysignificant correlation with the days to 50% flowering (0.383), number of effective tillersper plant (0.315), number of filled grain per panicle (0.219) and paddy length (0.219). Interms of direct effect, paddy length (4.735) shows the highest impact, followed by brownrice length (1.183), number of filled grain per panicle (0.578), days to 50% flowering(0.347), panicle length (0.135), harvest index (0.082).

Key words: Genetic divergence, Rice, germplasm accessions, genetic

Introduction

"Riceisknownas the"GrainofLife'becauseitprovidesfoodformorethanone-third of the world's population. Furthermore, the United Nations has designated 2004 as the "International Year of Rice" to recognize the importance of rice in human life. Rice is endowedwithawealthofgeneticdiversity"(Akshay*etal.*,2022). "Italsooccupiesaround25% of the world's land used for cereal production. It is one of the most genetically diverse crop species since it is one of the very few with over a million landraces and improved cultivars. When determining the degree of variability present in the germplasm, genetic metrics like genotypiccoefficientofvariation(GCV)andphenotypiccoefficientofvariation(PCV)are helpful. Heritability in combination with high genetic advance would be a more beneficial tool in predicting the outcome of selecting the optimal genotypes for yield and its attributes. Estimates of heritability aid plant breeders in choosing superior genotypes from a variety of genetic populations" (Johnson *et al.*, 1955;Kurada et al. 2023). Crop development efforts could benefit greatly from knowledge of the genetic relationship between breeding materials and the diversity of germplasm. Genetic variety determines the inherent potential of a cross for heterosis and the frequency of desirable recombinants in later generations (Ovung*et al.*, 2012). Heritability also reveals how much a character will be passed down to succeeding generations, which makesunderstandingitcrucialforselection-basedimprovement(Sabesan*etal.*,2009;Singh *etal.*,2015).Acharacter'sheritabilitytellsushoweasilyitcanbepasseddowntosubsequent generations.

MaterialandMethods

Fifty-five lines of rice germplasm accessions, including five checks IR64, Swarna, Jaya,DRRDhan42,andMTU1010wereusedinstudy.Thestudywassetupasatwo-replicationRandomizedCompletelyBlockDesign(RCBD)experiment.Experimentalworkwasperformedat ResearchCumInstructionalFarm,Departmentof GeneticsandPlantBreeding, Indira Gandhi Krishi Vishwavidyalaya,Raipur,Chhattisgarhduringthe*Kharif* seasonof2023.Seedlingsthatwere21daysoldwereplanted20x15cmapart.Every agronomicpracticewasdesignedtopromotehealthycropgrowth.Forthepurposeof recordingobservations,fiveplantsfromeachreplicationwereselected.Forsubsequent study,theaverageoffiveplantswasutilized.Allobservationspertainingtoyieldwere documented in order to assess PCV, GCV, GA, heritability, correlation and path analysis.

Result

Analysisofvariance.

Analysis of variance was performed on the replication wise mean data for yield and yield attributing traits of rice germplasm accessions. The analysis of variance revealed significant differences in all of the 16 attributes studied, such as days to 50% flowering, plant height, panicle length, number of effective tillers per panicle, number of filled grains per panicle,numberofunfilledgrainsperpanicle,spikeletfertility%,100seedweight,grainyield per plant, harvest index %, paddy length, paddy breadth, paddy L/B ratio, brown rice length, brownricebreadth, brownrice L/Bratio.Table 1 showsthe resultsof analysisofvariance,as wellasthesignificantdifferenceforeachofthefeaturesstudied.Thisindicatesthatthematerial utilized in this investigation have genetic variability among them. The presence of genetic variation (the appearance of variation among the individual in a plant population) is a requirement for every breeding effort; without it, neither improving current lines nor developing distinct lines is conceivable. Similar findings were also reported by Htwe *et al.* (2019) and Saha *et al.* (2019).

Table1:Analysisofvariationforyieldandyieldattributingtraits

ANOVA Summary				
S.No.	**Source**	**MeanSumofSquares(MSS)**		
		Replication	**Treatment**	**Error**
	Degreesoffreedom	**1**	**54**	**54**
1	Daysto50% flowering	15.67	13.19**	6.48
2	Plantheight (cm)	47.65	573.18**	52.26
3	Paniclelength (cm)	1.37	10.83**	1.94
4	Numberofeffectivetillersperplant	0.32	0.95**	0.08
5	Numberoffilledgrainsperpanicle	107.10	1252.18**	42.87
6	Numberofunfilled grainsper panicle	2.40	69.41**	0.80
7	Spikeletfertility%	34.68	74.30**	38.16
8	Hundredseedweight(g)	0.08	0.45**	0.03
9	Grainyieldperplant (g)	0.80	11.25**	1.46
10	Harvestindex %	11.95	72.56**	14.47
11	PaddyLength(mm)	7.64	154.96**	10.80
12	Paddybreadth(mm)	0.58	14.62**	0.573
13	PaddyL/B Ratio	0.04	0.52**	0.02
14	Brownricelength(mm)	0.22	95.92**	10.78
15	BrownRicebreadth(mm)	0.14	13.14**	1.22
16	BrownriceL/B	0.01	0.45**	0.02

**Significanceat1% levelof probability.

Estimationofgeneticvariabilityparameters

Thenatureofgeneticvariationistheconditionofplantbreeding.Geneticvariationis importantforanybreedingmaterial,asitnotonlyprovidesselection,butalsovaluable information on the selection of different parents for hybridization programs. Landraces are valuablegenetictoolsbecausetheyprovidealotofgeneticvariationandcanbeusedto supplementandexpandthegenepoolofdevelopedgenotypes.Improvingyieldrequires understandingthegeneticvariabilityanddemographiccompositionofgermplasmcollections. More diversity in the original breeding material ensures better chances of producing acceptable varieties of a crop plant. Therefore, the primary objective of germplasm conservationistocollectandpreservegeneticdiversityinagroupofindigenousagricultural species for the benefit of current and future generations. Genetic measures such as the genotypic coefficient of variation (GCV) and the phenotypic coefficient of variation (PCV) can be used to assess the level of diversity in the germplasm.

Table 2 showed the values of the genotypic and phenotypic coefficients of variation. TheGCVandPCVwereshowntohaveasignificantassociationforallcharacters.Theresults of the analysis of variance showed that there were extremely significant genotype differences foreachofthequantitativetraits.InthestudyofPCVandGCV,numberoffilledandunfilled grains per panicle are characteristics with high PCV and GCV values.All of the traits had greater phenotypic coefficients of variability than genotypic coefficients of variability, showing that environmental factors as well as genotypes play a role in the apparent variation. Similar findings were given by Iqbal *et al.* (2018), Htwe *et al.* (2019), Saha *et al.* (2019) and Tiwari *et al.* (2019). Among the characters studied, a higher number of the genotypic coefficient of variation was obtained for number of unfilled grains per panicle (37.94%) followed by number of filled grain per panicle. Moderate genotypic coefficient of variation was recorded for 100 seed weight (18.98%), grain yield per plant (16.25%), brown rice (16.14%),numberofeffectivetillersperplant(15.38%),paddylength:breadthratio(15.23%), plant height (12.30%), brown rice breadth (11.28%), brown rice length (10.57%), paddy breadth (1.50%), harvest index (10.38%) and paddy length (10.36%). The low percentage of genotypiccoefficient of variation (less than 10%) in thepresent analysis has been recorded in panicle length (8.87%) followed by spikelet fertility (4.96%) and days to 50% flowering (1.87%).

GeneticadvanceaspercentofmeanandHeritability

Heritability is the ratio of genotypic variance to total or phenotypic variance (Broadsense)andtheratioofadditivegeneticvariancetophenotypicvariance(Narrowsense). Genetic advance is the improvement in the mean genotypic value of selected plants over the parental population. It is quitechallenging to determinewhether ornot observed variability is heritable. A character’s heritability tells us how easily it can be passed down to subsequentgenerations. The reliability of phenotypic value is expressed using heritability estimates as a forecastingtool.Highheritabilitythereforeaidsintheefficientselectionofaparticularfeature. Thehighestheritabilitymeasures(>60)werefound innumberoffilledgrainperpanicle (93.38%),paddybreadth(92.46%),paddylength:breadthratio(91.97%),brownrice length:breadthratio(90.53%),100seedweight(87.14%),paddylength(86.97%),plantheight (83.29%),brownricebreadth(82.96%),numberofeffectivetillersperplant(82.87%),brown rice length (79.78%), number of unfilled grain per panicle (79.46%) grain yield per plant (76.93%), panicle length (69.56%), harvest index (66.74%).

Thisterm"geneticadvance"referstotheamountofgeneticgainthathasoccurredasa result of selection. The heritability for which traits was under examination determines the effectiveness of genetic advances under selection. Even when the feature is lesser impacted with environmental influences, selection for enhancement of such characters could not be successfulsinceheredityisbasedontotalgeneticvariation,whichcomprisesfixable(additive) and non-fixable (dominance and epistatic) variation.

High heritability with high genetic advance shown by characters such as plant height, numberoffilledgrainsperpanicle,paddylengthandbrownricelength. Thestudyshowedan additive gene effect for the above characters.The result are in agreement with Devkota *et al.* (2023)indicatingtheroleofadditivegeneactionincontrollingthesecharacters.AlsoGupta*et al.* (2021) revealed that for biological yield per plant, harvest index, grain yield per plant, number of effective tillers per plant and number of filled grains per panicle.

Table2:Geneticparametersforvariousyieldandyieldrelatedcharacters.

S. No.	Characters	Mean	Range Min.	Max.	GCV%	PCV%	$h^2_{(bs)}$	GAas%of mean
1.	Daysto 50% flowering	98.01	91.50	104.00	1.87	3.20	34.07	2.25
2.	Plantheight (cm)	131.21	79.40	155.80	12.30	13.48	83.29	23.12
3.	Paniclelength (cm)	24.01	19.97	32.40	8.78	10.53	69.56	15.09
4.	Numberofeffectivetillersper plant	4.28	2.60	6.20	15.38	16.89	82.87	28.84
5.	Numberoffilled grainsperpanicle	100.89	44.40	193.30	24.37	25.22	93.38	48.52
6.	No.ofunfilled grainsperpanicle	15.44	2.70	28.40	37.94	38.38	79.46	78.82
7.	Spikeletfertilitypercent(%)	85.68	67.48	96.39	4.96	8.75	32.13	5.79
8.	100seedweight(g)	2.41	1.29	3.55	18.98	20.33	87.14	36.49
9.	Grain yield perplant (g)	13.61	8.50	18.90	16.25	18.53	76.93	29.37
10.	Harvestindex(%)	52.00	41.00	63.00	10.38	12.71	66.74	17.48
11.	Paddylength (mm)	7.97	5.90	10.05	10.36	11.11	86.97	19.90
12.	Paddybreadth(mm)	2.55	2.00	3.10	10.50	10.92	92.46	20.81
13.	Paddylengthbreadth ratio	3.29	2.27	5.03	15.23	15.88	91.97	30.08
14	Brownricelength (mm)	6.07	4.40	7.75	10.57	11.83	79.78	19.45
15	Brownricebreadth(mm)	2.25	1.55	2.95	11.28	12.38	82.96	21.15
16	Brownricelengthbreadth ratio	3.26	2.10	4.43	16.14	16.96	90.53	31.63

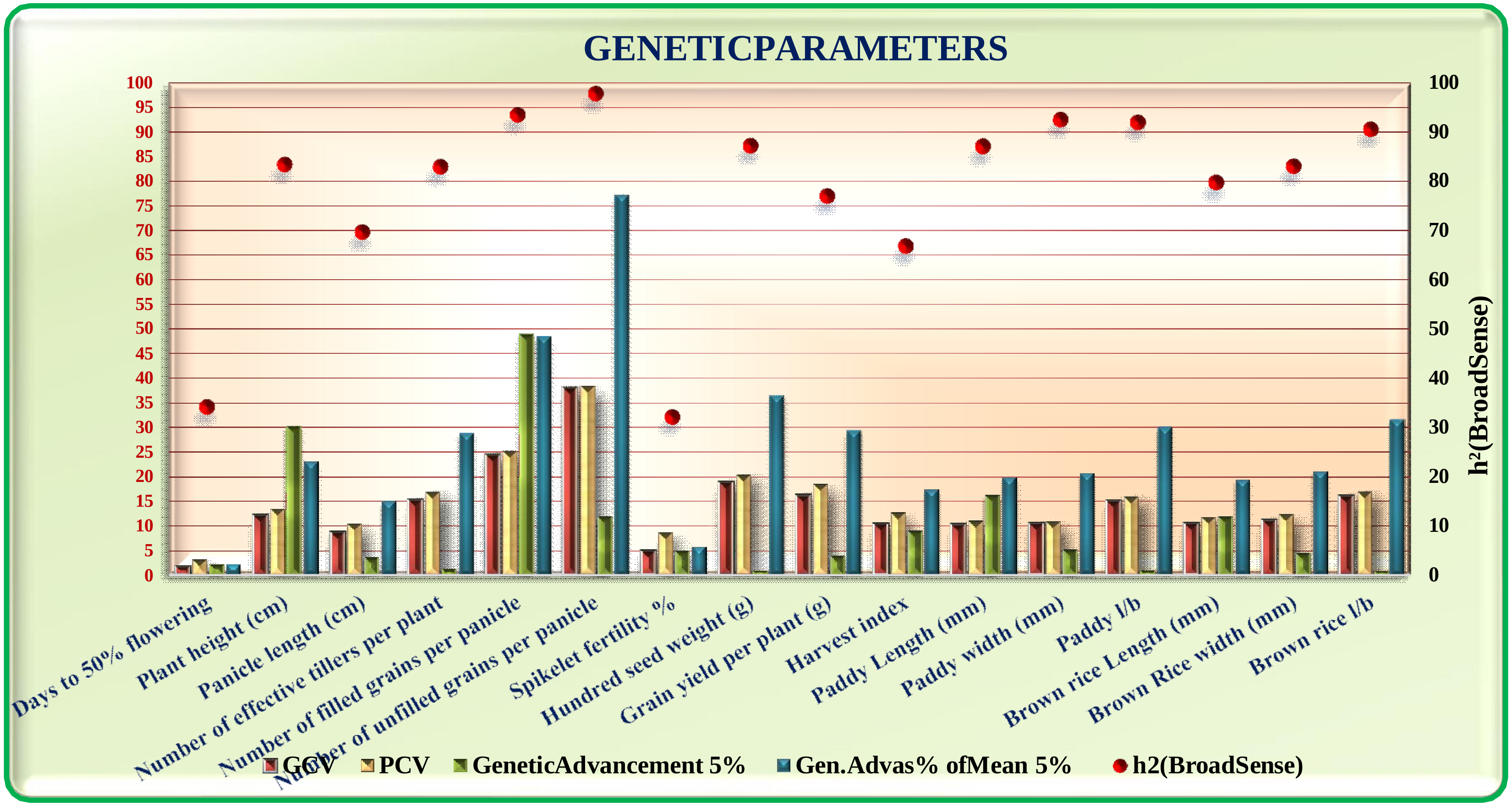

Fig1-PCV,GCV,HeritabilityandGeneticadvanceaspercentageofmeanforyieldanditsattributingtraits.

Correlationcoefficientanalysis

Grain yield per plant exhibits a positive and highly significant correlation with the daysto50%flowering(0.383),numberofeffectivetillersperplant (0.315),numberoffilled grainperpanicle(0.219)andpaddylength(0.342)inTable3and4.Itshowedanegativeand highly significant correlation with the plant height (-0.327). Similar findings were reported byPatel*etal*.(2017)forbiologicalyieldperplant,harvestindex,filledspikeletsperpanicle, numberofeffectivepaniclesperplant,andtotaltillersperplant;Bitew*etal*.(2018)andGupta *et al.* (2021) for filled grains per panicle.

The positive relationship between desired features is advantageous since it aids in the development of both features at the same time. The negative correlation, while, will prevent the simultaneous manifestation of two high-value characters in this case, some form of economic compromise has to be made.

Table3:Genotypiccorrelationcoefficientforyieldandyieldattributingtraits

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1	-0.295	-0.174	0.136	-0.044	0.123	-0.526**	0.224*	0.188*	0.153	-0.171	0.230*	0.022	0.138	-0.100	0.383**
2		1	0.322**	-0.510**	0.213	0.003	0.571**	0.271*	-0.401**	-0.073	0.204*	-0.201*	-0.038	0.156	-0.214*	-0.327**
3			1	-0.159	0.045	0.345**	-0.155	0.114	-0.237*	0.082	0.386**	-0.190*	0.017	-0.014	-0.005	-0.137
4				1	-0.007	0.001	-0.483**	-0.415**	0.153	-0.028	-0.255*	0.144	-0.064	-0.387**	0.230*	0.315**
5					1	0.286*	0.381**	-0.445**	-0.018	-0.301*	-0.275*	-0.036	-0.323**	-0.404**	0.019	0.219*
6						1	-0.881**	-0.005	0.012	0.217*	0.0724	0.070	0.138	0.053	0.0545	0.197
7							1	-0.148	0.005	-0.518**	-0.218*	-0.182	-0.418**	-0.300*	-0.135	-0.302
8								1	-0.022	0.577**	0.540**	0.017	0.508**	0.435**	0.051	0.165
9									1	0.018	-0.110	0.097	0.060	-0.005	0.036	0.182
10										1	0.013	0.711**	0.913**	0.103	0.569**	0.342**
11											1	-0.687**	-0.091	0.129	-0.157	-0.038
12												1	0.712**	-0.035	0.529**	0.234*
13													1	0.107	0.668**	0.289*
14														1	-0.663**	-0.112
15															1	0.283*
16																1

*:-Significancelevelat0.05%**:-Significance levelat0.01 %

Note:-1=Daysto50%flowering,2=Plantheight,3=Paniclelength,4=Numberofeffectivetillerperplant,5=Numberoffilledgrainperpanicle 6= Number of unfilled grain per panicle, 7= Spikelet fertility, 8= 100 seed weight, 9= Harvest index, 10= Paddy length, 11= Paddy breadth, 12= Paddy length:breadth ratio, 13= Brown rice length, 14= Brown rice breadth, 15= Brown rice length:breadthratio, 16= Grain yield per plant

Table4:Phenotypiccorrelationcoefficientsforyieldandyieldcontributingtraits

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	1	-0.195*	-0.161	0.118	-0.046	0.059	-0.224*	0.154	0.155	0.123	-0.117	0.158	-0.040	0.132	-0.1145	0.199*
2		1	0.308*	-0.426**	0.213*	0.006	0.310**	0.201*	-0.351**	-0.094	0.190*	-0.194*	-0.056	0.162	-0.218*	-0.180
3			1	-0.193*	0.024	0.283*	-0.153	0.094	-0.161	0.046	0.328**	-0.171	-0.011	-0.046	-0.001	-0.088
4				1	0.013	-0.003	-0.216*	-0.358**	0.113	-0.033	-0.220*	0.122	-0.073	-0.334**	0.201*	0.271*
5					1	0.277*	0.279*	-0.406**	-0.020	-0.280*	-0.245*	-0.046	-0.279*	-0.350**	0.012	0.221*
6						1	-0.525**	0.004	0.019	0.216*	0.063	0.079	0.126	0.051	0.051	0.166
7							1	-0.128	-0.074	-0.296*	-0.099	-0.123	-0.209*	-0.109	-0.098	-0.145
8								1	-0.005	0.522**	0.459**	0.043	0.444**	0.363**	0.057	0.114
9									1	0.052	-0.104	0.106	0.009	0.023	0.002	0.100
10										1	0.013	0.700**	0.812**	0.102	0.522**	0.237*
11											1	-0.692**	-0.108	0.098	-0.152	-0.023
12												1	0.662**	-0.013	0.500**	0.170
13													1	0.096	0.654**	0.167
14														1	-0.667**	-0.076
15															1	0.197*
16																1

*:-Significancelevelat0.05%**:-Significance levelat0.01 %

Note:-1=Daysto50%flowering,2=Plantheight,3=Paniclelength,4=Numberofeffectivetillerperplant,5=Numberoffilledgrainperpanicle 6= Number of unfilled grain per panicle, 7= Spikelet fertility, 8= 100 seed weight, 9= Harvest index, 10= Paddy length, 11= Paddy breadth, 12= Paddy length:breadth ratio, 13= Brown rice length, 14= Brown rice breadth, 15= Brown rice length:breadth ratio, 16= Grain yield per plant

Pathcoefficientanalysis

In terms of direct effect, paddy length shows the highest impact (4.735), followed by brown rice length (1.183),number of filled grain per panicle (0.578), days to 50% flowering (0.347),paniclelength(0.135),harvestindex(0.082),Conversely,paddylength:breadthratio hadthehighestnegativedirecteffect(-6.147),followedbypaddybreadth(-3.908),brownrice length:breadthratio(-1.204),brownricebreadth(-0.946),numberofunfilledgrainperpanicle (-0.606),plantheight(-0.364),100seedweight(-0.298),spikeletfertility(-0.217),numberof effective tiller per plant (-0.119).

Accordingtothemagnitudeofthedirecteffect,daysto50%flowering,paniclelength, numberoffilledgrainsperpanicle,harvestindex,paddylength,brownricelengthhadahighly significantandpositivecorrelationwithgrainyieldperplantalongwithapositivedirecteffect on grain yield per plant. These points indicate true relationships among these traits, and for yield improvement, direct selection for these characters will be rewarding. Similar findings were concluded by Devi *et al.* (2017), Rasel *et al.* (2018), Sivasankar *et al.* (2018) and Singh*et al.* (2024)

Table5Estimationofpathcoefficient(directandindirecteffects)forvariousyield attributingtraitsongrainyieldper plant

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	**0.347**	-0.102	-0.060	0.047	-0.015	0.042	-0.182	0.077	0.065	0.053	-0.059	0.079	0.007	0.048	-0.034	0.383**
2	0.107	**-0.364**	-0.117	0.186	-0.077	-0.001	-0.208	-0.098	0.146	0.027	-0.074	0.073	0.013	-0.056	0.078	-0.327**
3	-0.023	0.043	**0.135**	-0.021	0.006	0.046	-0.021	0.015	-0.032	0.011	0.052	-0.025	0.002	-0.002	-0.008	-0.137
4	-0.016	0.060	0.018	**-0.119**	0.009	-0.002	0.057	0.049	-0.018	0.003	0.030	-0.017	0.007	0.046	-0.027	0.315**
5	-0.025	0.123	0.026	-0.004	**0.578**	0.165	0.220	-0.257	-0.010	-0.174	-0.159	-0.021	-0.186	-0.233	0.011	0.219*
6	-0.074	-0.002	-0.209	-0.008	-0.173	**-0.606**	0.533	0.003	-0.007	-0.131	-0.043	-0.042	-0.083	-0.032	-0.033	0.197
7	0.114	-0.124	0.033	0.105	-0.083	0.191	**-0.217**	0.032	-0.001	0.112	0.047	0.039	0.091	0.065	0.029	-0.302
8	-0.066	-0.080	-0.034	0.123	0.132	0.001	0.044	**-0.298**	0.006	-0.171	-0.160	-0.005	-0.151	-0.129	-0.015	0.165
9	0.015	-0.032	-0.019	0.012	-0.001	0.001	0.004	-0.001	**0.082**	0.001	-0.009	0.008	0.005	-0.004	0.003	0.182
10	0.729	-0.350	0.388	-0.135	-1.424	1.026	-2.454	2.730	0.088	**4.735**	0.062	3.367	4.322	0.491	2.692	0.342**
11	0.670	-0.798	-1.507	0.998	1.074	-0.282	0.851	-2.10	0.432	-0.051	**-3.908**	2.685	0.358	-0.505	0.616	-0.038
12	-1.410	1.235	1.165	-0.889	0.222	-0.435	1.121	-0.10	-0.600	-4.371	4.224	**-6.147**	-4.375	0.217	-3.250	0.234*
13	0.026	-0.045	0.020	-0.076	-0.381	0.163	-0.494	0.600	0.071	1.079	-0.108	0.842	**1.183**	0.127	0.789	0.289*
14	-0.130	-0.147	0.014	0.366	0.382	-0.050	0.284	-0.411	0.004	-0.098	-0.122	0.033	-0.102	**-0.946**	0.627	-0.112
15	0.120	0.257	0.007	-0.277	-0.023	-0.065	0.163	-0.061	-0.043	-0.684	0.190	-0.636	-0.803	0.798	**-1.204**	0.283*

Residualeffect=0.369

Note:-1=Daysto50%flowering,2=Plantheight, 3=Paniclelength,4=Numberofeffectivetillerperplant,5=Numberoffilledgrainper panicle6=Number ofunfilled grain perpanicle, 7=Spikelet fertility, 8=100 seed weight, 9= Harvest index, 10=Paddy length, 11=Paddy breadth, 12= Paddy length:breadth, 13= Brown rice length, 14= Brown rice length, 15= Brown rice length:breadth.

ConclusionandFuturescope

It is clear from the current study that the genotypes examined may be an effective sourceofmaterialforfuturebreedingprogrammes.Highheritabilityalongwithhighgenetic advance indicates that the heritability is due to additive gene action and is found least influenced by environment. Hence, the desirable characters with high heritability coupled withgeneticadvancecanbeusedforselection.Highestimatesofvariabilityalsosuggestthat the germplasm lines used for the study have a broad genetic background, suggesting an opportunityofgeneticimprovementthroughselectionforthesequalities.Thecorrelationand path analysis studies together revealed that the traits days to 50% flowering, panicle length, number of filled grain and brown rice length are important components for increasing grain yield. Hence, these traits could be given due importance for enhancing grain yield in rice.

Acknowledgement.

The authors are thankful to Indira Gandhi Krishi Vishwavidyalaya for providing all the necessary resources to carry out the research. Sincere thanks to Dr. Deepak Gauraha, for providing the necessary literature and for his continuous support during the research work.

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REFERENCES

Akshay, M., Chandra, B. S., Devi, K. R. and Hari, Y. 2022. Genetic variability studies for yield and its attributes, quality and nutritional traits in rice (*Oryza sativa* L.). The Pharma Innovation Journal, 11(5): 167-172.

Bitew,J.M.,Mekbib,F.andAssefa,A.2018.Correlationcoefficientandpathanalysisamong yield and yield related traits in upland rice (*Oryza sativa* L.) and Oryza glaberrimaSteudgenotypesinNorthwesternEthiopia.InternationalJournalofPlantBreedingand Crop Science, 5(3): 429-436

Devi, K. R., Chandra, B. S., Lingaiah, N., Hari, Y. and Venkanna, V. 2017. Analysis of variabilityandpathcoefficientstudiesforyieldandqualitytraitsinrice(*Oryzasativa* L.). Agricultural Science Digest, 37(1): 1-9.

Devkota,S.,Raut,S.K.,Shrestha,S.andPoudel,U.2023.Geneticvariabilityforgrowth and yield traits in rice. Journal of Tikapur Multiple Campus, (6): 2382-5227.

Gupta,S.,Gauraha,D.,Sao,A.andChaudhary,P.R.2021.Assessmentofgeneticvariability, heritability and genetic advance in accessions of Rice (*Oryza sativa* L.). The Pharma Innovation, 10(6): 1231-1233.

Htwe,N.M.,Phyu,S.L.andThu,C.N.2019.Assessmentofgeneticvariabilityandcharacter association of Myanmar local rice (*Oryza sativa* L.) germplasm. Journal of Experimental Agriculture International, 40(3): 1-10.

Iqbal,T.,Majeed,A.,Khattak,S.I.,Ali,F.,Malik,S.N.,Ahmed,N.,Nauman,M.andAli,M. 2018.GeneticvariabilityandinterrelationshipstudiesinGreen SuperRice.Research in Plant Biology, (8): 37-41.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. 1955. Estimates of genetic and environmental variability in soybeans. Agronomy journal, 47(7), 314-318.

Ovung,C.Y.,Lal,G.M.andRai,P.K.2012.Studiesongeneticdiversityinrice(*Oryzasativa* L.).AgriculturalJournalTechnology,8(3):1059-1065.

Patel,J.K.,Patel,D.K.,Prajapati,K.N.,Soni,N.V.andPatel,A.2017.Correlationandpath coefficient analysis in rainfall upland rice (*Oryza sativa* L.).

Sabesan,T.,Suresh,R.andSaravanan,K.2009. Geneticvariabilityandcorrelation foryield and grain quality characters of rice grown in coastal saline low land of Tamilnadu. Electronic Journal of Plant Breeding, 1(1), 56-59.

Saha,S.R.,Hassan,L.,Haque,M.A.,Islam,M.M.andRasel,M.2019.Geneticvariability, heritability,correlationandpathanalysesofyieldcomponentsintraditionalrice

(*Oryzasativa*L.)landraces.JournaloftheBangladeshAgriculturalUniversity,17(1): 26-32.

Singh,A. K., Nandan, R. and Singh, P. K. 2015.Genetic variability and association analysis in rice germplasm under rainfed conditions. Crop Research., 47(1-3), 7 11.

Singh,T., Singh, P. K.,Yadav, R. K., Saxena, P. and Singh, S. 2024.Assessment of Genetic Variability Character Association of Yield Related Traits and Genetic Divergence Study in Rice (*Oryza Sativa* L.)". International Journal of Plant & Soil Science 36 (9):545-55.

Sivasankar, R., Suresh, B. G., Ashish, S. and Sudheer, T. R. 2018. Correlation and path coefficientanalysisinelitegermplasmofrice(*Oryzasativa*L.).InternationalJournal of Current Microbiology and Applied Sciences, 7(7): 3454-3459.

Tiwari, D. N., Tripathi, S. R., Tripathi, M. P., Khatri, N. and Bastola, B. R. 2019. Genetic variability and correlation coefficients of major traits in early maturing rice under rainfed lowland environments of Nepal.

Kurada Satya Rama Harika, Deepak Gauraha and Abhinav Sao (2023). Genetic Divergence and Character Association Studies on Germplasm Accessions of Rice (Oryza Sativa L.). Biological Forum – An International Journal, 15(8): 237-243.