The Pharma Innovation Journal 2022; 11(10): 195-200

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(10): 195-200

www.thepharmajournal.com
Received: 13-07-2022
Accepted: 29-08-2022

Kirtan Kumar
Section of Genetics and Plant Breeding, Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Shivendra Kumar Giri
Section of Genetics and Plant Breeding, Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Pratiksha Bhagat
Section of Genetics and Plant Breeding, Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

JK Tiwari
Section of Genetics and Plant Breeding, Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

SK Sinha
Section of Genetics and Plant Breeding, Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
SK Sinha
Section of Genetics and Plant Breeding, Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Genetic variability, correlation and path analysis in rice (*Oryza sativa* L.) Genotypes

Kirtan Kumar, Shivendra Kumar Giri, Pratiksha Bhagat, JK Tiwari and SK Sinha

Abstract
The experiment was conducted at the Instructional Farm, Section of G&PB, Rajmohini Devi College of Agriculture and Research Station, Ambikapur, IGKV Chhattisgarh. During *Kharif* season 2021-22 with a view to study the "Genetic variability, correlation and path analysis in rice (*Oryza sativa* L.) Genotypes". The 56 rice genotypes were grown in the field in Randomized Block Design (RBD) with three replications. In the present investigation findings, it may be concluded that significant genetic variability was recorded, the genotype R2032-87-1-23-1 was found to be the best for yield and yield contributing traits. Heritability was found to be maximum for plant height (96.12%) with genetic advance of 37.87 whereas PCV & GCV was recorded highest for number of unfilled grains/panicle (13.18 & 11.12 respectively). Association of correlation was recorded significant & positive correlation of grain yield with plant height, tillers per meter square, 1000 grain weight, panicle length, number of filled grains /panicle, biological yield and harvest index. Path analysis revealed that the maximum direct effect was recorded for harvest index, biological yield and 1000 grain weight.

Keywords: Correlation analysis, rice, path analysis, heritability, GCV, PCV, variability

1. Introduction
Rice is world's one of the most important staple food crops. It is grown in 115 countries in different parts of the world and provides staple food to more than half of the world's population. The genus *Oryza* has 24 species distributed throughout tropical and subtropical regions of all continents (Veasey *et al.*, 2004) [28]. The cultivated species of rice are *Oryza sativa* Linn and *Oryza glaberrima* Staud. *Oriza Sativa* originated from South-East Asia and is grown worldwide whereas *Oryza glaberrima* is grown solely in West Africa, its area of origin (Linares, 2002; Fageria & Baligar, 2003) [15, 4].
In India it is cultivated in 43.79 million ha with production of about 115.60 million tonnes and average productivity of 2578 kg/ha (Anonymous, 2018) [1]. Rice is major crop in Uttar Pradesh & is grown in an area of about 5.87 million ha with production of 12.51 million tonnes and productivity of 2131 kg/ha (Anonymous 2018) [1].
Chhattisgarh the central eastern state is also called as the "Rice bowl of India". The total estimated area of Rice in Chhattisgarh is 3.70 million ha, production is 4.89 million tonnes and productivity is 3002 kg/ha, in 2019-20 (Krishi Darshika, 2021). The Chhattisgarh and the adjoining areas of Orissa are considered to be the store house of vast genetic variability, where varietal pattern changes at every 250 hectares of land due to extreme variation in the agro and eco climatic conditions, seasons, topography, altitudes, soils and moisture stress factors, coupled with variation in the cultural heritage of the inhabitants (Richharia, 1979) [19].

2. Materials and Methods
The field experiment was conducted at the Instructional Farm, Section of G&PB, Raj Mohini Devi College of Agriculture and Research Station, Ambikapur, IGKV Chhattisgarh, situated at 23°12' N latitude, 83°20' E longitude and altitude of 623 meter above mean sea level.
The 56 genotypes of paddy were assessed in the field during wet season *kharif* 2021. The field trials were carried out under irrigated transplanted condition. The plant material was sown in a raised bed nursery and transplanted in the field after thirty-two days in Randomized Block Design (RBD) with three replications. Each entry was transplanted in five lines with 20 cm of spacing among row to row and 15 cm between plants to plant. Fertilizer dose @ of 80N: 50P: 30 K Kg per ha was applied.

The observations on quantitative and qualitative characters were recorded based on five randomly taken plants from each genotype for some observations and for other observations recorded on whole plot basis.

3. Results and Discussion

Data pertaining to analysis of variance, genetic parameters, correlation coefficient analysis and path coefficient analysis influenced by various genotypes has been given in table 1, 2, 3 & 4.

On the basis of the mean value of all the characters, the variance was calculated. The result revealed that there was significant difference among all the characters under study. The treatment differences were obtained significant for all the characters.

The magnitude of phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the traits. High GCV was recorded for number of unfilled grains/panicle 11.12 followed by plant height (cm) 8.66 and days to 80% maturity 8.04, whereas PCV was recorded higher for number of unfilled grains/panicle 13.18 followed by width of leaf blade (cm) 9.49 and plant height (cm) 8.83 respectively. The estimate of GCV was moderate for leaf length of blade (cm) 5.65, followed by harvest index (%) 5.38 and tillers per meter square 5.32, whereas PCV was moderate for 1000 grain weight (g) 4.94 followed by days to 50% flowering 2.77. The least GCV & PCV was observed for biological yield (q/ha) 0.94 and panicle length (cm) 1.33 respectively. High difference between the genotypic (GCV) and PCV were observed for most of the traits. Sharma and Sharma (2007) [23], Kole *et al*. (2008) [10], Gideon and Dennis (2016) and Khan *et al*. (2009) all reported similar findings.

The estimates of the heritability for 13 qualitative characters ranged from 27.35% to 96.12%. The highest heritability (broad sense) was observed in plant height (cm) (96.12), number of filled grains /panicle (90.11), days to 50% flowering (88.93), days to 80% maturity (86.96), number of unfilled grains /panicle (71.19) and panicle length (cm) (71.12) characters. Similar results have been reported by Jaiswal *et al.* (2007) [6], Sreedhar (2017) [24] and Nandeshwar *et al*. (2010) [17], high heritability (broad sense) for yield per plant and number of grains per panicle.

The strongly influenced genetic advance was reported for the attributes, plant height (cm) (37.87), followed by number of filled grains /panicle (24.11), days to 80% maturity (15.80), days to 50% flowering (5.61), number of unfilled grains /panicle (3.66), leaf length of blade (cm) (2.80), panicle length (cm) (2.79), grain yield (q/ha) (2.67), harvest index (%)(2.59), tillers per meter square (1.68), biological yield (q/ha) (1.30), 1000 grain weight (g) (0.62) and width of leaf blade (cm) (0.12). Similar findings were reported by Jaiswal *et al.* (2007) [6], Nandeshwar *et al*. (2010) [17], Sanjiv Kumar *et al.* (2012) [20] and Kumar *et al.* (2012) [12].

Correlation coefficient analysis of days to 50% flowering was found positive and highly significant correlation with days to 80% maturity (0.245) and number of unfilled grains per panicle (0.348). Days to 80% maturity was found highly significant and positive correlation with days to 50% flowering (0.245) and 1000 grain weight (g) (0.217). Archana Devi *et al.* (2017) [2], Maurya *et al.*, (2018) [16], and Khalid *et al*. (2012) [7] all observed similar results (2001).

Plant height was found highly significant and in positive correlation with tillers per meter square (0.391), panicle length (cm) (0.530), width of leaf blade (cm) (0.230), number of filled grains per panicle (0.416), biological yield (q/ha) (0.530), harvest index (%) (0.163) and grain yield (q/ha) (0.360). Tillers per meter square was found highly significant and in positive correlation with plant height (cm) (0.391), panicle length (cm) (0.458), number of filled grains per panicle (0.291), biological yield (q/ha) (0.637), harvest index (%) (0.406) and grain yield (q/ha) (0.582). Similar results were reported by Archana Devi *et al.* (2017) [2], Varthini *et al.* (2014) [27], Maurya *et al.*, (2018) [16] and Tripathi *et al.* (2018).

1000 grain weight (g) was found highly significant and in positive correlation with days to 80% maturity (0.217), leaf length of blade (cm) (0.176), harvest index (%) (0.366) and grain yield (q/ha) (0.254). Panicle length (cm) was found highly significant and positive correlation with plant height (cm) (0.530), tillers per meter square (0.458), number of filled grains per panicle (0.343), biological yield (q/ha) (0.573), harvest index (%) (0.158) and grain yield (q/ha) (0.374). Upadhayay and Jaiswal (2015) [15], Kishore *et al.* (2015) [9], Kumar *et al.*, (2016) [11], Lingaraja *et al*. (2015) [14] and Maurya *et al.*, (2018) [16] all reported similar findings.

Leaf length of blade (cm) was found highly significant and in positive correlation with 1000 grain weight (g) (0.176) and number of unfilled grains per panicle (0.198). Width of leaf blade (cm) was found highly significant and positive correlation with plant height (cm) (0.230) and panicle length (cm) (0.388). Similar results were reported by Upadhayay and Jaiswal (2015) [15], Maurya *et al.*, (2018) [16], Sravan *et al.* (2012) and Khalid *et al*. (2012) [7].

Number of filled grains per panicle was found highly significant and in positive correlation with plant height (cm) (0.416), tillers per meter square (0.291) panicle length (cm) (0.343), number of unfilled grains per panicle (0.219), biological yield (q/ha) (0.486) and grain yield (q/ha) (0.305). Number of unfilled grains per panicle was found highly significant and positively correlated with days to 50% flowering (0.348), plant height (cm) (0.194), leaf length of blade (cm) (0.198), number of filled grains /panicle (0.219), biological yield (q/ha) (0.213) and grain yield (q/ha) (0.175). Similar results were reported by Maurya *et al.*, (2018) [16], Tripathi *et al.* (2018), Lingaraja *et al*. (2015) [14], Krantikumar *et al.* (2015) [13], Khalid *et al*. (2012) [7] and Nikhil *et al.* (2014) [18].

Biological yield (q/ha) was found highly significant and positively correlated with plant height (cm) (0.530), tillers per meter square (0.637), panicle length (cm) (0.573), number of unfilled grains /panicle (0.213), harvest index (%) (0.444) and grain yield (q/ha) (0.770). Harvest index (%) was found highly significant and in positive correlation with plant height (cm) (0.163), tillers per meter square (0.406), 1000 grain weight (g) (0.366), panicle length (cm) (0.158), biological yield (q/ha) (0.444) and grain yield (q/ha) (0.913). Grain yield (q/ha) was found highly significant and positive correlation with plant height (cm) (0.360), tillers per meter square (0.582), 1000 grain weight (g) (0.254), number of unfilled grains /panicle (0.175), biological yield (q/ha) (0.770) and harvest index (%) (0.913).

Path analysis revealed that the maximum direct effect of days to 50% flowering on the grain yield (q/ha) was highly positive (0.00473). Its indirect effect through number of unfilled grains per panicle (0.00135) and biological yield (q/ha) (0.00115) were positive. Days to 80% maturity had negative direct effect (-0.00918) with grain yield (q/ha). The indirect

positive effect through days to 50% flowering (0.00116), 1000 grain weight (g) (0.00167) and Number of filled grains per panicle (0.00012).

Plant height had positive direct effect (0.00689) with grain yield (q/ha). The indirect effect through days to 80% maturity (0.00004), tillers per meter square (0.00291) and panicle length (cm) (0.00119). The direct effect of tillers per meter square was positive (0.00743) with grain yield (q/ha). The indirect effect was positive from characters, days to 80% maturity (0.00203), plant height (cm) (0.00270) and 1000 grain weight (g) (0.00065).

1000 grain weight (g) had positive direct effect (0.00772) with grain yield (q/ha). The indirect effect through tillers per meter square (0.00063) and harvest index (%) (0.25913) was positive. Panicle length (cm) had positive direct effect (0.00225) with grain yield (q/ha). The indirect effect through days to 80% maturity (0.00162), plant height (cm) (0.00365) and tillers per meter square (0.00340). Leaf length of blade (cm) had highly negative direct effect (-0.00457) with grain yield (q/ha). The indirect effect was positive from characters, days to 50% flowering (0.00020), 1000 grain weight (g) (0.00136) and panicle length (cm) (0.00026). Width of leaf blade (cm) had positive direct effect (0.00055) with grain yield (q/ha). The indirect effect through days to 80% maturity (0.00083), plant height (cm) (0.00158), tillers per meter square (0.00082) and panicle length (cm) (0.00087).

Number of filled grains per panicle had positive direct effect (0.00225) with grain yield (q/ha). The indirect effect through plant height (cm) (0.00286), tillers per meter square (0.00216) and panicle length (cm) (0.00077). Number of unfilled grains per panicle had positive direct effect (0.00388) with grain yield (q/ha). The indirect effect was positive from characters, days to 50% flowering (0.00164) and days to 80% maturity (0.00121). Biological yield (q/ha) had highly positive direct effect (0.44057) with grain yield (q/ha). The indirect effect was positive from characters days to 50% flowering (0.00001), days to 80% maturity (0.00282) and plant height (cm) (0.00365). Harvest index (%) had highly positive direct effect (0.70816) with grain yield (q/ha). The indirect effect was positive for characters- days to 80% maturity (0.00108) and plant height (cm) (0.00113). Similar findings have been reported by Edukondalu *et al.* (2017) [3] and Selvaraj *et al.* (2011) [22].

Table 1: Analysis of variance for Grain Yield parameters and its attributing traits in Rice genotypes

S. No.	Characters	Mean Sum of Square		
		Replication	Treatment	Error
	Degree of Freedom	2	55	110
1	Days to 50% flowering	0.15	26.10*	1.04
2	Days to 80% maturity	1.01	8.79**	1.05
3	Plant Height (cm)	38.84	218.70**	8.58
4	Tillers per meter square	79.51	1067.22**	15.14
5	1000 grain weight (g)	1.04	6.20**	1.78
6	Panicle length (cm)	0.49	2.97**	0.42
7	Leaf length of blade (cm)	1.77	12.75**	2.72
8	Width of leaf blade (cm)	0.067	0.037**	0.011
9	Number of filled grains per panicle	22.26	472.31**	13.75
10	Number of unfilled grains per panicle	1.60	15.10**	1.80
11	Biological yield (q/ha)	9.77	31.02**	1.74
12	Harvest index (%)	0.19	7.11**	1.17
13	Grain yield (q/ha)	2.17	15.21**	1.24

*, ** significant at 5% and 1% level, respectively

Table 2: Genetic parameters of variability for yield and attributes traits in rice

S. No.	Genotypes	Mean	Range		Heritability (%)	GA	GA as % of mean	GCV (%)	PCV (%)
			Min	Max					
1	Days to 50% flowering	110.52	103.00	118.00	88.93	5.61	5.08	2.61	2.77
2	Days to 80% maturity	102.27	86.60	118.87	86.96	15.80	15.45	8.04	8.63
3	Plant Height (cm)	216.54	192.00	266.67	96.12	37.87	17.49	8.66	8.83
4	Tillers per meter square	22.82	20.20	25.63	45.29	1.68	7.37	5.32	7.90
5	1000 grain weight (g)	22.16	20.73	24.00	27.35	0.62	2.78	2.58	4.94
6	Panicle length (cm)	143.42	139.00	148.00	71.12	2.79	1.95	1.12	1.33
7	Leaf length of blade (cm)	32.35	28.20	36.67	55.18	2.80	8.65	5.65	7.61
8	Width of leaf blade (cm)	1.49	1.30	1.73	42.36	0.12	8.28	6.18	9.49
9	Number of filled grains /panicle	174.92	146.00	196.00	90.11	24.11	13.78	7.05	7.42
10	Number of unfilled grains /panicle	18.94	13.33	22.67	71.19	3.66	19.33	11.12	13.18
11	Biological yield (q/ha)	107.85	106.00	112.00	38.48	1.30	1.20	0.94	1.52
12	Harvest index (%)	31.29	26.60	35.59	55.96	2.59	8.29	5.38	7.19
13	Grain yield (q/ha)	33.73	28.53	38.55	55.68	2.67	7.92	5.15	6.90

Table 3: Genotypic correlation coefficients between different traits in rice genotypes

S. No.	Characters	Days to 50% flowering	Days to 80% maturity	Plant Height (cm)	Tillers per meter square	1000 grain weight (g)	Panicle length (cm)	Leaf length of blade (cm)	Width of leaf blade (cm)	Number of filled grains per panicle	Number of unfilled grains per panicle	Biological yield (q/ha)	Harvest index (%)	Grain yield (q/ha)
1	Days to 50% flowering	1.000	0.245**	-0.100	-0.164*	-0.209**	-0.118	0.043	-0.067	-0.032	0.348**	0.003	-0.119	-0.083
2	Days to 80% maturity		1.000	-0.005	-0.221**	0.217**	-0.177*	0.135	-0.090	0.053	-0.131	-0.307**	-0.118	-0.228**
3	Plant Height (cm)			1.000	0.391**	-0.205**	0.530**	-0.067	0.230**	0.416**	0.194*	0.530**	0.163*	0.360**
4	Tillers per meter square				1.000	0.084	0.458**	-0.162*	0.111	0.291**	-0.083	0.637**	0.406**	0.582**
5	1000 grain weight (g)					1.000	-0.121	0.176*	-0.054	-0.088	-0.308**	-0.014	0.366**	0.254**
6	Panicle length (cm)						1.000	0.115	0.388**	0.343**	0.043	0.573**	0.158*	0.374**
7	Leaf length of blade (cm)							1.000	0.138	0.140	0.198*	-0.171*	-0.207**	-0.226**
8	Width of leaf blade (cm)								1.000	0.002	-0.075	0.096	-0.119	-0.039
9	Number of filled grains /panicle									1.000	0.219**	0.486**	0.119	0.305**
10	Number of unfilled grains /panicle										1.000	0.213**	0.107	0.175*
11	Biological yield (q/ha)											1.000	0.444**	0.770**
12	Harvest index (%)												1.000	0.913**
13	Grain yield (q/ha)													1.000

Table 4: Estimates of path coefficient (direct and indirect effect) for various traits on grain yield (q/ha) in rice genotype

S. No.	Characters	Days to 50% flowering	Days to 80% maturity	Plant Height (cm)	Tillers per meter square	1000 grain weight (g)	Panicle length (cm)	Leaf length of blade (cm)	Width of leaf blade (cm)	Number of filled grains per panicle	Number of unfilled grains per panicle	Biological yield (q/ha)	Harvest index (%)	Grain yield (q/ha)
1	Days to 50% flowering	0.00473	-0.00225	-0.00069	-0.00122	-0.00161	-0.00027	-0.00020	-0.00004	-0.00007	0.00135	0.00115	-0.08420	-0.083
2	Days to 80% maturity	0.00116	-0.00918	-0.00003	-0.00164	0.00167	-0.00040	-0.00062	-0.00005	0.00012	-0.00051	-0.13504	-0.08359	-0.228**
3	Plant Height (cm)	-0.00047	0.00004	0.00689	0.00291	-0.00159	0.00119	0.00031	0.00013	0.00094	0.00075	0.23359	0.11571	0.360**
4	Tillers per meter square	-0.00077	0.00203	0.00270	0.00743	0.00065	0.00103	0.00074	0.00006	0.00066	-0.00032	0.28074	0.28729	0.582**
5	1000 grain weight (g)	-0.00099	-0.00199	-0.00141	0.00063	0.00772	-0.00027	-0.00080	-0.00003	-0.00020	-0.00120	-0.00613	0.25913	0.254**
6	Panicle length (cm)	-0.00056	0.00162	0.00365	0.00340	-0.00093	0.00225	-0.00053	0.00021	0.00077	0.00017	0.25238	0.11192	0.374**
7	Leaf length of blade (cm)	0.00020	-0.00124	-0.00046	-0.00121	0.00136	0.00026	-0.00457	0.00008	0.00031	0.00077	-0.07555	-0.14639	-0.226**
8	Width of leaf blade (cm)	-0.00032	0.00083	0.00158	0.00082	-0.00042	0.00087	-0.00063	0.00055	0.00000	-0.00029	0.04246	-0.08426	-0.039
9	Number of filled grains /panicle	-0.00015	-0.00049	0.00286	0.00216	-0.00068	0.00077	-0.00064	0.00000	0.00225	0.00085	0.21422	0.08415	0.305**
10	Number of unfilled grains /panicle	0.00164	0.00121	0.00133	-0.00062	-0.00238	0.00010	-0.00091	-0.00004	0.00049	0.00388	0.09392	0.07610	0.175*
11	Biological yield (q/ha)	0.00001	0.00282	0.00365	0.00473	-0.00011	0.00129	0.00078	0.00005	0.00109	0.00083	0.44057	0.31474	0.770**
12	Harvest index (%)	-0.00056	0.00108	0.00113	0.00301	0.00283	0.00036	0.00094	-0.00007	0.00027	0.00042	0.19581	0.70816	0.913**

Residual = 0.00050

*, ** significant at 5% and 1% level, respectively

4. Conclusion

From the present investigation findings, it may be concluded that significant genetic variability was recorded for all the characters under study. The genotype R2032-87-1-23-1 was found to be the best for yield and yield contributing traits.

The high heritability was observed in plant height (cm), number of filled grains/panicle, days to 50% flowering, days to 80% maturity, number of unfilled grains/panicle and panicle length (cm) characters. The genetic advance was recorded high for plant height and number of filled grains/panicle.

Association of correlation recorded significant & positive correlation of grain yield q/ha with plant height (cm), tillers per meter square, 1000 grain weight (g), panicle length (cm), number of filled grains/panicle, biological yield (q/ha) and harvest index (%). Path analysis revealed that the maximum direct effect was recorded harvest index (%), biological yield (q/ha) and 1000 grain weight (g).

5. References

1. Anonymous. Ministry of Agriculture & Farmers Welfare, Department of Agriculture Cooperation & Farmers Welfare, Directorate of Economics & Statistics Indian Agricultural Statistics at a Glance; c2018. p. 87-89.
2. Archana Devi, Preeti Kumari, Ranjan Dwivedi, Saket Dwivedi, Verma OP, *et al*. Studies on heterosis and combining ability in rice (*Oryza sativa* L.) for morpho-physiological traits under normal and saline conditions. International Journal of Current Microbiology and Applied Sciences. 2017;6(8):1558-1571.
3. Edukondalu B, Ram Reddy V, Shobha Rani T, Aruna Kumari, Soundharya B. Studies on variability, heritability, correlation and path analysis for yield, yield attributes in rice (*Oryza sativa* L.). International Journal of Current Microbilogy and Applied Sciences. 2017;6(10):2369-2376.
4. Fageria NK, Baligar VC. Upland rice and allelopathy. Commun. Soil Sci. Plant Anal. Germplasm: conservation, evaluation and utilization. In: Singh RK, Singh in the Loss of Seed Dormancy during After- ripening of Wild and Cultivated Rice; 2003.
5. Gideon I, Dennis U. Genetic variability and heritability of yield and yield components in rice genotypes. Global Journal of Plant Breeding and Genetics. 2016;3(6):215-220.
6. Jaiswal HK, Srivastava AK, Dey A. Variability and association studies in indigenous aromatic rice (*Oryza sativa* L.). *Oryza.* 2007;44(4):351-353.
7. Khalid AO, Ahmed MM, Farhan A, Zheng Y, Qiu F. Genetic variability for yield and related attributes of upland rice genotypes in semi-arid zone (Sudan). African J Agric. Res. 2012;7(33):4613-4619.
8. Khan AS, Muhammad I, Muhammad A. Estimation of genetic variability and correlation for grain yield components in rice (*Oryza sativa* L.). American-Eurasian J Agri. & Env. Sci., 2009;6(5):585-590.
9. Kishore NS, Srinivas T, Nagabhushanam U, Pallavi M, Sameera SK. Genetic variability, correlation and path analysis for yield and yield components in promising rice (*Oryza sativa* L.) genotypes. SAARC Journal of Agriculture. 2015;13(1):99-108.
10. Kole PC, Chakraborty NR, Bhat JS. Analysis of variability, correlation and path coefficients in induced mutants of aromatic non-basmati rice. Trop. Agric. Res. Ext. 2008;11:60-64.
11. Kumar V, Rastogi NK, Sarawgi AK, Chandraker PK, Jena BK. Agro-morphological and quality characterization of indigenous and exotic Aromatic rice (*Oryza sativa* L.) germplasm. J Appl. Nat. Sci. 2016;8(1):314-320.
12. Kumar S, Singh D, Satyendra AS, Kant S, Kumar A, Pal K, Kumar M. Variability, heritability and genetic advance in rice (*Oiyza sativa* L.) under aerobic condition. Env. & Eco. 2012;30(4):1374-1377.
13. Krantikumar, Patil H, Lekha RC. Genetic variability and character association in rainfed upland rice (*Oryza sativa* L.). The Ecosan. 2015;9(3&4):911-915.
14. Lingaraja L, Mohammad S, Sriharsha V, Suresh B. Estimation of genetic variability, direct and indirect effects of yield contributing traits ongrain yield in aerobic rice (*Oryza sativa* L.) germplasm. The Ecoscan. 2015;9(2):357-361.
15. Linares OF. African rice (*Oryza glaberrima*): History and future potential. 2002;99(25):16360-16365.
16. Maurya V, Prasad R, Meena S, Bisen P, Loitongbam B, Rathi SR, *et al*. Assessment of genetic variability, correlation and path analysis for yield and yield related traits in Rice (*Oryza sativa* L.). IJAEB; c2018. p. 935-940.
17. Nandeshwar BC, Pal S, Senapati BK, De DK. Genetic variability and character association among biometrical traits in F2 generation of somerice crosses. Elec. J Pl. Breeding. 2010;1(4):758-763.
18. Nikhil BSK, Rangare NR, Saidaiah P. Correlation and path analysis in rice (*Oryza sativa* L.). International Journal of Tropical Agriculture. 2014;32(1/2):1-5.
19. Richharia RH. An aspect of genetic diversity in rice [India] [1979]. Central Rice Research Inst., Cuttack (India). 1979;16(1):1-31.
20. Sanjiv Kumar, Devi Singh, Satyendra, Anil Sirohi, Shashi Kant, Anil Kumar, *et al*. Variability, Heritability and Genetic Advance in Rice (*Oryza sativa* L.) Under Aerobic Condition. Environment & Ecology. 2012;30(4):1374-1377.
21. Saravan T, Rangare NR, Suresh BG, Ramesh Kumar S. Genetic variability and character association in rainfed upland rice (*Oryza sativa* L.). J Rice Res. 2012;5(1& 2):24-29.
22. Selvaraj I, Nagarajan P, Thiyagarajan, Bharathi M, Rabindran R. Genetic parameters of variability, correlation and path coefficient studies for grain yield and other yield attributes among rice blast disease resistant genotypes of rice (*Oryza sativa* L.). African Journal of Biotechnology. 2011;10(17):3322-3334.
23. Sharma AK, Sharma RN. Genetic Variability and Character association in early maturing rice. *Oryza*. 2007;44(4):300-303.
24. Sreedhar S. Studies on variability, heritability, genetic advance and divergence for yield and yield components in various maturity and grain type groups of rice (*Oryza sativa* L.) genotypes. Bulletin of Environment, Pharmacology and Life Sciences. 2017;6(1):467-474.
25. Tripathi N, Verma OP, Singh PK, Rajpoot P. Studies on genetic variability, heritability and genetic advance in rice (*Oryza sativa* L.) for yield and its components under salt affected soil. International Journal of Current

Microbiology and Applied Sciences. 2018;7:5316-5324.
26. Upadhayay MN, Jaiswal HK. Combining ability analysis for yield and earliness in hybrid rice (*Oryza sativa* L.). Asian Journal of Crop Science. 2015;7(1):81-86.
27. Varthini VN, Robin S, Sudhakar D, Raveendran M, Rajeshwari S, Manonmani S. Evaluation of rice genetic diversity and variability in a population panel by principal component analysis. Indian J of Sci. Tech. 2014;7(10):1555–1562.
28. Veasey EA, Karasawa MG, Santos PP, Rosa MS, Mamani E, Oliveira GCX. Variation in the Loss of Seed Dormancy during After-ripening of Wild and Cultivated Rice Species. Annals of Botany. 2004;94(6):875-882.