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SELECTION CRITERIA, YIELD RELATIONSHIP WITH COMPONENT TRAITS AND GROUPING OF RICE (*ORYZA SATIVA* L.) GENOTYPES

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Abstract

An investigation was carried with 50 genotypes of rice to study the correlation and path analysis for 9 character namely 50% flowering, Plant height, Number of tillers per plant, Number of panicles per plant,Panicle length, Number of grains per panicle, Grain L/B ratio,Hundred grain weight and Grain yield per plant. The analysis of variance mean sum of square due to genotypes showed significant difference for all nine character under study, suggesting that the genotypes selected for the present study were genetically divergent. The genotypic correlation coefficient showed higher magnitude and phenotypic correlation coefficient which indicated masking or modifying effect of environment. The genetic correlation revealed that grain yield per plant had strong positive and significant association with number of tillers per plant Number of panicles per plant and panicle length at both genotypic and phenotypic levels. Path analysis revealed that maximum direct effect on grain yield was exerted by number of tillers per plant, panicle length and grain L/B ratio. Hence, these traits should be taken in account of breeding programme to develop the maximum of threshold yield obtaining new rice varieties or hybrids.

Key words: Correlation, Path analysis, Rice

Introduction

Rice (*Oryza sativa* L.) is the major food crop of more than half of the global population and will continue to occupy the pivotal place in global food and livelihood security systems. Grain yield in rice is a quantitatively inherited traits and involves function of several components. Selection of superior genotypes based on yield is difficult due to the integrated structure of plant in which the component characters are interdependent and are governed by a large number of genes. An idea on the extent of association between traits conferring higher yield will be much helpful to decide upon the traits to be given importance in selection process. A positive association between traits warrants the simultaneous improvement of both the traits while restricting selection to any one of the associated traits. On the other hand, a negative relationship between two traits during selection. At genetic level, a positive correlation occurs due to coupling phase of linkage and negative correlation arises due to repulsion phase of linkage of genes controlling two different traits (Nadarajan and Gunasekaren 2008). Path analysis has been used to organize the relationship between predictor variables and response variables. The advantage of path analysis is that it permits the partitioning of the correlation coefficient into its components-one component being the path coefficient (or standardized partial regression coefficient) that measures the direct effect of a predictor variable upon its response variables, the second component being the indirect effects (s) of a predictor variable on the response variable through other predictor variables (Deway and Lu 1959). Path coefficient analysis assists plant breeders in identifying traits on which selection pressure should be given for improving yield.With these points in view, the present investigation was framed to study the relationship between yield related traits under upland rice ecosystem.

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Materials and Methods

The present investigation was conducted at the Plant Breeding Farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu, India during the year 2017 – 2019. The experimental materials for this genetic divergence study comprised of 50 rice genotypes collected from various places. The details of the materials are presented in Table 1.

Seeds of the 50 genotypes were sown in raised nursery beds during February, 2018. In each genotype, one seedling per hill was transplanted in the main field after 25 days with spacing of 20 cm × 20 cm. These genotypes were grown in saline soil with electrical conductivity (EC) of 3.83 dSm-1. The experiments were conducted at the Experimental Farm of Plant Breeding (11°24' N latitude and 79° 44' E longitude, + 5.79 MSL), Annamalai University, Tamil Nadu, India. The experiment was carried out in a Randomized Block Design with three replications. As recommended, agronomic and plant protection measures were followed during the crop period. A uniform population of 12 plants in a row was maintained.

Eleven productive and quality characters were recorded on single plant basis in ten randomly selected plants of each genotype per replication. The mean data were utilized for the statistical studies. The following were the agronomic and quality characters studied for D^2 analysis.The observations were recorded for days to 50% flowering, Plant height, Number of tillers per plant, Number of panicles per plant, Panicle length, Number of grains per panicle,Grain L/B ratio, Hundred grain weight and Grain yield per plant. Mean data were used for statistical analysis. Correlation coefficient at the genotypic and phenotypic level was computed from the variance and covariance as suggested by Aljibouri et al 1958). Path coefficient analysis suggested by wright (1921) and Dewey and Lu (1959).

Results and Discussion

Selection based on the detailed knowledge of magnitude and direction of association between yield and its attributes is very important in identifying the key characters, which can be exploited for crop improvement through suitable breeding programme.

Days to 50% flowering had significant positive association with plant height, panicle length, both phenotypic and genotypic levels. It also had significant positive association with number of tillers per plant at genotypic level. All other characters recorded non-significant association with days to 50% flowering. Plant height had significant positive association with number of tillers per plant, number of panicles per plant, panicle length at both phenotypic and genotypic levels. It also had significant positive association with grain L/B ratio at genotypic level. It had non-significant association with the other traits (Table^2).

Number of tillers per plant had significant positive association with number of panicles per plant, panicle length, hundred grain weight, grain yield per plant at both phenotypic and genotypic level whereas non significant association with other traits. Number of panicles per plant had positive significant association with panicle length, grain yield per plant at both phenotypic and genotypic levels. It also had significant positive association with hundred grain weight at genotypic level. It had non-significant association with other traits.

Panicle length had significant positive association with grain yield per plant at both phenotypic and genotypic level. It also had significant positive association with hundred grain weight at genotypic level. All the other characters recorded non-significant association with panicle length. Number of grains per panicle had positive significant association with grain yield per plant at genotypic level. For the remaining traits, it had non-significant association at both phenotypic and genotypic levels. Grain L/B ratio had significant positive association with hundred grain weight at genotypic levels. All other characters recorded non-significant association lower values with grain L/B ratio. All the characters recorded non-significant association with hundred grain weight at both phenotypic and genotypic levels.

Grain yield per plant recorded significant positive association with number of tillers per plant, number of panicles per plant, panicle length, grain yield per plant, at both phenotypic and genotypic levels. It also significant positive association with number of grains per panicle at genotypic level. Other than that, grain yield per plant had non-significant association with days to 50% flowering, plant height, grain L/B ratio, hundred grain weight both phenotypic and genotypic level. Grain yield per plant had non-significant association with number of grains per panicle at phenotypic level.

In the present study path coefficient analysis has been conducted taking grain yield per plant and head rice recovery percentage as dependent variables. In the direct effect, traits such as number of tillers per plant, panicle length, grain L/B ratio, had very high positive direct effect. Characters like number of panicles per plant, hundred grain weight, plant height, number of grain per panicle and days to 50% flowering had negative very high direct effect on grain yield per plant.

Indirect effects

Days to 50% flowering: Days of 50% flowering had very high positive indirect effect via., panicle length (5.68), number of tillers per plant (4.80). High positive indirect effect via grain L/B ratio (0.56). The character had very high negative indirect effect via, plant height (-5.56), number of panicles per plant (-1.78), days to 50% flowering (-1.72), hundred grain weight (-1.61). It has high negative indirect effect via., number of grains per panicle (-0.38) (Table 4).

Plant height: The indirect effect of plant height character via panicle length (7.12), number of tillers per plant (5.00), grain L/B ratio (1.73) was found to be very high positive indirect effect on grain yield. This trait has high positive indirect effect on number of grains per panicle (0.38). It has low

positive indirect effect on grain yield per plant via., hundred grain weight (0.17). The character had very high negative indirect effect on grain yield through plant height (-10.03), number of panicles per plant (-3.27). It also has high negative indirect effect via days to 50% flowering (-0.95).

Number of tillers per plant: This character had very high positive indirect effect on grain yield via number of tillers per plant (15.37), panicle length (4.79). This character had very high negative indirect effect on grain yield through number of panicles per plant (-10.47), hundred grain weight (-4.91), plant height (-3.26). High negative indirect effect of days to 50% flowering (-0.53), grain L/B ratio (-0.34). Moderate negative indirect effect on grain yield through number of grains per panicle (-0.20).

Number of panicles per plant: Number of panicles per plant had very high positive indirect effect on grain yield *via* number of tillers per plant (14.33), panicle length (4.94). The character had very high negative indirect effect *via* number of panicles per plant (-11.23), hundred grain weight (-3.80), plant height (-2.92). High negative indirect effect *via* grain L/B ratio (-0.40). Moderate negative indirect effect *via* days to 50% flowering (-0.27). Low negative indirect effect *via* number of grains per panicle (-0.18).

Panicle length: Panicle length had very high positive indirect effect on grain yield *via* panicle length (9.10), number of tillers per plant (8.09), grain L/B ratio (1.47). The character had very high negative indirect effect *via* plant height (-7.84), number of panicles per plant (-6.09), hundred grain weight (-3.06) and days to 50% flowering (-1.07). High negative indirect effect *via* number of grains per panicle (-0.31).

Number of grains per panicle: Number of grains per panicle had very high positive indirect effect on grain yield *via* plant height (1.46), number of tillers per plant (1.20), panicle length (1.09). High positive indirect effect *via* grain L/B ratio (0.74). The character had very high negative indirect effect *via* number of grains per panicle (-2.63). High negative indirect effect *via* number of panicles per plant (-0.79), hundred grain weight (-0.57).Moderate negative indirect effect via days to 50% flowering (-0.25).

Grain L/B Ratio: It had very high positive indirect effect on grain yield per plant via grain L/B ratio (6.80), panicle length (1.97), high positive indirect effect *via* number of panicles per plant (0.66). The character had very high negative indirect effect of hundred grain yield (-5.51), plant height (-2.56). High negative indirect effect of number of tillers per plant (-0.78), moderate negative indirect effect of number of grains per panicle (-0.28), low negative indirect effect of days to 50% flowering.

Hundred grain weight: Hundred grain weight had very high positive indirect effect on grain yield per plant via number of tillers per plant (7.72), grain L/B ratio (3.84) and panicle length (2.85). This character had low positive indirect effect *via* plant height (0.18). It had indirect negligible positive effect on grain yield per plant. This character had very high negative indirect effect *via* hundred grain weight (-9.77), number of panicles per plant (-4.37). It had indirect moderate negative effect of days to 50% flowering (-0.28), low negative indirect effect *via* number of grains per panicle (-0.15).

Analysis of variance revealed significant differences for all the characters in respect of the genotypes under present study (Table 2) indicating the presence of considerable amount of variability among the genotypes. Similar findings were reported by Bhati *et al*. (2015), Srinivas *et al*. (2015), Kumar (2015), Chamundeswari (2016), Chandramohan *et al*. (2016) and Toshimenla *et al*. (2016).

Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement in yield. Grain yield is a complex character and is the end product of various traits. Therefore, knowledge regarding the correlation of grain yield with other component characters is valuable for understanding the correlated response to selection for yield while selecting the suitable plant type, correlation studies would provide reliable information in nature, extent and the direction of selection, especially when the breeder needs to combine high yield potentials with desirable agronomic traits and quality characters.

A positive value of correlations shows that the changes of two variables are in the same direction i.e. high value of one variable are associated with high values of the other and vice-versa. The breeder is always concerned for the selection of superior genotypes on the basis of phenotypic expression. However, for the quantitative characters, genotypes are influenced by environment, thereby affecting the phenotypic expression. Information regarding the nature and extent of association of morphological characters would be helpful in developing suitable plant type, in addition to the improvement of yield, a complex character for which direct selection is not effective.

In general, the genotypic and the phenotypic correlation coefficients showed similar trend but genotypic correlation coefficients were of higher in magnitude than the correlation phenotypic correlation coefficients which might be due to marking or modifying effect of environment (Singh, 1980).

In present investigation, number of tillers per plant had the maximum correlations among all the characters studied for correlation coefficients. It had positive and significant correlation with number of panicles per plant, number of grains per panicle, panicle length, hundred weight, grain L/B ratio and grain yield per plant. Similar reports were reported by Vijay Kumar (2015) for significant and positive

correlations in panicle length at phenotypic level, Thippeswamy *et al*. (2016) for positive significant correlation in panicle length and number of grains per panicle (Table 3).

Also, days to 50% flowering had positive significant correlation with plant height and negative significant correlation with grain yield per plant at genotypic and phenotypic levels. The results clearly indicated that long duration genotypes would be tall yet contribute less grain yield. Similar result was reported by Mohan *et al*. (2015) and Thippeswamy *et al*. (2016) reported that days to 50% flowering had positive significant correlation with plant height at both levels.

Information obtained from correlation study does not give comprehensive idea about the contributions of each component characters because if relationship is due to multiple effect of gene (s) it is difficult to separate these effects by selecting particular character. Therefore, it is important to establish the genetic basis of correlation. Path coefficient analysis is helpful to recognize direct and indirect causes of correlation and also enables us to compare the causal factors on the genetic basis of their relative contributions. Shrivastava and Sharma (1976) suggested that only direct yield components should be used for path analysis.

Genotypic estimates were used in path coefficient analysis (using formula given by Dewey and Lu) in order to determine direct and indirect effects of traits on yield. Yield per plant was considered as the resultant variables and others as casual variables. When characters having direct bearing on yield are selected, their associations with other characters are to be considered simultaneously as this will indirectly affect yield.Path coefficient analysis allows separating the direct and indirect effects through other contributes by apportioning the correlations (Wright, 1921) for better interpretation of cause and effect relationship. The results clearly showed significant difference in genotypic and phenotypic direct and indirect effects, indicating the predominance of environmental influence in expression of the traits.

In the present investigation, the residual effect was 0.912 (Table 4). Perusal of results obtained in path analysis revealed that very high direct effect on grain yield was exhibited by number of tillers per plant, panicle length and grain L/B ratio. Similar result was reported by Ravindra Babu *et al.* (2012) whereas contrary reports were given by Thippeswamy et al. (2016), Mohan *et al.* (2015), Yadav *et al.* (2011) and Akhtar *et al.* (2011).The trait, number of panicle per plant, plant height, hundred grain weight, number of grains per panicle, days to 50% flowering had very high negative direct effect on grain yield per plant. Similar report was given by Mohan *et al.* (2015), Rajamadhan *et al.* (2011) and Akhtar *et al.* (2011). In addition to the direct effect, indirect effect of days to 50% flowering via panicle length and number of tiller per plant was very high and positive while grain L/B ratio was high and positive on grain yield per plant was observed. Similar finding was reported by Yadav *et al*. (2011).Very high positive indirect effect was observed by plant height through panicle length, number of tillers per plant and grain L/B ratio while number of grains per panicle was high and positive on grain yield per plant was observed. But Ravindra Babu *et al*. (2012) and Yadav *et al*. (2011) reported positive low indirect effect on grain yield by the same.

Also, number of tillers per plant was detected to have very high positive indirect effect through panicle length on grain yield. Very high positive indirect effect of number of panicles per plant via number of tillers per plant and panicle length on grain yield per plant. Similar reports were reported by Basavaraj *et al.* (2011) and Rajamadhan *et al.* (2011). Panicle length had also observed very high positive indirect effect through panicle length, number of tillers per plant and grain L/B ratio on grain yield. Number of grains per panicle also had very high and positive indirect effect on plant height, number of tillers per plant and panicle length while grain L/B ratio was high and positive on grain yield. Also, grain L/B ratio also had very high and positive indirect effect on grain L/B ratio, panicle length while number of panicles per plant was high and positive on grain yield. Hundred grain weight recorded high positive indirect effect on number of tillers per plant, grain L/B ratio and panicle length on grain yield. Similar finding were reported by Yadav *et al.* (2011).

From the above discussion, it was inferred that the pattern of path coefficient observed in the present study was in agreement with the correlation attained. In general, the character days to 50% flowering recorded negative significant correlation and high direct effect with grain yield per plant. Hence it could be used as selection criteria in breeding programme to develop high yielding new plant type rice varieties.

From the present study, it might be enriched that genotype AURC 17 showed significant superior mean values for yield attributes such as days to 50% flowering, number of tillers per plant, number of panicles per plant, panicle length, number of grains per panicle, hundred grain weight, grain L/B ratio and grain yield per plant. Based on mean performance, these genotypes might be selected for future improvement through hybridization and selection.

The genotypic correlation coefficients showed higher magnitude than phenotypic correlation coefficient which indicated masking or modifying effect of environment. The genetic correlation revealed that grain yield per plant had strong positive and significant association with number of tillers per plant, number of panicles per plant and panicle length at both genotypic and phenotypic levels.

Path analysis revealed that maximum direct effect on grain yield was exerted by number of tillers per plant, panicle length and grain L/B ratio. Hence, these traits should be taken in account of breeding programme to develop the maximum of threshold yield obtaining new rice varieties or hybrids..

Table 1: List of genotypes selected for D^2 analysis

SL. No	Name of genotype	Origin
1.	AURC 1	Indian Institute of Rice Research
2.	AURC 2	Indian Institute of Rice Research
3.	AURC 3	Indian Institute of Rice Research
4.	AURC 4	Indian Institute of Rice Research
5.	AURC 5	Indian Institute of Rice Research
6.	AURC 6	Indian Institute of Rice Research
7.	AURC 7	Indian Institute of Rice Research
8.	AURC 8	Indian Institute of Rice Research
9.	AURC 9	Indian Institute of Rice Research
10.	AURC 10	Indian Institute of Rice Research
11.	AURC 11	Indian Institute of Rice Research
12.	AURC 12	Indian Institute of Rice Research
13.	AURC 13	Indian Institute of Rice Research
14.	AURC 14	Indian Institute of Rice Research
15.	AURC 15	Indian Institute of Rice Research
16.	AURC 16	Indian Institute of Rice Research
17.	AURC 17	Indian Institute of Rice Research
18.	AURC 18	Indian Institute of Rice Research
19.	AURC 19	Indian Institute of Rice Research
20.	AURC 20	Indian Institute of Rice Research
21.	AURC 21	Indian Institute of Rice Research
22.	AURC 22	Indian Institute of Rice Research
23.	AURC 23	Indian Institute of Rice Research
24.	AURC 24	Indian Institute of Rice Research
25.	AURC 25	Indian Institute of Rice Research
26.	AURC 26	Indian Institute of Rice Research
27.	AURC 27	Indian Institute of Rice Research
28.	AURC 28	Indian Institute of Rice Research
29.	AURC 29	Indian Institute of Rice Research
30.	AURC 30	Indian Institute of Rice Research
31.	AURC 31	Indian Institute of Rice Research
32.	AURC 32	Indian Institute of Rice Research
33.	AURC 33	Indian Institute of Rice Research
34.	AURC 34	Indian Institute of Rice Research
35.	AURC 35	Indian Institute of Rice Research
36.	AURC 36	Indian Institute of Rice Research
37.	AURC 37	Indian Institute of Rice Research
38.	AURC 38	Indian Institute of Rice Research
39.	AURC 39	Indian Institute of Rice Research
40.	AURC 40	Indian Institute of Rice Research
41.	AURC 41	Indian Institute of Rice Research
42.	AURC 42	Indian Institute of Rice Research
43.	AURC 43	Indian Institute of Rice Research
44.	AURC 44	Indian Institute of Rice Research
45.	AURC 45	Indian Institute of Rice Research
46.	AURC 46	Indian Institute of Rice Research
47.	AURC 47	Indian Institute of Rice Research
48.	AURC 48	Indian Institute of Rice Research
49.	AURC 49	Indian Institute of Rice Research
50.	AURC 50	Indian Institute of Rice Research

Table 2: Analysis of variance for nine characters in rice genotypes

S. No.	Source	Df	Days to 50% flowering	Plant height	Number of tillers per plant	Number of panicles per plant	Panicle length	No. of grains per panicle	Grain L/B ratio	100 seed weight	Grain yield per plant
1	Replication	2	79.43	1.62	0.03	0.31	2.37	19.82	0.77	0.04	15.08
2	Genotype	49	114.65**	495.14**	42.45**	43.79**	30.60**	3047.23**	40.80**	36.18**	38.08**
3	Error	98	18.46	0.88	0.75	0.89	0.89	2.08	0.10	0.09	1.06

***Significant at 1 per cent level**

Table 3: Phenotypic and genotypic correlation coefficients among yield attributing characters in rice genotypes

S. No	Characters		Days to 50% flowering	Plant height	Number of tillers per plant	Number of panicles per plant	Panicle length	Number of grains per panicle	Grain L/B ratio	Hundred grain weight	Grain yield per plant
1	Days to 50% flowering	P	1.00	0.43**	0.23	0.13	0.43**	0.11	0.00	0.13	-0.03
		G	1.00	0.55*	0.31*	0.15	0.62**	0.14	0.08	0.16	-0.01
2	Plant height	P		1.00	0.31*	0.28*	0.75**	-0.14	0.21	-0.01	0.16
		G		1.00	0.32*	0.29*	0.78**	-0.14	0.25*	-0.01	0.17
3	Number of tillers per plant	P			1.00	0.89**	0.48**	0.07	-0.02	0.24*	0.38**
		G			1.00	0.93**	0.52**	0.07	-0.05	0.50**	0.42**
4	Number of panicles per plant	P				1.00	0.50**	0.06	-0.06	0.20	0.39**
		G				1.00	0.54**	0.07	-0.05	0.38**	0.44**
5	Panicle length	P					1.00	0.11	0.21	0.12	0.26*
		G					1.00	0.11	0.21	0.31*	0.27*
6	Number of grains per panicle	P						1.00	0.09	0.03	0.23
		G						1.00	0.10	0.05	0.25*
7	Grain L/B ratio	P							1.00	0.12	0.09
		G							1.00	0.56**	0.15
10	Hundred grain weight	P								1.00	-0.00
		G								1.00	-0.01
11	Grain yield per plant	P									1.00
		G									1.00

* Significant to 5 per cent level
** Significant to 1 per cent level

P – Phenotypic correlation coefficient
G – Genotypic correlation coefficient

Table 4: Path coefficient analysis showing direct and indirect effects of yield attributing characters on grain yield per plant in rice genotypes

Clusters	Days to 50% flowering (days)	Plant height (cm)	Number of tillers per plant	Number of panicles per plant	Panicle length (cm)	Number of grains per panicle	Grain L/B ratio	Hundred grain weight (g)	Grain yield per plant
Days to 50% flowering (days)	**-1.72**	-5.56	4.80	-1.78	5.68	-0.38	0.56	-1.61	-0.01
Plant height (cm)	-0.95	**-10.03**	5.00	-3.27	7.12	0.38	1.73	0.17	0.17
Number of tillers per plant	-0.53	-3.26	**15.37**	-10.47	4.79	-0.20	-0.34	-4.91	0.42
Number of panicles per plant	-0.27	-2.92	14.33	**-11.23**	4.94	-0.18	-0.40	-3.80	0.44
Panicle length (cm)	-1.07	-7.84	8.09	-6.09	**9.10**	-0.31	1.47	-3.06	0.27
Number of grains per panicle	-0.25	1.46	1.20	-0.79	1.09	**-2.63**	0.74	-0.57	0.25
Grain L/B ratio	-0.14	-2.56	-0.78	0.66	1.97	-0.28	**6.80**	-5.51	0.15
Hundred grain weight (g)	-0.28	0.18	7.72	-4.37	2.85	-0.15	3.84	**-9.77**	0.01

Residual effect =0.912

Direct effect – diagonal bold values
Indirect effect-unbold values

References

Akhtar, N., M. F. Nazir, A. Rabnawaz, T. Mahmood, M. E. Safdar, M. AsifandA. Rehman. 2011. Estimation of Heritability, Correlation and Path Coefficient Analysis in fine grain Rice (*Oryza sativa* L.). *The Journal of Animal & Plant Sciences,* **21(4):** 660-664.

Basavaraj, T.S., Ganagaprasad, B.M. Dhusyantha Kumar and Shilaja Hittlamani. 2011. Correlation and path analysis of yield and yield contributes in local rice cultivars (*Oryza sativa* L.). *Electronic J. Plant Breed.,* 523-526.

Bhati, P.K., S.K. Singh, S.Y. Dhurai and Amita Sharma. 2015. Genetic divergence for quantitative traits in rice germplasm. *Electronic J. Pl. Breed.,* **6(2):** 528-534.

Chamundeswari, N. 2016. Studies on nature of genetic divergence in rice (*Oryza sativa* L.). *Intl. J. of Science, Environment,* **5(6):** 4018-4023.

Chandramohan, Y., B. Srinivas, S. Thippeswamy and D. Padmaja. 2016. Diversity and variability analysis for yield parameters in rice (*Oryza sativa* L.) genotypes. *Indian J. Agric. Res.,* **50(6):** 609-613.

Dewey, D.R. and K.H. Lu. 1959. A correlation and path coefficient analysis of component of crested wheat grass production. *Agron. J.,* **51:** 515-518.

Mohan, Y.C., S. Thippeswamy, K. Bhoomeshwar, B. Madhavilatha and JameemaSamreen. 2015. Diversity analysis for yield and gall midge resistance in rice (*Oryza sativa* L.) in Northern Telangana zone, India. *SABRAO J. of Breed. and Genet.,* **47(2):** 160-171

Rajamadhan, R., R. Eswaran and A. Anandan. 2011. Investigation of correlation between traits and path analysis of rice (*Oryza sativa* L.) grain yield under coastal salinity. *Electronic J. of Plant Breed.,* **2(4):** 538-542.

RavindraBabu, V., K. Shreya, Kuldeep Singh Dangi, G. Usharani and P. Nagesh. 2012. Genetic variability studies for qualitative and quantitative traits in popular rice (*Oryza sativa* L.) hybrids in India. *Intl. J. of Scientific and Res. Publications,* **2(6):** 1-5.

Shrivastav, M.N. and K.K. Sharma, 1976. Analysis of path coefficient in rice. Zeitsch. Pflanzen., **77:** 174-177.

Singh, R.P., 1980. Association of grain yield and its component in F1 and F2 population of rice. **Oryza, 17:** 200-204.

Thippeswamy, S., Y. Chandramohan, B. Srinivas and D. Padmaja. 2016. Selection of diverse parental lines for heterotic hybrid development in rice (*Oryza sativa* L.). *SABRAO J. of Breed. and Genet.,* **48(3):** 285-294.

Toshimenla, Jogendra Singh and SapuChangkija. 2016. Genetic divergence studies on upland rice grown in Nagaland, India. *Indian J. Agric. Res.,* **50(6):** 555-560.

Wright, S. 1921. Correlation and association. *J. Agric. Res.,* **20:** 550-587.

Yadav, S.K., P. Pandey, B. Kumar and B.G. Suresh. 2011. Genetic Architecture, Inter-relationship and selection criteria for yield improvement in rice (*Oryza sativa* L.). *Pakistan J. of Biological Sci.,* **14(9):** 540-545.