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COHERITABILITY AND CORRELATION ANALYSIS FOR YIELD AND QUALITY TRAITS IN RICE (*ORYZA SATIVA* L) LANDRACES

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ABSTRACT

The present study investigated the coheritability and correlation of yield and associated agronomic and grain quality traits in rice landraces to identify the trait combinations suitable for simultaneous improvement through selection. Coheritability values varied from -55.10 to 4.183, with the majority falling between 0.5 and 2.0. The highest coheritability was found between grain zinc content and panicle number (4.183), followed by grain iron content and panicle length (3.501). Grain yield has a strong positive coheritability with panicle number (1.84), L/B ratio (1.693), grain iron content (1.678), grain breadth (1.041), grain length (0.983), plant height (0.594), days to 50% flowering (0.563), panicle length (0.532), and straw yield (0.402). the high negative coheritability was observed between the traits panicle length and L/B ratio (–55.095) followed by straw yield and number of panicles hill^{-1} (–2.269). The correlation study highlighted the positive significant association of grain yield with straw yield (0.737**), plant height (0.539**), panicle length (0.373**), grain breadth (0.311**), and grain length (0.289**). In comparison, a negative significant correlation was recorded with grain iron content (–0.364**). These results indicate that focusing on traits with high coheritability and positive correlations could be a smart strategy for boosting grain yield in rice improvement programs.

Keywords: Rice, Landraces, Coheritability, Correlation, Crop improvement.

Introduction

Rice (*Oryza sativa* L.), a diploid species (2n = 2x = 24) in the Poaceae family, is one of the most important cereal crops worldwide. It serves as a staple food for over half of the global population. Rice is grown in more than 117 countries in subtropical and tropical regions, during the *kharif* (wet) and *rabi* (winter) seasons. It is a rich source of complex carbohydrates and also provides essential proteins, vitamins, and minerals (Calayugan *et al*., 2020), supplying 50-60% of the total calories and 30% of the total protein in the human diet (Mackill *et al*., 2012).

Asia, often called the "Rice Bowl of the World," grows and consumes more rice than any other region in the world, accounting for over 90% of global rice production. This is primarily due to the dense population and reliance on rice as a staple food. In 2023, the world produced 799.99 million tons of rice on 168.35 million hectares of land (FAOSTAT, 2023). The countries like China, India, Indonesia, Bangladesh, and Vietnam are the top rice-producing countries. India ranks second in rice production after China, producing 137.82 million tons of rice across 47.82 million hectares in 2023–24 (INDIASTAT, 2023–2024).

In any crop improvement program aimed at developing high-yielding genotypes, it is essential to understand the genetic relationships among yield and its contributing traits for effective selection in breeding

programs (Kishor *et al*., 2008). Correlation analysis provides a good measure of the association between traits and helps identify the most important character(s) to consider for effective selection to increase yield. However, correlation alone does not quantify the extent to which two traits are jointly heritable. Coheritability measures the potential for the joint transmission of two characters and allows for the study of simultaneous changes in two correlated characters through the selection of one character (Chakraborty and Chakraborty, 2010). This approach helps determine whether the simultaneous improvement of traits is feasible through selection.

The present investigation was designed to estimate coheritability and character association among key agronomic traits in rice landraces. This will aid in identifying genetically associated trait combinations that can be targeted in selection indices for yield enhancement.

Materials and Methods

The study was conducted during *Kharif* 2023 and *Kharif* 2024 at the field plots of Sirsi, a voluntary center of the All India Coordinated Rice Improvement Project, affiliated with the University of Agricultural Sciences, Dharwad. The experimental material consists of a set of hundred local landraces collected from Karnataka. The genotypes were evaluated using a Randomized Complete Block Design with three replications. The crops were maintained by following the recommended package of practices. The observations were recorded for the five randomly selected plants in each replication for traits like Days to 50 percent flowering, Plant height (cm), Panicle length (cm), Number of panicles hill-1, Grain yield (Kg plot-1), Straw Yield (Kg plot-1), Grain length (mm), Grain breadth (mm), Length/breadth (L/B) ratio and also micronutrient traits like grain iron content and grain zinc content.

Mean values of the traits for each landrace per replication were used for analysis of variance and covariance as per Singh and Chaudhary (1985). Phenotypic and Genotypic correlation coefficients between characters were estimated according to Panse and Sukhatme (1967), and coheritability between two characters as per Nei (1960). Statistical analysis was carried out using R software.

Results and Discussion

Coheritability

Coheritability measures the likelihood of jointly transmitting two characteristics and allows for the examination of simultaneous changes in two correlated traits by selecting one of them. The value of the coheritability between the traits ranged from -55.10 to 4.183 and most of the values lay between 0.5 to 2 (Table 1). Habiba *et al*. (2012) documented the coheritability values of rice agronomic traits varied from 0 to 1.7 in plant height, number of total tillers, productive tillers, panicle length, and number of spikelets per panicle with yield per plot. The grain yield had the highest coheritability with the Number of panicles hill^{-1} (1.84), L/B ratio (1.693), grain iron content (1.678), grain breadth (1.041), grain length (0.983), plant height (0.594), Days to 50 percent flowering (0.563), panicle length (0.532), straw yield (0.402) in a positive direction. The negative coheritability between grain zinc content (-0.798). Tomar *et al* (2000); Chakraborty *et al* 2010: Chakraborty and Chakraborty (2010); Romesh Kumar Salgotra and Bharat Bhushan Gupta (2010); and Sary *et al*. (2022) showed a similar type of positive coheritability with panicle length. Positive coheritability with plant height by Chakraborty *et al.* 2010, Romesh Kumar Salgotra and Bharat Bhushan Gupta (2010), and Sary *et al*. (2022). The coheritability estimates were found to be highest between the grain zinc content and number of panicles hill^{-1}(4.183), followed by grain iron content and panicle length (3.501), straw yield and grain iron content (2.026), L/B ratio and grain yield (1.693) followed by the L/B ratio with straw yield (1.589). The negative coheritability exists between the panicle length and L/B ratio (-55.095) followed by straw yield and Number of panicles hill^{-1} (-2.269). It is noted that all the traits had positive coheritability with all traits except a few. Concerning the grain yield, all traits showed positive coheritability thus selection for these traits may be effective for yield improvement.

Correlation analysis

In the current study, a significant positive correlation was recorded between the straw yield plot^{-1}(0.737**), plant height (0.539**), panicle length (0.373**), grain breadth (0.311**), grain length (0.289**) with grain yield plot^{-1} and significant negative correlation was observed with grain iron content (-0.364**) (Table 2). The straw yield plot^{-1}had positive correlation with grain yield plot^{-1}(0.737**), plant height (0.672**), grain breadth (0.375**), panicle length (0.351**), grain length (0.243*), and significant negative correlation with grain iron content (-0.402**). The grain iron content showed a significant positive correlation with grain zinc content (0.568**). A significant positive correlation was observed between panicle height with the number of panicles hill^{-1} (0.354**), grain breadth (0.315**), and negative with grain iron content (-0.364**). Panicle length

showed a positive correlation with the number of panicles hill^{-1}(0.255**). Positive correlation between grain breadth (0.375**), L/B ratio (0.504**) with grain length. The grain breadth showed a significant negative correlation with the L/B ratio (-0.593**). The positive correlation of grain yield plot^{-1}, and straw yield plot^{-1} with plant height, panicle length, grain length, and grain breadth, selection of these traits will help enhance the grain yield and straw yield. Muthuramu and Ragavan (2020), and Fentie *et al*. (2014) observed a similar positive correlation between grain yield and straw yield. Similar results of grain yield with panicle length, and plant height were reported by Fentie *et al.* (2014), Bhati *et al.* (2015), and Sadhana *et al.* (2022). A positive correlation between straw yield with plant height and panicle length was reported by Bhati *et al.* (2015), Muthuramu and Ragavan (2020), and Teja *et al.* (2023). Similar results of Positive correlation with plant height, and panicle length with grain yield were reported by Hossain *et al.* (2018). Similarly grain length with L/B by Dutta *et al.* (2023), grain length with grain breadth by Jebakani *et al.* (2023), and grain breadth with L/B by Umadevi *et al* 2009.

Conclusion

The present study reveals the presence of high coheritability and significant correlations among traits studied in rice landraces. The trait grain yield had the highest coheritability with the Number of panicles hill^{-1}, L/B ratio, grain iron content, grain breadth, grain length, and plant height, indicating that these traits can be improved together through selection. All trait combinations exhibited positive coheritability, but very few showed negative coheritability indicating the limited scope for simultaneous improvement. Correlation analysis further substantiated the significance of plant height, panicle length, grain dimensions, and straw yield as essential factors in enhancing grain yield. These findings offer valuable insights for designing multi-trait selection strategies aimed at enhancing both yield and grain quality in rice breeding programs. These results provide valuable information for creating multi-trait selection techniques that will improve both the yield and quality of rice grains in crop improvement programs.

Table 1: Coheritability table for agronomic and quality traits in rice landraces.

		DFF	PH	PL	NPH	GYP	SYP	GL	GB	LB	IRON
PH	Cov g	-15.117									
	Cov p	-35.673									
	coh	0.424									
PL	Cov g	-3.100	25.602								
	Cov p	-7.922	38.644								
	coh	0.391	0.663								
NPH	Cov g	3.819	11.800	1.040							
	Cov p	2.693	9.704	0.914							
	coh	1.418	1.216	1.138							
GYP	Cov g	-0.430	2.551	0.216	0.148						
	Cov p	-0.763	4.296	0.405	0.080						
	coh	0.563	0.594	0.532	1.840						
SYP	Cov g	-0.012	10.652	0.680	0.468	0.194					
	Cov p	-0.953	20.442	1.125	-0.206	0.483					
	coh	0.012	0.521	0.605	-2.269	0.402					
GL	Cov g	-0.440	2.698	0.170	0.099	0.070	0.195				
	Cov p	-0.536	2.870	0.200	0.102	0.071	0.224				
	coh	0.821	0.940	0.850	0.964	0.983	0.871				
GB	Cov g	0.071	1.785	0.052	-0.002	0.029	0.118	0.108			
	Cov p	0.055	1.743	0.053	0.019	0.028	0.112	0.111			
	coh	1.290	1.024	0.978	-0.093	1.041	1.047	0.976			
LB	Cov g	-0.139	-0.884	-0.008	0.054	-0.004	-0.042	0.169	-0.079		
	Cov p	-0.174	-0.785	0.000	0.036	-0.002	-0.027	0.244	-0.103		
	coh	0.799	1.126	-55.095	1.511	1.693	1.589	0.694	0.768		
IRON	Cov g	0.032	-6.222	-0.446	-0.373	-0.104	-0.383	-0.124	0.013	-0.071	
	Cov p	-2.859	-3.180	-0.127	-0.343	-0.062	-0.189	-0.104	0.010	-0.062	
	coh	-0.011	1.957	3.501	1.089	1.678	2.026	1.197	1.278	1.147	
ZINC	Cov g	1.597	-8.018	-1.162	0.297	-0.083	-0.144	0.201	0.173	-0.106	1.664
	Cov p	-3.696	-4.331	-0.909	0.071	0.104	0.558	0.172	0.160	-0.099	2.827
	coh	-0.432	1.851	1.278	4.183	-0.798	-0.257	1.165	1.076	1.064	0.589

(DFF=Days to 50 percent flowering, PH=Plant height (cm), PL= Panicle length (cm), NPH= Number of panicles hill-1, GYP=Grain yield (Kg plot-1), SYP=Straw Yield (Kg plot-1), GL=Grain length (mm), GB=Grain breadth (mm), LB= Length/breadth (L/B) ratio, IRON=grain iron content and ZINC=grain zinc content)

Table 2: Correlation matrix (Pearson (n)) for agronomic and quality traits in rice landraces.

	DFF	PH	PL	NPH	GYP	SYP	GL	GB	LB	IRON	ZINC
DFF	1.000										
PH	-0.089	1.000									
PL	-0.15	0.737**	1.000								
NPH	0.193	0.354**	0.255*	1.000							
GYP	-0.153	0.539**	0.373**	0.266**	1.000						
SYP	-0.001	0.672**	0.351**	0.251*	0.737**	1.000					
GL	-0.051	0.187	0.096	0.058	0.289**	0.243*	1.000				
GB	0.021	0.315**	0.075	-0.003	0.311**	0.375**	0.375**	1.000			
LB	-0.037	-0.135	-0.013	0.07	-0.035	-0.115	0.504**	-0.593**	1.000		
IRON	0.003	-0.364**	-0.214*	-0.186	-0.364**	-0.402**	-0.143	0.037	-0.178	1.000	
ZINC	0.055	-0.164	-0.194	0.052	-0.101	-0.052	0.081	0.177	-0.092	0.568**	1.000

(*, ** Significant at 5% and 1% levels, respectively DFF=Days to 50 percent flowering, PH=Plant height (cm),PL= Panicle length (cm),NPH= Number of panicles hill-1, GYP=Grain yield (Kg plot-1), SYP=Straw Yield (Kg plot-1), GL=Grain length (mm), GB=Grain breadth (mm),LB= Length/breadth (L/B) ratio, IRON=grain iron content and ZINC=grain zinc content)

References

Anonymous (2023). Area, production and productivity of Rice, FAOSTAT

Anonymous 2023). Area, production and productivity of Rice, http://www.indiastat.com.

Bhati, M., Babu, G.S. and Rajput, A.S. (2015). Genetic variability, correlation and path coefficient for grain yield and quantitative traits of elite rice (*Oryza sativa* L.) genotypes at Uttar Pradesh. *Electronic Journal of Plant Breeding*, **6**(2), pp.586-591.

Calayugan, M.I.C., Formantes, A.K., Amparado, A., Descalsota-Empleo, G.I., Nha, C.T., Inabangan-Asilo, M.A., Swe, Z.M., Hernandez, J.E., Borromeo, T.H., Lalusin, A.G. and Mendioro, M.S. (2020). Genetic analysis of agronomic traits and grain iron and zinc concentrations in a doubled haploid population of rice (*Oryza sativa* L.). *Scientific Reports*, **10**(1), p.2283.

Chakraborty, R., and S. Chakraborty (2010). "Genetic variability and correlation of some morphometric traits with grain yield in bold grained rice (*Oryza sativa* L.) gene pool of Barak valley." 26-29.

Chakraborty, S., Biswajit, G.U.H.A., Sarmah, K.K. and Barman, B. (2010). Quantitative genetic analysis for yield and yield components in boro rice (*Oryza sativa* L.). *Notulae Scientia Biologicae*, **2**(1), pp.117-120.

Chaudhary, F.S. and Singh, R. (1985). An evaluation of response models. *Sankhyā: The Indian Journal of Statistics, Series B*, pp.280-289.

Dutta, L., Sharma, K.K. and Bordoloi, D. (2023). Correlation Study on Some Rice Landraces of Assam for Yield and Ancillary Traits under Organic and Conventional Cultivation Method. In *Int J Biol Forum,* 15(12), 309-12.

Fentie, D., Alemayehu, G., Siddalingaiah, M. and Tadesse, T. (2014). Genetic variability, heritability and correlation coefficient analysis for yield and yield component traits in upland rice (Oryza sativa L.). *East African Journal of Sciences*, **8**(2), 147-154.

Habiba, U., Bishwas, B.K., Aktaruzzaman, M., Sarkar, E.N.S., Sultana, S. (2012). Covariance and coheritability of different traits against the prevalence of major diseases in fine rice. *Bangladesh J. Prog. Sci. & Tech*. **10**(1): 109-112.

Hossain, S., Salim, M., Azam, M.G. and Noman, S. (2018). Variability, correlation and path analysis in drought tolerant rice (*Oryza sativa* L.). *Journal of Bioscience and Agriculture Research*, **18**(2), 1521-1530.

Jebakani, K.S., Aishwarya, D., Pramitha, J.L., Ramchander, S., Devasena, N., Wilson, D., Kumar, P.D. and Samundeswari, R. (2023). Assessing the genetic diversity and association of traits among the rice (*Oryza sativa* L.) landraces and varieties from Tamil Nadu. *Electronic Journal of Plant Breeding*, **14**(3), pp.818-832.

Kishor, C., Prasad, Y., Haider, Z.A., Kumar, R. and Kumar, K. (2008). Quantitative analysis of upland rice. *ORYZA-An International Journal on Rice*, **45**(4), 268-272.

Mackill, D.J., Ismail, A.M., Singh, U.S., Labios, R.V. and Paris, T.R. (2012). Development and rapid adoption of submergence-tolerant (Sub1) rice varieties. *Advances in agronomy*, **115**, 299-352.

Muthuramu, S. and Ragavan, T. (2020). Genotypic correlation and path coefficient analysis for yield traits in rainfed rice (*Oryza sativa* L.). *Journal of Pharmacognosy and Phytochemistry*, **9**(2), 1621-1623.

Nei, Masatoshi (1959). "Studies on the application of biometrical genetics to plant breeding.

Panse, V.G. and Sukhatme, P.V. (1967). Statistical methods of agricultural workers. 2nd Endorsement. *ICAR Publication, New Delhi, India*, 381.

Sadhana, P., Raju, C.D., Rao, L.V. and Kuna, A. (2022). Studies on variability, correlation and path coefficient analysis for yield and quality traits in rice (Oryza sativa L.) genotypes. *Electronic journal of plant breeding*, **13**(2), 670-678.

Salgotra, R.K. and Gupta, B.B. (2010). Genetic Analysis of Quantitative Traits In Basmati and Aromatic Rice Under Intermediate Region of Himalaya. Proceedings of the IASTED International Conference Computational Bioscience (CompBio 2010)

Sary, D.N., Badriyah, L., Sihombing, R.D., Syauqy, T.A., Mustikarini, E.D., Prayoga, G.I., Santi, R. and Waluyo, B. (2022). Estimation of heritability and association analysis of agronomic traits contributing to yield on upland rice (*Oryza sativa* L.).

Teja, D.S., Balakrishnan, D., Kar, S., JL, S., DP, S., Kumar, A.P., AVSR, S. and LV, S.R. (2023). Genetic Variability and Correlation Studies in High-yielding Varieties of Rice (*Oryza sativa* L.). *Journal of Rice Research*, **16**(2), p.23.

Tomar, J.B., Dabas, B.S. and Gautam, P.L. (2000). Genetic variability, correlation coefficient and path analysis for quantitative characters under rainfed ecosystem in the native landraces of rice. *Indian Journal of Plant Genetic Resources*, **13**(03), 239-246.

Umadevi, M., Veerabadhiran, P. and Manonmani, S. (2009). Genetic variability, heritability, genetic advance and correlation for morphological traits in rice genotypes. *Madras Agricultural Journal*, **96**(jul-dec), p.1