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Correlation and Path Analysis in Aromatic and Pigmented Genotypes of Rice (*Oryza sativa* L.)

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ABSTRACT

Keywords

Correlation, Path analysis, Rice genotypes, *Oryza sativa* L

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An experiment was conducted during *kharif* 2017 comprised of 25 genotypes of aromatic and pigmented rice to study character interrelationship using correlation and path analysis. Correlation coefficient revealed that leaf length of blade, stem length, time of 50% heading, number of filled spikelet per panicle, 1000 grain weight, spikelet fertility %, biological yield per plant, harvest index per plant and days to maturity showed positive significant correlation with grain yield per plant at genotypic level. And stem length, number of filled spikelet per plant, 1000 grain weight, spikelet fertility %, biological yield per plant and harvest index per plant showed positive significant correlation with grain yield per plant at phenotypic level. Path analysis revealed that leaf width of blade, time of 50% heading, number of panicle per plant, number of filled spikelet per panicle, 1000 grain weight, grain width, grain length and grain width ratio, biological yield per plant and days to maturity had positive direct effect on grain yield per plant.

Introduction

Rice (*Oryza sativa* L.) is one of the top three leading food crops in the world together with wheat and maize. In Asia, rice is the most important cereal crop providing the main energy source of carbohydrates for most of the Asian people (Mohanty, 2013).

Aromatic rice constitute small and special group of rice and highly priced compare to other group of rice due to their quality. Generally in India, aromatic rice is also known as basmati rice which is usually grown

in states like Punjab, Haryana, Jammu and Kashmir, Delhi, Uttarakhand, Uttar Pradesh and Bihar. Besides basmati rice, hundreds of aromatic short grained rice is grown in specialized area in the states like Bihar, Orissa, MP, WB, Chhattisgarh, Uttar Pradesh etc. These are short and medium grains and having good aroma.

There is also high demand of this rice in national as well as international markets. It is estimated that India has over 85,000 germplasm including wild forms. These genotypes are the reservoir of many useful

genes. Chhattisgarh is having greatest diversity of rice including aromatic rice (Bisne and Sarawgi, 2008). Yield is a complex and polygenically inherited character resulting from multiplicative interaction of its contributing characters.

Both correlation and path analysis form a basis for selection and also help in understanding those yield components affecting yield improvement through study of their direct and indirect effects. The present investigation was carried out to understand the inter-relationship between yield and its contributing traits for character to be considered in selections for improvement of rice.

Materials and Methods

The materials for the present investigation comprised of 25 aromatic and pigmented genotypes of rice along with 3 checks. These genotypes were sown in Randomized Block Design (RBD) with three replications at IGKV, RMD CARS, Research and Instructional Farm, Ambikapur during *Kharif* 2017. Each genotype was sown as row to row and plant to plant distance of 20 cm and 15 cm, respectively. The observations on 19 quantitative characters were recorded based on five randomly taken plants from each genotype for some observations and for other observations will be recorded on whole plot basis.

Data was collected on leaf length of blade, leaf width of blade, stem thickness, stem length, number of panicle per plant, number of tillers per plant, number of effective tillers per plant, number of spikelets per panicles, number of filled spikelets per panicles, 1000 grain weight, grain length, grain width, grain length and breadth ratio, spikelet fertility %, grain yield per plant, biological yield per plant, harvest index per plant, time of heading (50%) and time to maturity (days).

Results and Discussion

Correlation coefficient

Correlation coefficient is used to measure the degree and direction of association between two or more variables. A positive value of correlation coefficient indicates that the change in two variables is in the same direction, whereas negative value of correlation coefficient indicates that the changes in two variables are in the opposite direction. If the value of genotypic correlation coefficient is higher than phenotypic correlation coefficient. It indicates that there is strong association between two traits and the value of phenotypic correlation coefficient is higher than genotypic correlation coefficient. It indicates there is least association between the two traits. The genotypic correlation coefficient was higher than phenotypic correlation in general (Table 1). Correlation in aromatic and non-aromatic rice and found that genotypic correlation coefficient were higher than phenotypic correlation coefficient for most of the characters under study Sandya *et al.*, (2007). Grain yield per plant exhibited significant positive correlations with number of filled spikelet per panicle, 1000 grain weight, spikelet fertility %, biological yield per plant and harvest index per plant both genotypic and phenotypic levels, whereas leaf length of blade, stem length, time of 50% heading and days to maturity were positively and significantly associated with grain yield per plant at the genotypic level only. This indicates the relative utility of all these traits for selection with respect to grain yield. Tillers per plant and leaf width of blade were also significantly negatively associated at both genotypic and phenotypic levels. A positive and significant correlation between desirable characters is favorable to the plant breeder. It helps in simultaneous improvement of both characters.

Table.1 Genotypic and phenotypic correlation coefficient for quantitative traits in rice

Char.		LL	LW	DF	ST	SL	NPP	TPP	ETPP	SPP	FSPP	1000GW	GL	GW	GL/GW	SF%	BYPP	HIPP	DM	GYPP
LL	G	1.000	-0.544**	-0.042	-0.178	-0.132	0.141	0.055	0.088	-0.061	0.280*	0.203*	0.242*	0.052	0.293*	0.358**	0.013	0.242**	-0.231*	0.201*
	P	1.000	-0.151	-0.024	-0.043	0.012	-0.031	0.017	0.019	-0.052	0.129	0.093	0.173	0.001	0.149	0.181	0.003	0.119	-0.158	0.130
LW	G		1.000	-0.415**	0.088	0.100	0.239*	0.504**	0.151	-0.046	-0.558**	-0.079	0.627**	-0.183	0.626**	-0.689**	-0.418**	-0.309**	-0.215*	-0.509**
	P		1.000	-0.120	0.057	-0.079	0.123	0.172	-0.003	-0.043	-0.244*	-0.044	0.256*	-0.058	0.255*	-0.238*	-0.170	-0.064	0.002	-0.220*
DF	G			1.000	0.302**	0.347**	-0.257*	0.052	-0.290*	0.591**	0.500**	-0.581**	-0.858**	0.224*	-0.537**	0.245*	0.326**	0.257*	0.861**	0.330**
	P			1.000	0.145	0.162	-0.003	0.066	-0.068	0.518**	0.340**	-0.342**	-0.289*	-0.048	-0.323*	0.003	0.195	-0.003	0.699**	0.199
ST	G				1.000	0.418**	-0.448**	-0.199	-0.552**	0.431**	-0.069	0.133	0.237*	0.601**	-0.234*	-0.317**	0.188	0.001	0.424**	0.090
	P				1.000	0.202*	-0.115	-0.196	-0.133	0.097	-0.105	0.100	0.175	0.427**	-0.165	-0.153	0.132	-0.032	0.189	0.065
SL	G					1.000	-0.448**	-0.153	-0.991**	0.487**	0.264*	-0.191	0.015*	0.021	-0.024	0.107	0.683**	-0.106	0.409**	0.412**
	P					1.000	-0.162	-0.215*	-0.219*	0.268*	0.203*	-0.103	0.027	0.015	-0.032	0.093	0.513**	-0.140	0.153	0.304**
NPP	G						1.000	0.132	0.943**	0.101	-0.178	-0.043	0.079	0.061	-0.162	-0.248**	-0.419**	0.328**	-0.301**	-0.183
	P						1.000	0.013	0.909**	0.042	-0.028	-0.017	0.029	0.038	-0.144	-0.071	-0.231*	0.152	-0.198	-0.138
TPP	G							1.000	0.142	0.088	-0.008	-0.365**	-0.0378**	-0.237*	-0.118	-0.210*	-0.251*	-0.467**	0.122	-0.380**
	P							1.000	0.007	0.062	-0.008	-0.347**	-0.317**	-0.189	-0.091	-0.177	-0.237*	-0.346**	0.120	-0.354**
ETPP	G								1.000	-0.118	-0.191	0.110	0.087	0.078	-0.162	-0.145	-0.516**	0.448**	-0.316**	-0.166
	P								1.000	-0.052	-0.015	0.075	-0.061	0.050	-0.142	-0.001	-0.256*	0.182	-0.238*	-0.121
SPP	G									1.000	0.569**	-0.590**	-0.437**	0.006	-0.495**	0.108	0.231*	0.069	0.742**	0.187
	P									1.000	0.495**	-0.476**	-0.201*	0.057	-0.365**	0.136	0.159	0.003	0.543**	0.136
FSPP	G										1.000	-0.043	-0.229*	0.045	-0.271*	0.876**	0.590**	0.542**	0.440**	0.740**
	P										1.000	-0.051	-0.186	0.032	-0.257*	0.757**	0.544**	0.460**	0.339**	0.672**
1000GW	G											1.000	0.653**	0.554**	0.208*	0.331**	-0.013	0.468**	-0.599**	0.230*
	P											1.000	0.538**	0.473**	0.185	0.288*	0.010	0.392**	-0.406**	0.224*
GL	G												1.000	0.294*	0.713**	0.037	-0.075	0.166	-0.718**	-0.008
	P												1.000	0.350**	0.520**	-0.037	-0.059	0.105	-0.292*	0.002
GW	G													1.000	-0.464**	0.037	0.158	0.160	-0.389**	0.115
	P													1.000	-0.510**	0.002	0.139	0.129	-0.145	0.100
GL:GW	G														1.000	0.010	-0.217*	-0.057	0.328**	-0.168
	P														1.000	-0.019	-0.183	-0.076	-0.252*	-0.133
SF%	G															1.000	0.614**	0.692**	0.245**	0.841**
	P															1.000	0.554**	0.583**	-0.029	0.742**
BYPP	G																1.000	0.235*	0.104	0.824**
	P																1.000	0.201*	0.190	0.792**
HIPP	G																	1.000	0.104	0.735**
	P																	1.000	-0.014	0.642**
DM	G																		1.000	0.238*
	P																		1.000	0.155

Note: Leaf length of blade (LLB), Leaf width of blade (LWB). Stem thickness (ST), Stem length (excluding panicle, excluding floating rice) (SL), Panical number of per plant(NPP), Total number of tillers per plant (TPP), Total number of effective tillers per plant (ETPP), Number of spikelets per panicals (SPP), number of filled spikelets per panicles (FSPP), Grain weight of 1000 fully developed grain (gram) (GW1000), Grain length (mm)(GL), Grain width (mm) (GW), Grain length and breadth ratio (GL:GB), Spikelet fertility (SF%), Grain yield per plant (GYPP), Biological yield per plant(BYPP), Harvest index per plant (HIPP), Time of heading (50%) (HT), Time maturity (days) (DM).

Table.2 Estimates of path coefficient (direct and indirect effects) for various yield contributing traits on grain yield per plant

Char.	LL	LW	DF	ST	SL	NPP	TPP	ETPP	SPP	FSPP	1000 GW	GL	GW	GL/GW	SF%	BYPP	HIPP	DM	GYPP
LL	-0.166	0.090	0.007	0.029	0.022	-0.023	-0.009	-0.014	0.010	-0.046	-0.033	0.007	0.000	0.006	-0.059	0.002	0.005	-0.006	0.130
LW	-0.038	0.070	-0.029	0.006	0.007	0.017	0.035	0.010	-0.003	-0.039	-0.005	-0.006	0.001	0.044	-0.046	0.004	0.001	0.000	-0.220
DF	-0.010	0.099	0.239	0.072	0.083	-0.061	0.012	-0.069	0.141	0.119	-0.139	-0.205	-0.053	-0.128	0.058	0.078	0.061	0.206	0.330
ST	0.032	-0.016	-0.054	-0.181	-0.075	0.081	0.036	0.100	-0.078	0.012	-0.024	-0.043	-0.109	0.042	0.057	-0.034	-0.000	-0.077	0.090
SL	0.032	-0.024	-0.084	-0.102	-0.243	0.166	0.037	0.241	-0.118	-0.064	0.046	-0.003	-0.005	0.006	-0.026	-0.166	0.026	-0.099	0.412
NPP	0.159	0.270	-0.291	-0.507	-0.771	1.131	0.150	1.066	0.115	-0.202	-0.049	0.089	0.069	-0.133	-0.280	-0.473	0.371	-0.340	-0.183
TPP	-0.010	-0.092	-0.009	0.036	0.028	-0.024	-0.183	-0.026	-0.016	0.001	0.067	0.069	0.043	0.021	0.038	0.046	0.085	-0.022	-0.380
ETPP	-0.065	-0.113	0.217	0.413	0.740	-0.704	-0.106	-0.747	0.088	0.142	-0.082	-0.065	-0.058	0.121	0.108	0.385	-0.334	0.236	-0.166
SPP	0.012	0.009	-0.123	-0.090	-0.101	-0.021	-0.018	0.024	-0.208	-0.118	0.123	0.091	-0.001	0.103	-0.022	-0.048	-0.014	-0.154	0.187
FSPP	0.132	-0.558	0.236	-0.032	0.124	-0.084	-0.004	-0.090	0.269	0.472	-0.020	-0.108	0.021	-0.128	0.414	0.279	0.256	0.208	0.740
1000G W	0.124	-0.048	-0.354	0.081	-0.116	-0.026	-0.223	0.067	-0.360	-0.026	0.610	0.398	0.338	0.127	0.202	-0.008	0.288	-0.365	0.230
GL	-0.173	-0.450	0.616	-0.170	-0.011	-0.056	0.271	-0.063	0.313	0.164	-0.468	-0.717	-0.211	-0.511	-0.026	0.054	-0.119	0.515	-0.008
GW	0.032	-0.113	-0.138	0.371	0.013	0.038	-0.146	0.048	0.004	0.028	0.341	0.181	0.617	-0.286	0.023	0.093	0.098	-0.240	0.115
GL/GW	0.288	0.616	-0.529	-0.231	-0.024	-0.160	-0.116	-0.159	-0.487	-0.267	0.205	0.702	-0.457	0.985	0.010	-0.214	-0.056	-0.323	-0.168
SF%	-0.049	0.094	-0.033	0.043	-0.014	0.034	0.028	0.020	-0.014	-0.120	-0.045	-0.005	-0.005	-0.001	-0.137	-0.084	-0.094	-0.009	0.841
BYPP	0.011	-0.344	0.268	0.154	0.562	-0.344	-0.206	-0.424	0.190	0.486	-0.011	-0.062	-0.001	-0.178	-0.007	0.822	0.193	0.220	0.824
HIPP	-0.002	0.003	-0.002	0.000	0.001	-0.003	0.004	-0.004	0.000	-0.005	-0.004	-0.205	-0.053	-0.128	0.058	0.078	-0.010	-0.001	0.735
DM	-0.107	-0.099	0.398	0.196	0.189	-0.139	0.056	-0.146	0.343	0.203	-0.277	-0.332	-0.180	-0.151	0.031	0.124	0.048	0.463	0.238

RESIDUAL EFFECT = 0.305

Figures in bold are direct effects

Note: Leaf length of blade(LLB), Leaf width of blade (LWB).Stem thickness(ST), Stem length (excluding panicle, excluding floating rice)(SL), Panical number of per plant(NPP), Total number of tillers per plant(TPP), Total number of effective tillers per plant(ETPP), Number of spikelets per panicals (SPP), number of filled spikelets per panicles(FSPP), Grain weight of 1000 fully developed grain (gram) (GW1000), Grain length (mm)(GL), Grain width (mm)(GW), Grain length and breadth ratio (GL:GB), Spikelet fertility %(SF%), Grain yield per plant(GYPP), Biological yield per plant(BYPP), Harvest index per plant(HIPP), Time of heading (50%) (TOH), days to maturity (DM).

Similarly results recorded by Murthy *et al.*,(2004) for leaf length, Rajamani *et al.*, (2004)for number of filled spikelet per panicle, Priyanka *et al.*, (2016) for effective tillers per plant and Padmaja *et al.*, (2011), Reddy *et al.*, (2013) and Patel *et al.*, (2014) for number of filled grains per panicle, Panwar and Ali (2006) for biological yield per hill and Choudhary and Motiramani (2003)for effective tillers per plant and biological yield per plant.

Path analysis

Path coefficient analysis is simply a standardized partial regression coefficient which splits the correlation coefficient into the measure of direct and indirect effect. (Table 2) Path coefficient analysis revealed that number of panicles per plant had highest positive direct effect on grain yield per plant followed by grain length and grain width ratio, biological yield per plant, grain width, 1000 grain weight, filled spikelet per plant, days to maturity and time of 50% heading indicating a true relationship among these traits., whereas effective tillers per plant had highest negative direct effect on grain yield per plant followed by grain length, stem length, spikelet per plant, tillers per plant, stem thickness and leaf length.

The characters number of panicles per plant, by GL/GW ratio, biological yield per plant, grain width, 1000 grain weight, filled spikelet per plant, days to maturity and 50 % heading time had positive direct effect and exhibited significant positive correlation among these traits. This may indicate that the direct selection for these traits would likely be effective in increasing grain yield. Similarly result recorded by Shweta *et al.*,(2011) for biological yield per hill, Nandan *et al.*,(2010) for harvest index, Ravindra Babu *et al.*, (2012) for number of panicle per plant and Naseem *et al.*, (2014) for spikelet per plant.

In conclusion, the path analysis indicates that the highest positive direct effect on grain yield per plant with number of panicles per plant, grain length and width ratio, biological yield per plant, grain width, 1000 grain weight, filled spikelet per plant, days to maturity and time of 50% heading could be used as selection for their improvement.

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