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Correlation and Path Analysis in Indian Barnyard Millet (*Echinochloa frumentacea* (L.)) Germplasm

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ABSTRACT

Sixty four genotypes were evaluated to determine correlation and path analysis among the grain yield and its attributing characters. Correlation analysis disclose that the grain yield per plant had positive significant correlation with majority of traits like basal tillers (r_p= 0.182** and r_g=0.2201**), 1000 seed weight (r_p=0.2369* and r_g=0.2923**), Panicle weight per plant (r_p=0.7476** and r_g=0.8398**), Peduncle length (r_p=0.1944** and r_g= 0.2058**) at both genotypic and phenotypic levels. It means that these characters are predominantly controlled by additive gene action and hence selection for these traits will lead to the improvement in grain yield. The path analysis showed that traits like panicle length (P= 0.0284 and G=0.1026), test weight (P=0.0773 and G= 0.0568), panicle weight per plant (P=0.7727 and G=0.8396), calcium (P=0.1055 and G=1029), iron (P=0.1813 and G= 0.1268) recorded on grain yield per plant with high positive direct effect suggesting the importance of selection for these characters can be done directly.

Keywords Correlation coefficient, Barnyard millet, Path analysis.

INTRODUCTION

Millets are the oldest cultivated foods known to humans and have traditionally been the main food for the poor people. Barnyard millet is an ancient millet crop widely cultivated in Asia, particularly India, China, Japan and Korea. It is the fourth most produced minor millet, providing food security to many poor people across the world. Globally, India is the biggest producer of barnyard millet, both in terms of area (0.146 m ha^{-1}) and production (0.147 mt) with average productivity of 1034 kg/ha during the last 3 years (ICAR 2018). The major barnyard millet producing states in India are Uttarakhand, Madhya Pradesh, Karnataka, Uttar Pradesh and North east region of India.

Now a days the crop gained importance due to its rich nutritional profile and high dietary fiber content. Watanable (1999) stated that the importance of

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barnyard millet has increased due to its highly rich nutritious grains and presence of strong antioxidative compounds. The barnyard millet contains 10.5% protein, 3.6% fat, 68.8% carbohydrate and 398 kcal/100 g energy. The dietary fiber content was high (12.6%) including soluble (4.2%) and insoluble (8.4%) fractions. Indian barnyard millet contains between 51.5% to 59.5% starch (Ugare *et al.* 2014). Due its economic importance, the efforts are on going by the researcher for improving the grain yield.

Studies on character association provide cognition of correlation among different traits and yield which results in selecting genotypes possessing desired traits for genetic improvement of grain yield. The path analysis is nothing but a standardized partial regression of coefficient which splits the correlation coefficient into the indirect and direct effects. The present study is to investigate the association and path coefficient analysis in different diverged genotypes of barnyard millet to develop a criterion for selection that could be constructively used for selecting the favorable genotypes with higher yield potential in future.

MATERIALS AND METHODS

Sixty four genetic resources of Indian barnyard millet were studied during *kharif* 2020 in a lattice square design, twice replicated at RARS, Nandyal – ANGRAU. The genotype was sown by a two row plot of 3 m length with inter spacing with 22.5 cm and intra-row spacing with 10 cm. On randomly five selected plants of each genotypes in two replication, data were collected for 18 quantitative traits like days to 50% flowering, Basal tillers, Days to maturity, Peduncle length (cm), Flag leaf blade length (cm), Flag leaf blade width (cm), Plant height (cm), Panicle length (cm), 1000 seed weight (g), Panicle weight/plant (g), Harvest index (%), Lower raceme length (cm), Grain yield/plant (g), Phosphorus, Calcium, Iron, Zinc mg/100 g, Protein %. The data were analyzed through software - WINDOWSTAT 9.2 version.

RESULTS AND DISCUSSION

Correlation analysis

The correlation at phenotypic and genotypic level was estimated between yield and its attributes was represented in the Table 1 and Figs. 1–2. The results disclose that for all the character studied, phenotypic correlations are lower than their corresponding genotypic correlations. It indicates that polygene controlling the characters were similar and environmental influence on traits might be minimal. Grain yield shows positive significant correlation with basal tillers (r_p= 0.182** and r_g=0.2201**), 1000 seed weight (r_p=0.2369* and r_g=0.2923**), Panicle weight per plant (r_p=0.7476** and r_g=0.8398**), Peduncle length (r_p=0.1944** and r_g= 0.2058**) at both levels i.e., genotypic and phenotypic. It means that these traits are predominantly controlled by additive gene effect and therefore selection for these characters will lead to the enhancement in grain yield. Same finding were registered by (Rao and Agrawal 2000) for basal tillers, (Jyothi *et al.* 2020) for test weight and panicle weight / plant, (Amarnath *et al*. 2018, Negi *et al.* 2016, Nandini *et al*. 2016, Joshi *et al.* 2015) for 1000 seed weight and (Amarnath *et al.* 2018) for peduncle length.

Path coefficient analysis

Path analysis is a statistical technique that divided the correlation coefficient into direct and indirect effects. The direct and indirect effects of the yield attributing component on grain yield plant^{-1} at both phenotypic and genotypic levels are furnish in the Table 2 and Figs. 3–4. At genotypic and phenotypic levels, panicle length (P= 0.0284 and G=0.1026), 1000 seed weight (P=0.0773 and G= 0.0568), panicle weight per plant (P=0.7727 and G=0.8396), calcium (P=0.1055 and G=1029), iron (P=0.1813 and G= 0.1268) registered positive direct effect on grain yield plant^{-1} indicating that selection for these character could be better yield. Contrarily, negative direct effect shown by the characters like peduncle length (P=-0.0168 and G= -0.0545), plant height (P=-0.0315 and G= -0.1248), harvest index (P=-0.0987 and G=-0.0905), lower raceme length (P=-0.1318 and G= -0.0482), phosphorus (P= -0.1114 and G= -0.1424), protein (P= -0.0773 and G= -0.1446) whereas days to 50% flowering (G= -4.038), basal tillers (G-= -0.0793) at genotypical level on grain yield plant^{-1} and days to maturity (P= -0.9907), flag leaf blade length (P= -0.0222), flag leaf width (P= -0.0539) and zinc (P= -0.002) at phenotypic levels.

Table 1. Phenotypic (P) correlation and genotypic (G) correlations for yield and its attributes in 64 barnyard millet germplasm accessions. r_p= Phenotypic correlation, r_g= Genotypic correlation, *, ** Significant at 5% and 1% levels, respectively. DFF - Days to 50% flowering, BT- Basal tillers, DTM-Days to maturity, PL- Peduncle length, FLBL- Flag leaf blade length, FLBW- Flag leaf blade width, PH-Plant height, PAL- Panicle length, TSW-1000 seed weight, PW- panicle weight, HI-Harvest index, LRL-Lower raceme length, GYP- Grain yield per plant, Ph-Phosphorus mg/100 g, Ca-Calcium mg/100 g, Fe -Iron mg/100 g, Zinc-mg/100 g, Pr-Protein.

Characters	r	DFF	BT	DTM	PL	FLBL	FLBW	PH	PAL	TSW
DFF	r_p	1	-0.1093	0.9976**	0.0708	0.1900*	0.2193*	0.3800**	-0.0074	-0.0397
	r_g	1	-0.1187	0.9998**	0.0994	0.2023*	0.2556**	0.4038**	-0.0083	-0.0581
BT	r_p		1	-0.1025	0.2441**	0.2192*	0.0152	0.0963	0.2464**	-0.0481
	r_g		1	-0.1158	0.2711**	0.2401**	0.0065	0.0937	0.2316**	-0.0700
DTM	r_p			1	0.0658	0.1870*	0.2131*	0.3681**	-0.0173	-0.0420
	r_g			1	0.1023	0.1975*	0.2508**	0.3939**	-0.0224	-0.0575
PL	r_p				1	0.1351	0.0252	0.1810*	0.2512**	0.1355
	r_g				1	0.1657	-0.0098	0.1796*	0.2717**	0.1658
FLBL	r_p					1	0.2090*	0.2622**	0.2236*	-0.1410
	r_g					1	0.1715	0.3123**	0.2402**	-0.1324
FLBW	r_p						1	0.1876*	0.1200	0.1455
	r_g						1	0.2120	0.1631	0.2008
PH	r_p							1	0.4499**	-0.0220
	r_g							1	0.4892**	-0.0407
PAL	r_p								1	0.0816
	r_g								1	0.0786
TSW	r_p									1
	r_g									1
PW	r_p									
	r_g									
HI	r_p									
	r_g									
LRL	r_p									
	r_g									
Phs	r_p									
	r_g									
Ca	r_p									
	r_g									
Fe	r_p									
	r_g									
Zinc	r_p									
	r_g									
Pr	r_p									
	r_g									
GYP	r_p									
	r_g									

Table 1. Continued.

Characters	r	PW	HI	LRL	Phs	Ca	Fe	Zinc	Pr	GYP
DFF	r_p	0.0327	0.0272	-0.3111**	-0.1116	-0.1376	0.0628	-0.0390	-0.0862	-0.0887
	r_g	0.0383	0.0512	-0.3322**	-0.1077	-0.1602	0.0620	-0.0443	-0.0857	-0.0932
BT	r_p	0.1986*	-0.2447**	0.3072**	0.1057	0.3237**	0.0043	0.3088**	-0.0863	0.182**
	r_g	0.2276**	-0.3330**	0.3268**	0.1134	0.3472**	0.0171	0.3290**	-0.0951	0.2201**
DTM	r_p	0.0310	0.0235	-0.3161**	-0.1059	-0.1404	0.0692	-0.0424	-0.0820	-0.0931
	r_g	0.0393	0.0443	-0.3447**	-0.0995	-0.1603	0.0701	-0.0487	-0.0826	-0.0936
PL	r_p	0.2925**	-0.0218	0.3583**	0.0975	0.1336	0.0937	0.0243	-0.0396	0.1944**
	r_g	0.3003**	-0.0337	0.4114**	0.1287	0.1436	0.1406	0.0242	-0.0421	0.2058**
FLBL	r_p	0.0483	-0.1291	0.0001	-0.0632	0.2088*	0.0161	0.0669	0.1545	0.0022
	r_g	0.0084	-0.1016	-0.0154	-0.0908	0.2736**	0.0288	0.0597	0.1736	0.0305

Table 1. Continued.

Characters	r	PW	HI	LRL	Phs	Ca	Fe	Zinc	Pr	GYP
FLBW	r_p	0.1344	-0.0380	-0.1776*	-0.0027	0.0802	0.0530	-0.2280**	0.0946	0.0683
	r_g	0.0993	-0.0429	-0.1844	-0.0186	0.0489	0.0917	-0.2596	0.1101	0.1158
PH	r_p	0.1271	0.2000*	0.1489	-0.0506	0.1346	0.0245	-0.0645	0.1287	-0.0047
	r_g	0.1183	0.2440*	0.1397	-0.0450	0.1339	0.0536	-0.0712	0.1350	-0.0756
PAL	r_p	0.1835*	-0.0527	0.3972**	0.0555	-0.0115	0.2340**	0.0435	0.0737	0.1438
	r_g	0.2082*	-0.0586	0.4410**	0.0574	-0.0114	0.2896**	0.0479	0.0736	0.1663
TSW	r_p	0.1858*	-0.1302	0.1890*	0.1617	0.0914	0.0645	-0.0383	-0.2826**	0.2369**
	r_g	0.2066*	-0.1824	0.2143*	0.1838*	0.0690	0.0700	-0.0244	-0.3003**	0.2923**
PW	r_p	1	0.0803	0.2129*	-0.0644	0.0570	-0.0722	0.1272	-0.1030	0.7476**
	r_g	1	0.0637	0.2408	-0.0574	0.0082	-0.0592	0.1441	-0.1168	0.8398**
HI	r_p		1	-0.1833*	-0.1307	-0.0775	-0.1722	0.0261	0.0908	-0.0611
	r_g		1	-0.2379**	-0.1615	-0.1406	-0.1786*	0.0353	0.0995	-0.1149
LRL	r_p			1	0.0941	0.1167	0.1263	0.1401	0.0275	0.1507
	r_g			1	0.1041	0.1019	0.1625	0.1346	0.0210	0.1705*
Phs	r_p				1	-0.0149	-0.0181	0.0957	-0.1922*	-0.1238
	r_g				1	0.0010	-0.0375	0.1061	-0.1965*	-0.1063
Ca	r_p					1	-0.2173*	0.2689**	0.0247	0.1203
	r_g					1	-0.2468**	0.3183**	0.0316	0.0963
Fe	r_p						1	0.0667	0.0750	0.0903
	r_g						1	0.0807	0.0973	0.106
Zinc	r_p							1	-0.1609	0.1437
	r_g							1	-0.1658	0.1824*
Pr	r_p								1	-0.1574
	r_g								1	-0.1909*
GYP	r_p									1
	r_g									1

Table 2. Phenotypic (P) and genotypic (G) path coefficient for yield and it attributes in 64 barnyard millet germplasm accession. Residual effect (phenotypic)=0.588, Residual effect (genotypic)=0.424, Diagonal values = Direct values off –Diagonal values = Indirect effect, *,** Significant at 0.05 and 0.01 levels respectively. DFF-Days to 50% flowering, BT-Basal tillers, DTM-Days to maturity, PL- Peduncle length, FLBL - Flag leaf blade length, FLBW-Flag leaf blade width, PH-Plant height, PAL-Panicle length, TSW-1000 seed weight, PW-Panicle weight, HI-Harvest index, LRL-Lower raceme length, GYP-Grain yield per plant , Ph-Phosphorus mg/100 g, Ca- Calcium mg/100 g, Fe-Iron mg/100 g, Zinc-mg/100 g, Pr- Protein %.

Characters		DFF	BT	DTM	PL	FLBL	FLBW	PH	PAL	TSW
DFF	P	**0.8543**	-0.0018	-0.9883	-0.0012	-0.0042	-0.0118	-0.012	-0.0002	-0.0031
	G	**-4.0388**	0.0094	3.9033	-0.0054	0.015	0.018	-0.0504	-0.0008	-0.0033
BT	P	-0.0934	**0.0165**	0.1016	-0.0041	-0.0049	-0.0008	-0.003	0.007	-0.0037
	G	0.4793	**-0.0793**	-0.4519	-0.0148	0.0178	0.0005	-0.0117	0.0238	-0.004
DTM	P	0.8522	-0.0017	**-0.9907**	-0.0011	-0.0041	-0.0115	-0.0116	-0.0005	-0.0032
	G	-4.039	0.0092	**3.9031**	-0.0056	0.0146	0.0177	-0.0492	-0.0023	-0.0033
PL	P	0.0605	0.004	-0.0652	**-0.0168**	-0.003	-0.0014	-0.0057	0.0071	0.0105
	G	-0.4012	-0.0215	0.3994	**-0.0545**	0.0123	-0.0007	-0.0224	0.0279	0.0094
FLBL	P	0.1623	0.0036	-0.1853	-0.0023	**-0.0222**	-0.0113	-0.0083	0.0063	-0.0109
	G	-0.8167	-0.019	0.771	-0.009	**0.074**	0.0121	-0.039	0.0247	-0.0075
FLBW	P	0.1874	0.0003	-0.2112	-0.0004	-0.0046	**-0.0539**	-0.0059	0.0034	0.0112
	G	-1.0322	-0.0005	0.979	0.0005	0.0127	**0.0704**	-0.0265	0.0167	0.0114
PH	P	0.3246	0.0016	-0.3647	-0.003	-0.0058	-0.0101	**-0.0315**	0.0128	-0.0017
	G	-1.6309	-0.0074	1.5376	-0.0098	0.0231	0.0149	**-0.1248**	0.0502	-0.0023
PAL	P	-0.0063	0.0041	0.0172	-0.0042	-0.005	-0.0065	-0.0142	**0.0284**	0.0063
	G	0.0333	-0.0184	-0.0875	-0.0148	0.0178	0.0115	-0.0611	**0.1026**	0.0045
TSW	P	-0.0339	-0.0008	0.0416	-0.0023	0.0031	-0.0078	0.0007	0.0023	**0.0773**
	G	0.2347	0.0056	-0.2245	-0.009	-0.0098	0.0141	0.0051	0.0081	**0.0568**

Table 2. Continued.

Characters		DFF	BT	DTM	PL	FLBL	FLBW	PH	PAL	TSW
PW	P	0.0279	0.0033	-0.0307	-0.0049	-0.0011	-0.0073	-0.004	0.0052	0.0144
	G	-0.1541	-0.018	0.1532	-0.0164	0.0006	0.007	-0.0148	0.0214	0.0117
HI	P	0.0232	-0.004	-0.0233	0.0004	0.0029	0.002	-0.0063	-0.0015	-0.0101
	G	-0.2068	0.0264	0.173	0.0018	-0.0075	-0.003	-0.0305	-0.006	-0.0104
LRL	P	-0.2658	0.0051	0.3132	-0.006	0	0.0096	-0.0047	0.0113	0.0146
	G	1.3418	-0.0259	-1.3456	-0.0224	-0.0011	-0.013	-0.0174	0.0453	0.0122
Phs	P	-0.0954	0.0017	0.1049	-0.0016	0.0014	0.0001	0.0016	0.0016	0.0125
	G	0.4349	-0.009	-0.3882	-0.007	-0.0067	-0.0013	0.0056	0.0059	0.0104
Ca	P	-0.1175	0.0053	0.1391	-0.0022	-0.0046	-0.0043	-0.0042	-0.0003	0.0071
	G	0.6472	-0.0275	-0.6257	-0.0078	0.0202	0.0034	-0.0167	-0.0012	0.0039
Fe	P	0.0536	0.0001	-0.0686	-0.0016	-0.0004	-0.0029	-0.0008	0.0066	0.005
	G	-0.2504	-0.0014	0.2738	-0.0077	0.0021	0.0065	-0.0067	0.0297	0.004
Zinc	P	-0.0333	0.0051	0.042	-0.0004	-0.0015	0.0123	0.002	0.0012	-0.003
	G	0.1789	-0.0261	-0.1902	-0.0013	0.0044	-0.0183	0.0089	0.0049	-0.0014
Pr	P	-0.0736	-0.0014	0.0812	0.0007	-0.0034	-0.0051	-0.0041	0.0021	-0.0218
	G	0.3462	0.0075	-0.3222	0.0023	0.0128	0.0078	-0.0169	0.0076	-0.0171

Table 2. Continued.

Characters		PW	HI	LRL	Phs	Ca	Fe	Zinc	Pr	GYP
DFF	P	0.0253	0.0027	0.041	0.0124	-0.0145	0.0114	0	0.0067	**-0.0887**
	G	0.032	-0.0046	0.016	0.0153	-0.0165	0.0079	-0.0026	0.0124	**-0.0932**
BT	P	0.1534	0.0242	-0.0405	-0.0118	0.0342	0.0008	-0.0001	0.0067	**0.182***
	G	0.1911	0.0301	-0.0158	-0.0162	0.0357	0.0022	0.0195	0.0137	**0.2201****
DTM	P	0.024	-0.0023	0.0417	0.0118	-0.0148	0.0126	0.000	0.0063	**-0.0931**
	G	0.033	-0.004	0.0166	0.0142	-0.0165	0.0089	-0.0029	0.0119	**-0.0936**
PL	P	0.2261	0.0022	-0.0472	-0.0109	0.0141	0.017	0.000	0.0031	**0.1944***
	G	0.2521	0.003	-0.0199	-0.0183	0.0148	0.0178	0.0014	0.0061	**0.2058***
FLBL	P	0.0373	0.0127	0	0.007	0.022	0.0029	0.000	-0.012	**0.0022**
	G	0.007	0.0092	0.0007	0.0129	0.0281	0.0037	0.0035	-0.0251	**0.0305**
FLBW	P	0.1039	0.0037	0.0234	0.0003	0.0085	0.0096	0.0001	-0.0073	**0.0683**
	G	0.0834	0.0039	0.0089	0.0026	0.005	0.0116	-0.0154	-0.0159	**0.1158**
PH	P	0.0982	-0.0197	-0.0196	0.0056	0.0142	0.0044	0.000	-0.01	**-0.0047**
	G	0.0994	-0.0221	-0.0067	0.0064	0.0138	0.0068	-0.0042	-0.0195	**-0.0756**
PAL	P	0.1418	0.0052	-0.0523	-0.0062	-0.0012	0.0424	0.000	-0.0057	**0.1438**
	G	0.1748	0.0053	-0.0213	-0.0082	-0.0012	0.0367	0.0028	-0.0106	**0.1663**
TSW	P	0.1436	0.0129	-0.0249	-0.018	0.0096	0.0117	0.000	0.0219	**0.2369****
	G	0.1735	0.0165	-0.0103	-0.0262	0.0071	0.0089	-0.0014	0.0434	**0.2923****
PW	P	**0.7727**	-0.0079	-0.0281	0.0072	0.006	-0.0131	0.000	0.008	**0.7476****
	G	**0.8396**	-0.0058	-0.0116	0.0082	0.0008	-0.0075	0.0086	0.0169	**0.8398****
HI	P	0.062	**-0.0987**	0.0241	0.0146	-0.0082	-0.0312	0.0000	-0.007	**-0.0611**
	G	0.0535	**-0.0905**	0.0115	0.023	-0.0145	-0.0226	0.0021	-0.0144	**-0.1149**
LRL	P	0.1645	0.0181	**-0.1318**	-0.0105	0.0123	0.0229	0.0000	-0.0021	**0.1507**
	G	0.2022	0.0215	**-0.0482**	-0.0148	0.0105	0.0206	0.008	-0.003	**0.1705**
Phs	P	-0.0498	0.0129	-0.0124	**-0.1114**	-0.0016	-0.0033	0.0000	0.0149	**-0.1238**
	G	-0.0482	0.0146	-0.005	**-0.1424**	0.0001	-0.0048	0.0063	0.0284	**-0.1063**
Ca	P	0.044	0.0076	-0.0154	0.0017	**0.1055**	-0.0394	-0.0001	-0.0019	**0.1203**
	G	0.0069	0.0127	-0.0049	-0.0001	**0.1029**	-0.0313	0.0189	-0.0046	**0.0963**
Fe	P	-0.0558	0.017	-0.0166	0.002	-0.0229	**0.1813**	0.000	-0.0058	**0.0903**
	G	-0.0497	0.0162	-0.0078	0.0053	-0.0254	**0.1268**	0.0048	-0.0141	**0.106**
Zinc	P	0.0983	-0.0026	-0.0185	-0.0107	0.0284	0.0121	**-0.0002**	0.0124	**0.1437**
	G	0.121	-0.0032	-0.0065	-0.0151	0.0328	0.0102	**0.0594**	0.024	**0.1824***
Pr	P	-0.0796	-0.009	-0.0036	0.0214	0.0026	0.0136	0.0000	**-0.0773**	**-0.1574**
	G	-0.098	-0.009	-0.001	0.028	0.0033	0.0123	-0.0098	**-0.1446**	**-0.1909***

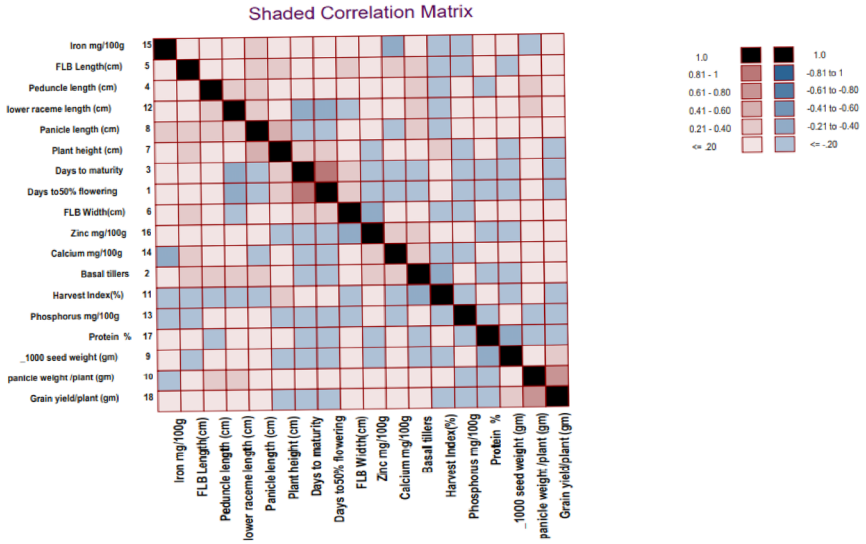

Fig. 1. Shaded phenotypic correlation matrix for all the characters studied in barnyard millet germplasm.

Similar finding were reported by Renganathan *et al.* (2017), Prakash and Vanniarajan (2015), Vikram *et al.* (2020) for panicle weight / plant (Eric *et al.* 2016), (Negi *et al.* 2016), (Nandini *et al.* 2010), (Shingane *et al.* 2017), (Jadhav *et al.* 2015) for 1000 seed weight (Nirmalakumari and Vetriventhan 2010), (Vikram *et*

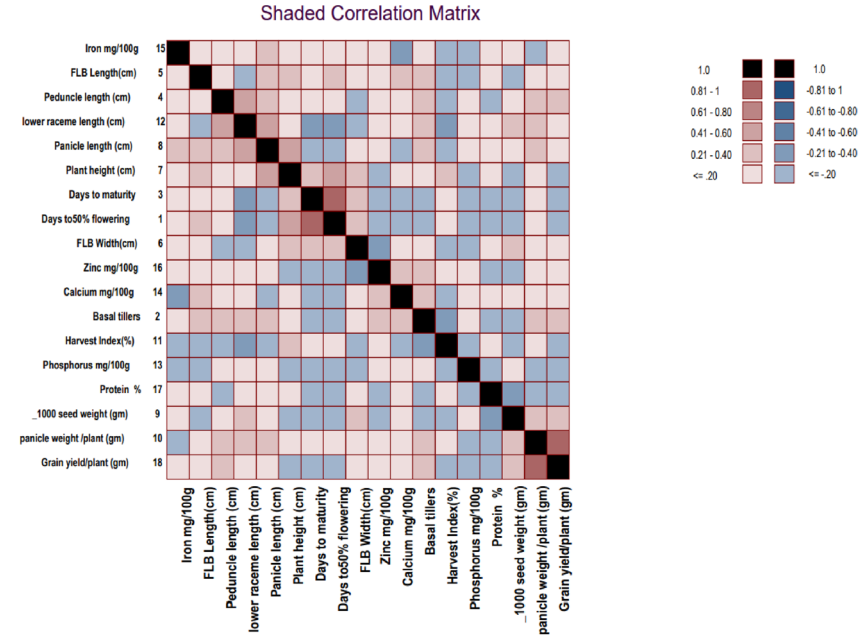

Fig. 2. Shaded genotypic correlation matrix for all the traits studied in barnyard millet germplasm.

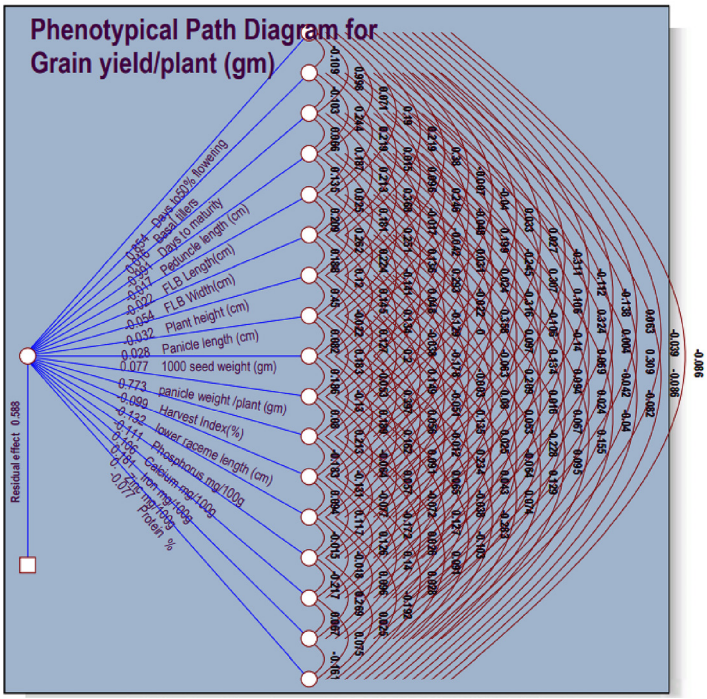

Fig. 3. Phenotypical path diagram for grain yield plant^{-1}.

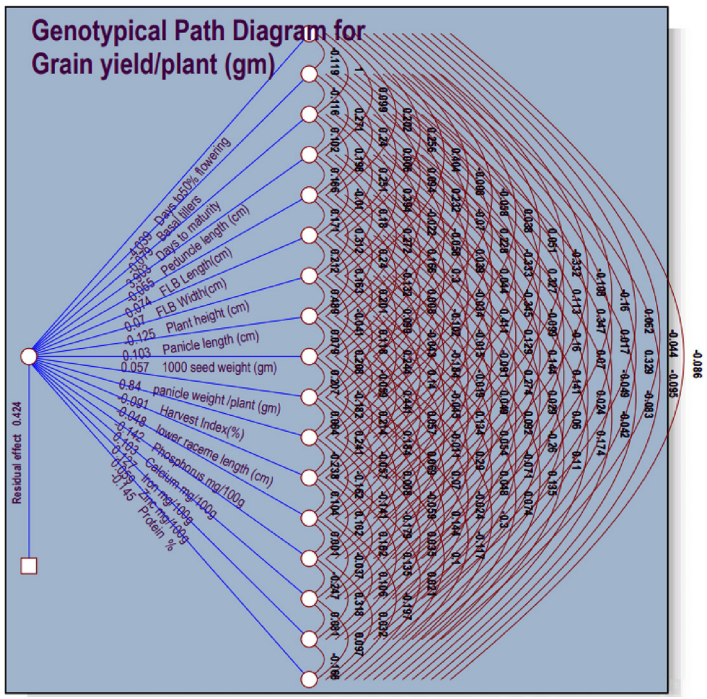

Fig. 4. Genotypical path diagram for grain yield plant^{-1}.

al. 2020) for panicle length.

CONCLUSION

Based on the studies the traits like test weight and panicle weight has positive correlation and direct effects on grain yield. Selection of these traits could be benefited for crop improvement program.

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REFERENCES

Amarnath K, Prasad AVSD, Reddy CVCM (2018) Character association and path analysis in foxtail millet genetic resources (*Setaria italica* (L.) Beauv). *Int J Chem Studies* 6 (5) : 3174—3178.

Eric MO, Pangirayi T, Paul S, Mwangi G, Abishek R (2016) Correlation and path coefficient traits in finger millet land races. *Phillippines J Sci* 145 (2) : 197—208.

ICAR (2018) Indian Institute of Millets Research. Annual report : 2017—2018. Rajendranagar, Hyderabad, pp 11—13.

Jadhav R, Babu RD, Ahamed ML, Rao SV (2015) Character association and path coefficient analysis for grain yield and yield components in finger millet (*Eleucine coracana* (L.) Gaertn). *Elect J Pl Breed* 6 (2) : 535—539.

Joshi RP, Jain AK, Chauhan SS, Singh G (2015) Characterization of barnyard millet (*Echinochloa frumentacea* (Roxb.) Link.) landraces for agro- morphological traits and disease resistance. *Elect J Pl Breed* 6 (4) : 888—898.

Jyothi T, Kanwar RR, Kumar Shyam (2020) Studies of correlation between yield and yield attributing characters of Kodo millet (*Paspalum scrobiculatum* L.). *J Pharmacog Phytochem* 9 (6) : 1919—1922.

Nandini B, Ravishankar CR, Mahesh B, Hittalmani S, Murty KKN (2010) Study of correlation and path analysis in F_2 population of finger millet. *Int J Pl Sci* 5 (2) : 602—605.

Nandini C, Sujata B, Krishnappa M, Aruna YR (2016) Genetic variability, heritability, genetic advance and character association studies in F_3 generation of cross JK8 × Peddasame (purple late) in little millet (*Panicum miliare* L.). *Asian J Biosci* 11 (2) : 244—249.

Negi AS, Pandey PK, Shrotria PK (2016) Correlation and path coefficient analysis of component attributes in finger millet (*Eleusine coracana* (L.) Gaertn). *Environ Ecol* 34 (4A) : 1852—1856.

Nirmala Kumari A, Vetriventhan M (2010) Characterization of foxtail millet germplasm collections for yield contributing triats. *Elect J Pl Breed* 1 (2) : 140—147.

Prakash R, Vanniarajan C (2015) Path analysis for grain yield in barnyard millet (*Echinochloa frumentacea* Roxb. Link). *Bangladesh J Bot* 44 (1) : 147—150.

Rao SS, Agrawal AP (2000) Genetic variability, correlation and path coefficient studies in barnyard millet (*Echinochloa frumentacea*). *J Agricult Sci* 1 : 27—31.

Renganathan VG, Vanniarajan C, Nirmala Kumari A, Raveendran M, Thiyageshwari S, Arunachalam P (2017) Association analysis in germplasm and F_2 segregating population of barnyard millet (*Echinochloa frumentacea* Roxb. Link) for biometrical and nutritional traits. *Int J Curr Microbiol Appl Sci* 6 (8) : 3394—3400.

Shingane S, Gomashe S, Ganapathy KN, Patil JV (2017) Genetic variability and association analysis for grain yield and nutritional quality in foxtail millet. *Int J Bio-res Stress Manag* 7 (6) : 1239—1243.

Ugare R, Chimmad B, Naik R, Bharati P, Itagi S (2014) Glycemic index and significance of barnyard millet (*Echinochloa frumentacea*) in type II Diabetics. *J Food Sci Technol* 51(2) : In press.

Vikram S, Sudhagar R, Masilamani P, Vanniarajan C (2020) Genetic variability and association analysis in barnyard millet mutants. *Elect J Pl Breed* 11(1) : 210—216.

Watanable M (1999) Antioxidative phenolic compounds from Japanese barnyard millet (*Echinochloa utilis*) grains. *J Agricult Food Chem* 47 (11) : 4500—4505.