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Correlation and path analysis in upland cotton (*Gossypium hirsutum* L.)

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ABSTRACT : The present investigation was undertaken by line x testers analysis involving 7 diverse line and 4 diverse testers to estimate extent of heterosis for yield and its quantitative traits. For this purpose, 28 hybrids were developed by using 11 parents during in summer 2012. These 28 hybrids along with 11 parents and 2 checks NHH 44 and DCH 32 were planted in *kharif* 2013. The significant positive association of monopodia, sympodia and bolls/plant, boll weight, ginning percentage, with seed cotton yield/plant obtained in the present study. Boll weight has significant and positive association with ginning percentage and uniformity ratio. Significant negative association of uniformity ratio and micronaire value with fibre strength. Path coefficient analysis revealed that monopodia, sympodia and bolls/plant and ginning percentage were found to have maximum direct positive effect on seed cotton yield and bolls/plant exhibited indirect effect on seed cotton yield *viz.,* fibre length, sympodia and monopodia/plant height.

Key words : Correlation, path analysis, upland cotton

Cotton is an important commercial crop of the country is called as 'White Gold'. It occupies a unique position among the textile fibres. It plays a key role in the national economy in terms of its contribution in trade, industrial activities, employment and foreign exchange earnings. The average productivity of cotton in India is lowest among cotton growing nations of the world. In order to increase the yield potential of cotton varieties, it is always desirable to understand and to identify different yield attributes. Feed back regarding inter relationships among yield and yield contributing attributes and their relative contribution towards yield will further help refining cotton plant improvement procedures. Therefore, the present investigation was conducted to obtain information on correlation and direct and indirect effects of different attributes and seed cotton yield for utilization in the improvement of crop.

MATERIALS AND METHODS

The experiment material for correlation and path analysis studies comprised of 11 parents which included 7 *Gossypium hirsutum* lines *viz.,* NH 545, NH 615, NH 630, NH 635, PH 1060, PH 1076, LRA 5166 and 4 testers out of which 3 were *Gossypium hirsutum viz.,* NH 452, NH 625, PKV Rajat and one was *G. barbadense* type *i.e.* Suvin and their 28 hybrids with 2 standard checks *viz.,* NHH 44 and DCH 32. All 41 entries ($28F_1$'s + 11 parents + 2 checks) were evaluated during *kharif* 2013-2014, at Cotton Research Scheme, V.N.M.K.V, Parbhani.

The experiment were planted in randomized block design with 3 replications under rainfed conditions. Each entry was sown in 2 rows in each replication with 10 dibbles/ row. The row length was 6.0 m. The spacing was 60 cm between rows and 60 cm between plant to plant. Observation recorded *viz.,* days to 50 per

cent flowering, monopodia, sympodia and bolls/ plant, plant height, days to maturity, boll weight, ginning percentage, micronaire value, fibre length, uniformity ratio, fibre strength, seed cotton yield/plant and (q/ha). Data were recorded on 5 randomly selected plant from each entry from all replication and mean of 5 plants was taken for further analysis.

RESULTS AND DISCUSSION

The significant positive association of monopodia, sympodia and bolls/ plant, boll weight, and ginning percentage with seed cotton yield/ plant obtained in the present study (Table 1). The significant and negative association of days to 50 per cent flowering, days to maturity, fiber length and fiber strength with seed cotton yield / plant at genotypic and phenotypic level. Contrary finding of significant and positive association with seed cotton yield/ plant were also given by Patnaik and Sial (2010) and Lal and Singh (2012).

Positive significant association of boll weight at genotypic and phenotypic level with seed cotton yield/plant was noticed in the present study (Table 1). Ginning percentage showed significant positive association with seed cotton yield (Table 1).

Negative and significant association between fiber strength with seed cotton yield/ plant was observed. In present study positive fibre strenght with high seed cotton yield / plant was recorded in the crosses NH 615 x Suvin and PH 1076 x Suvin conformation should be done in future. In the present study, sympodia/plant exhibited significant and positive association with bolls/plant and ginning percentage.

Boll weight has significant and positive association with ginning percentage and uniformity ratio and positive and non significant with micronaire value. Ginning percentage had significant positive association with microniare value (Table 1).

The character, micronaire value exhibited negative association with fibre strength. The less micronaire with value is desirable in cotton improvement programmes . In the present study less micronaire value with high fiber strength was recorded in the crosses PH 1060 x Suvin and PH 1076 x Suvin. The crosses should evaluate for fiber quality characters in future. The character fibre strength exhibited significant and negative association with seed cotton yield. These results was confirmed with the results of Rajmani *et al.,* (2013).

Seed cotton yield/plant showed significant positive correlation with monopodia, sympodia and bolls/ plant, boll weight, plant height and ginning percentage (Table 1). These finding are in agreement with Khan *et al.,* (2009), Mendez-Natera *et al.,* (2012) and Rajamani *et al.,* (2013).

Monopodia, sympodia and bolls/ plant and ginning percentage were found to have maximum direct positive effect on seed cotton yield/plant (Table 2). These results are in agreement with the results reported by Rajamani *et al.,* (2013). The bolls/plant had highest positive direct effect on seed cotton yield/plant followed by boll weight (Table 2). Similar result reported by Singh *et al.,* (2009).

In the present study, bolls/plant exhibited indirect effect on seed cotton yield/ plant *via* sympodia (Table 2). These results are in agreement with Lal and Singh (2012).

The sympodia/plant had exhibited positive indirect effect on seed cotton yield *via* bolls/plant (Table 2). Similar findings were reported by Patnaik and Sial (2010).

Among the fibre quality traits, fibre

Table 1. Phenotypic and genotypic correlation coefficients among seed cotton yield/plant and other characters in cotton

Characters	Monopodia/ plant	Sympodia/ plant	Plant height (cm)	Days to maturity	Boll weight (g)	Bolls/ plant	Ginning (%)	Micron-aire value (µg/ inch)	Fibre length (mm)	Uniformity ratio	Fibre strength (g/tex)	Seed cotton yield/ plant (g)
Days to 50 per cent flowering	0.001 (-0.089)	0.008 (-0.037)	0.156 (0.196*)	0.460** (0.485**)	-0.501** (-0.530**)	0.122 -0.159	-0.327** (-0.559**)	-0.093 (-0.129)	0.525** (0.569**)	-0.353** (-0.550**)	0.620** (0.736**)	-0.346** (-0.365**)
Monopodia/plant		0.016 (0.194*)	0.207* (0.425**)	-0.067 (-0.149)	0.038 -0.038	0.252** (0.554**)	0.044 (0.628**)	-0.003 -0.115	-0.087 (-0.210*)	-0.026 (-0.010)	-0.051 -0.016	0.258** (0.543**)
Sympodia/ plant			0.129 (0.472**)	-0.05 (-0.063)	-0.007 -0.022	0.293** (0.403**)	0.184* (0.405**)	0.075 -0.062	0.037 -0.057	-0.066 (-0.148)	-0.051 (-0.079)	0.271** (0.348**)
Plant height (cm)				0.084 -0.085	-0.024 (-0.051)	0.286** (0.368**)	0.132 (0.221*)	-0.036 (-0.034)	0.229* (0.253**)	-0.109 (-0.128)	0.251** (0.312**)	0.165 (0.183*)
Days to maturity					-0.630** (-0.668**)	-0.059 (-0.050)	-0.319** (-0.552**)	-0.136 (-0.152)	0.747** (0.761**)	-0.294** (-0.387**)	0.485** (0.525**)	-0.525** (-0.534**)
Boll weight (g)						0.139 -0.168	0.187* (0.435**)	0.037 -0.061	-0.456** (-0.484**)	0.314** (0.443**)	-0.405** (-0.472**)	0.582** (0.621**)
Bolls/plant							0.052 (0.227*)	0.011 -0.013	0.078 -0.08	-0.144 (-0.212*)	0.196* (0.230*)	0.715** (0.780**)
Ginning percentage (%)								0.304** (0.460**)	-0.408** (-0.661**)	0.066 -0.168	-0.250** (-0.516**)	0.313** (0.524**)
Micronaire value(µg/ inch)									-0.360** (0.381**)	0.132 (0.209*)	-0.108 (-0.120)	0.127 -0.139
Fibre length (mm)										-0.361** (-0.495**)	0.445** (0.479**)	-0.324** (-0.329**)
Uniformity ratio											-0.359** (-0.456**)	0.044 -0.08
Fibre strength (g/tex)												-0.218* (-0.235**)

*Significant at 5% level, **Significant at 1% level respectively; The values in the parenthesis are genotypic correlations

Table 2. Phenotypic and genotypic path coefficients for yield contributing and fibre quality characters in cotton

Characters	Days to 50 per cent flowering	Monopodia/ plant	Sympodia/ plant	Plant height (cm)	Days to maturity	Boll weight (g)	Bolls/ plant	Ginning (%)	Micron-aire value (µg/ inch)	Fibre length (mm)	Uniformity ratio	Fibre strength (g/tex)	Seed cotton yield/ plant (g)
Days to 50 per cent flowering	**-0.203** **-0.455**	0 (-0.040)	-0.001 (-0.017)	-0.031 -0.089	0.093 -0.221	0.101 (-0.241)	-0.024 -0.072	0.066 (-0.254)	0.019 (-0.058)	-0.106 -0.259	0.071 (-0.250)	-0.126 -0.335	-0.346 (-0.365)
Monopodia/plant	0 -0.255	**0.078** **(-2.838)**	0.001 (-0.552)	0.016 (-1.206)	-0.005 -0.424	0.003 (-0.108)	0.019 (-1.574)	0.003 (-1.783)	0 (-0.326)	-0.006 -0.597	-0.002 -0.03	-0.004 (-0.046)	0.258 -0.543
Sympodia/ plant	0 -0.055	0 (-0.285)	**0.049** **(-1.467)**	0.014 (-0.692)	-0.002 -0.093	0 (-0.032)	0.014 (-0.591)	0.009 (-0.595)	0.003 (-0.091)	0.001 (-0.083)	-0.003 -0.218	-0.002 -0.116	0.271 -0.348
Plant height(cm)	-0.004 (-0.189)	-0.005 (-0.408)	-0.008 (-0.453)	**-0.028** **(-0.961)**	-0.002 (-0.082)	0 -0.049	-0.008 (-0.354)	-0.003 (-0.213)	0.001 -0.032	-0.006 (-0.243)	0.003 -0.123	-0.007 (-0.300)	0.165 -0.183
Days to maturity	-0.13 (-0.579)	0.019 -0.178	0.014 -0.075	-0.024 (-0.102)	**-0.283** **(-1.191)**	0.178 -0.796	0.016 -0.06	0.09 -0.658	0.038 -0.181	-0.211 (-0.907)	0.083 -0.461	-0.137 (-0.625)	-0.525 (-0.534)
Boll weight (g)	-0.132 -0.732	0.01 (-0.052)	-0.002 (-0.030)	-0.006 -0.071	-0.166 -0.923	**0.263** **(-1.381)**	0.036 (-0.232)	0.049 (-0.602)	0.009 (-0.085)	-0.12 -0.669	0.083 (-0.612)	-0.107 -0.652	0.582 -0.621
Bolls/plant	0.077 -0.305	0.16 -1.06	0.186 -0.77	0.182 -0.705	-0.037 (-0.096)	0.088 -0.321	**0.636** **-1.912**	0.033 -0.435	0.007 -0.026	0.049 -0.154	-0.009 (-0.407)	0.125 -0.439	0.715 -0.78
Ginning percentage (%)	-0.03 (-3.260)	0.004 -3.658	0.017 -2.363	0.0123 -1.289	-0.029 (-3.215)	0.017 -2.533	0.004 -1.325	**0.093** **-5.822**	0.028 -2.679	-0.038 (-3.851)	0.006 -0.983	-0.023 (-3.00)	0.313 -0.524
Micronaire value(µg/ inch)	-0.006 -0.178	0 (-0.159)	-0.005 (-0.086)	-0.002 -0.047	-0.009 -0.21	0.002 (-0.085)	0 (-0.019)	0.021 (-0.637)	**0.07** **(-1.384)**	-0.025 -0.528	0.009 (-0.290)	-0.007 -0.167	0.127 -0.139
Fibre length (mm)	0.06 -1.552	-0.01 (-0.573)	0.004 -0.155	0.026 -0.69	0.085 -2.076	-0.052 (-1.320)	0.009 -0.219	-0.046 (-1.802)	-0.041 (-1.040)	**0.114** **-2.725**	-0.041 (-1.350)	0.051 -1.307	-0.324 (-0.329)
Uniformity ratio	0.027 (-1.046)	0.002 (-0.020)	0.005 (-0.282)	0.008 (-0.245)	0.022 (-0.736)	-0.024 -0.842	0.011 (-0.404)	-0.005 -0.321	-0.01 -0.398	0.027 (-0.942)	**-0.076** **-1.902**	0.027 (-0.868)	0.044 -0.08
Fibre strength (g/tex)	-0.004 -1.175	0 -0.025	0 (-0.126)	-0.001 -0.498	-0.003 -0.838	0.002 (-0.753)	-0.001 -0.367	0.001 (-0.824)	0 (-0.192)	-0.003 -0.765	0.002 (-0.728)	**-0.006** **-0.522**	-0.218 (-0.235)

Bold value are direct effect; The value in the parenthesis is genotypic correlation ; Phenotypic residual effect = 0.380; Genotypic residual effect=0.619

length showed negative indirect effect on seed cotton yield *via* ginning percentage, micronaire value and uniformity ratio, while ginning percentage exhibited indirect positive effect *via* sympodia and bolls/ plant, boll weight, micronaire value and uniformity ratio on seed cotton yield/plant (Table 2).

Selection for high seed cotton yield seemed to be possible through plant height and sympodia and bolls/plant as they exerted high direct and indirect effect as well as had highly positive and significant association with seed cotton yield. The finding revealed that the major contribution of seed cotton yield was for bolls/ plant, followed by boll weight. So, these traits may be given due importance during selection for high yielding genotype.

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