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Correlation and Path Coefficient Analysis in Castor (*Ricinus communis* L.)

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ABSTRACT

India is leading country in area, production and productivity of castor crop. Castor crop is cultivated nearly 30 diverse countries in the world. Castor oil is mainly used in production of aircraft lubricants, linoleum, printer inks, paints and electrical insulations. Determination of the correlation coefficient of yield and its components is undoubtedly helpful to breeders in selecting suitable plant types based on simultaneous selection of two or more characters, a better approach of character association is the path coefficient analysis. The experimental material comprised of 68 genotypes during Rabi 2015 at Tapioca and Castor Research Station, Yethapur. Analysis of variance (ANOVA) was computed from the plot means and tests of treatment significance were done for the traits measured. The genotypic and phenotypic correlations were of comparable magnitude. Genotypic correlation was in most cases higher than the phenotypic correlation. The highest significant genotypic correlation was found between seed yield per plant and total number of spike per plant (0.39) Total number of spikes shows highest positive total indirect effect (0.386) through days to 50 % flowering, days to 50% maturity and primary spike length. Days to 50% flowering and days to 50% maturity show negative total indirect effect. But the negative total indirect effect was very low and negligible. From the results obtained, it would be reasonable to suggest the breeder who involved in increasing the seed to concentrate more on total number of spike per plant, number of capsules per primary spike, days to 50 per cent flowering and plant height.

Key word: *Ricinus communis L, Correlation analysis, Path analysis.*

INTRODUCTION

Castor is a major oilseed crop which provides major world's supply of hydroxyl fatty acids. It is cultivated nearly 30 diverse countries in the world. India, Brazil, China, Russia, Thailand and Philippines are the major cultivating countries. Castor oil is mainly used in production of aircraft lubricants, linoleum, printer inks, varnishes, nylon, hydraulic fluids, soaps, enamels, paints and electrical insulations.

Primary objective of castor research is to increase the seed yield. This is final character resulting from many developmental and biochemical processes which occur between germination and maturity.

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Before realization of yield improvements, breeder should identify the reasons for variability in seed yield in given environment. Determination of the correlation coefficient of yield and its components is undoubtedly helpful to breeders in selecting suitable plant types based on simultaneous selection of two or more characters, a better approach of character association is the path coefficient analysis[7]. Whereas correlation is simply a measurement of mutual association, without regards to causation, path coefficient analysis specifies the causation; path coefficient analysis specifies the cause and measures their relative importance. According to Dewey and Lu 1959, this technique is most useful when conditions permit its application.

MATERIAL AND METHODS

68 castor genotypes were raised during Rabi 2015 at Tapioca and Castor Research Station, Yethapur with a spacing of 90cm X 60 cm. The experiment was arranged in a randomized complete block design with two replications, in three rows plots of 6m length. The recommended agronomical practices and plant protection measures were followed to ensure a normal crop growth. Observations were recorded on five randomly selected plants in each replication.

Observation were recorded for 11 biometrical characters *viz*., days to fifty per cent flowering, days to fifty per cent maturity, plant height (cm), number of nodes upto primary spike, primary spike length (cm), effective length of primary spike (cm), total number of capsules on primary spike, total number of spikes per plant, 100 seed weight (g), oil content (%) and seed yield per plant (g). Analysis of variance (Table 1) was computed from the plot means and tests of treatment significance were done for the traits measured. Also, both phenotypic and genotypic correlations between different pairs of characters were run to determine their association. The direct and indirect correlations were partitioned according to Dewey and Lu 1959 and Wright 1968.

RESULT AND DISCUSSION

The genotypes were significant for all the characters indicating that the genotypes selected for the present study were genetically divergent. Summary of phenotypic and genotypic correlation for seed yield and ten other important agronomic traits is presented in the table 2. The genotypic and phenotypic correlations were of comparable magnitude. Genotypic correlation was in most cases higher than the phenotypic correlation. This is in accordance with the results of Nalini Tewari and Akhilesh Mishra, 2013, and this indicates that the characters were more related genotypically.

The highest significant genotypic correlation was found between seed yield per plant and total number of effective spike per plant (0.386) followed by number of capsules per primary spike (0.366). Similar result was observed by Nalini Tiwari and Akhilesh Misra[5]. There is also positive correlation between seed yield and plant height (0.164), number of nodes per plant (0.143), length of primary spike (0.209), effective length of primary spike (0.225), 100 seed weight (0.186) and oil content (0.224). There is a negative correlation between seed yield and days to 50% flowering (-0.03) and days to 50% maturity (-0.01)

Table 3 shows the combined summary of the direct and indirect effects of 10 agronomic traits on castor seed yield. This table shows that, plant height, number of nodes to primary raceme, effective length of primary spike, number of capsule per plant, total number of spike and 100 seed weight had significant positive direct path coefficients with seed yield. The direct association of traits viz., days to 50% flowering, days to 50% maturity, length of primary spike and oil content had negative path coefficient with seed yield.

Total number of spikes shows highest positive total indirect effect (0.386) through days to 50% flowering, days to 50% maturity and primary spike length. Dhedhi *et al.*[3] and Movaliya *et al.*[4] also reported high positive correlation of length of primary spike towards seed yield. Number of capsules on primary spike shows second highest positive total indirect effect (0.366) through plant height, number of nodes upto primary spike and 100 seed weight. Effective length of primary spike shows positive indirect effect (0.225) through plant height, number of nodes upto primary spike, number of capsules on primary spike and 100 seed weight. Oil content shows positive total indirect effect (0.224) through days to 50% maturity, plant height, effective length of primary spike, number of capsules on primary spike, total number of spike and 100 seed weight. Primary spike length shows positive total indirect effect (0.209) through days to 50% maturity, plant height, number of nodes upto primary spike, effective length of primary spike, number of capsules on primary spike and 100 seed weight. 100 seed weight, plant height and number of nodes upto primary spike also show positive indirect effects (0.186, 0.164 and 0.143 respectively). Days to 50% flowering and days to 50% maturity show negative total indirect effect (-0.028 and -0.013 respectively). But the negative total indirect effect was very low and negligible.

Table 1. Analysis of Variance for 11 characters in 68 genotypes in castor

Mean sum of squares

Source of Var.	d.f.	Days to 50% flowering	Days to 50% maturity	Plant height	Number of nodes upto primary spike	Primary spike length	Effective length of primary spike	Number of capsules per primary spike	Total number of spike	100 seed weight	Oil content	Yield/ plant
Replication	1	8.50	13.60	1.13	7.89	19.92	1.29	6.77	0.84	1.95	11.17	717.14
Genotypes	67	88.20	223.51	1743.14	31.73	166.99	147.50	555.91	17.42	66.87	23.00	2256.00
Error	67	7.05	8.67	32.26	16.00	15.30	8.00	9.88	1.24	0.53	4.74	107.68

Table 2: Phenotypic (above diagonal) and Genotypic (below diagonal) correlation coefficients of eleven characters in Castor

Sl. No.	Characters	Days to 50% flowering	Days to 50% maturity	Plant height	Number of nodes upto primary spike	Primary spike length	Effective length of primary spike	Number of capsules per primary spike	Total number of effective spike	100 seed weight	Oil content	Yield/ plant
1	Days to 50 per cent flowering	**1.000**	0.734**	0.396**	0.429**	0.036	0.061	0.304*	-0.356	0.071	-0.003	-0.019
2	Days to 50% maturity	0.736**	**1.000**	0.397**	0.401**	-0.023	-0.002	0.222	-0.292	-0.014	-0.005	-0.016
3	Plant height	0.427**	0.412**	**1.000**	0.372**	0.199	0.194	0.099	-0.323	0.350**	0.153	0.161
4	Number of nodes upto primary spike	0.772**	0.713**	0.608**	**1.000**	0.120	0.175	0.294*	-0.238	0.003	-0.082	0.092
5	Primary spike length	0.069	-0.035	0.217	0.329**	**1.000**	0.920**	0.533**	-0.076	0.371**	0.050	0.173
6	Effective length of primary spike	0.078	-0.003	0.203	0.413**	0.976**	**1.000**	0.563**	-0.077	0.324**	0.045	0.205
7	Number of capsules per primary spike	0.342**	0.231	0.105	0.588**	0.573**	0.573**	**1.000**	-0.033	0.150	0.241*	0.342**
8	Total number of effective spike	-0.434	-0.324	-0.360	-0.487	-0.082	-0.082	-0.035	**1.000**	-0.082	0.144	0.348**
9	100 seed weight	0.084	-0.007	0.357**	0.001	0.407**	0.340**	0.155	-0.105	**1.000**	0.196	0.180
10	Oil content	0.058	-0.021	0.202	-0.049	0.046	0.025	0.260*	0.202	0.251*	**1.000**	0.192
11	Yield / plant	-0.028	-0.013	0.164	0.143	0.209	0.225	0.366**	0.386**	0.186	0.224	**1.000**

**significance at 1% level * significance at 5% level

Table 3: Path analysis showing direct and indirect effects of ten different characters on seed yield per plant in castor

Characters	Days to 50% flowering	Days to 50% maturity	Plant height	Number of nodes upto primary spike	Primary spike length	Effective length of primary spike	Number of capsules per primary spike	Total number of spike	100 seed weight	Oil content	R
Days to 50 per cent flowering	**-0.086**	-0.065	0.139	0.049	-0.045	0.040	0.149	-0.219	0.015	-0.004	-0.028
Days to 50 per cent maturity	-0.064	**-0.089**	0.134	0.045	0.023	-0.002	0.101	-0.164	-0.001	0.002	-0.013
Plant height	-0.037	-0.036	**0.326**	0.039	-0.143	0.105	0.046	-0.182	0.062	-0.016	0.164
Number of nodes upto primary spike	-0.067	-0.063	0.198	**0.063**	-0.217	0.213	0.257	-0.246	0.000	0.004	0.143
Primary spike length	-0.006	0.003	0.071	0.021	**-0.659**	0.503	0.250	-0.041	0.071	-0.004	0.209
Effective length of primary spike	-0.007	0.000	0.066	0.026	-0.643	**0.516**	0.250	-0.042	0.059	-0.002	0.225
Number of capsules on primary spike	-0.030	-0.020	0.034	0.037	-0.377	0.295	**0.437**	-0.018	0.027	-0.020	0.366
Total number of spikes	0.038	0.029	-0.118	-0.031	0.054	-0.042	-0.015	**0.505**	-0.018	-0.016	0.386
100 seed weight	-0.007	0.001	0.117	0.000	-0.268	0.176	0.068	-0.053	**0.174**	-0.019	0.186
Oil content	-0.005	0.002	0.066	-0.003	-0.031	0.013	0.113	0.102	0.044	**-0.077**	0.224

Bold and diagonal shows the direct effects, Residual effect: 0.77

CONCLUSION

From the results obtained, it would be reasonable to suggest the breeder who involved in castor breeding to concentrate more on total number of spike per plant, number of capsules per primary spike, days to 50 percent flowering and plant height. In present study the residual effect at genotypic level was 0.77 which suggested that there might be few more component traits responsible to influence the seed yield per plant than those studied.

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