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Correlation and path coefficient analysis in f2 segregating population of chilli (*Capsicum annuum* L.)

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Abstract
An experiment on chilli (*Capsicum annuum* L) was undertaken to study the correlation and path coefficient for nine traits of F_2 population were obtained from the cross of K-1 x China type. Correlation indicated that dry fruit yield per plant was significant and positively associated with plant height, number of branches per plant, number of fruits per plant, pod length, single dry fruit weight, number of seeds per fruit, relative water content and capsaicin. Number of fruits per plant and single dry fruit weight showed the highest positive direct effect on fruit yield per plant. Direct selection may be executed considering these traits as the main selection criteria to reduce indirect effect of other characters during development of high yielding chilli variety.

Keywords: F_2 population, correlation, china type, k-1, path analysis, chilli

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important vegetable-cum-spice crop valued for its aroma, taste, flavor and pungency. The origin of chilli is Maxico, with secondary centres in Guatemala. Pungency of chilli is due to a crystalline acrid volatile alkaloid capsaicin ($C_{18}H_{27}NO_3$) present in the placenta of fruit which has diverse prophylactic and therapeutic uses in Allopathic.

In any selection programme, it may not be always possible to make selections based on yield alone, for evolving superior yielding genotypes because yield is a complex character and is collectively influenced by many component characters. The interrelationships between yield and yield contributing characters are estimated by correlation coefficient analysis. Such association studies provide information on nature, extent and direction of selection. Further, the partitioning of correlation coefficient into direct and indirect effects of the yield components on yield will also throw more light on selection programme (Vadivel and Babu, 1990) [13]. Therefore present investigation was carried out to determine the nature and degree of association among the characters and their direct and indirect effects on yield of chilli.

Materials and methods

The experiment was carried out at the farmer field in Virudhunagar district. Totally 250 F_2 chilli plants obtained from the cross K-1 x China type and it was evaluated for high yield and quality characters during the year 2016 – 2017. The F_2 progenies obtained by selfing from the F_1 hybrid. The F_2 generation of K-1 x China type cross combination was raised along with their parents. Observations were recorded on single plant wise for each of F_2 populations and ten plants in parents. Each plant in the cross was labelled for recording nine quantitative and qualitative characters, which includes plant height, number of branches per plant, number of fruits per plant, fruit length, single dry fruit weight, number of seeds per fruit, dry fruit yield per plant, relative water content and capsaicin. The correlation coefficients among different characters were worked as per the procedure given Weber and Moorty (1952) [14]. The path coefficient of various characters towards dry fruit yield per plant were calculated according to Dewey and Lu (1959) [2].

Results and Discussion

The analysis of correlation coefficients for nine characters in F_2 generation of the cross K-1 x China type have been presented in Table 1.The present investigation on F_2 generation of the

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cross K-1 x China type revealed that the fruit yield per plant showed positive and significant association with plant height (0.1813), number of branches per plant (0.6768), number of fruits per plant (0.9263), fruit length (0.6380), single dry fruit weight (0.6655), number of seeds per fruit (0.6789), relative water content (0.8875), capsaicin (0.1456). The results of the present study indicated that these traits had certain inherent relationship with yield and suggested the importance of these traits in determining fruit yield and also these traits are highly heritable. This is in agreement with the findings of Karad *et al.* (2006) [5], Krishna *et al.* (2007) [6], Chatterjee *et al.* (2007) [1] and Priyanka and Mishra (2016) [9]. The very high positive correlation of number of fruits per plant with dry fruit yield indicated that number of fruits per plant was the primary yield attribute in chilli increase in this trait will ultimately increase the dry fruit yield per plant, which was also reported by Rani *et al.* (1996) [10].

Table 1: Simple correlation coefficients of yield and yield components in F_2 generation of the cross P_1 x P_9

Characters	Plant height	Number of branches per plant	Number of fruits per plant	Fruit length	Single dry fruit weight	Number of seeds per fruit	Relative water content	capsaicin	Dry fruit yield per plant
Plant height	1	0.1632**	0.214**	0.0154	-0.0017	0.0519	0.1117	0.1321**	0.1813**
Number of branches per plant		1	0.7279**	0.263**	0.2508**	0.3009**	0.5981**	0.1015	0.6768**
Number of fruits per plant			1	0.353**	0.3582**	0.4053**	0.8641**	0.1037	0.9263**
Fruit length				1	0.9288**	0.8806**	0.5286**	0.1491*	0.638**
Single dry fruit weight					1	0.9253**	0.5317**	0.1409*	0.6655**
Number of seeds per fruit						1	0.5436**	0.1552*	0.6789**
Relative water content							1	-0.0195	0.8875**
capsaicin								1	0.1456*

*Significant at 5 % level
**Significant at 1 % level

The interrelationship of various yield components showed that the plant height exhibited positive and significant relationship with number of branches per plant (0.1632), number of fruits per plant (0.214), capsaicin (0.1321) and negative and non significant with single dry fruit weight (-0.0017). Number of branches per plant exhibited positive and significant relationship with number of fruits per plant (0.7279), fruit length (0.263), single dry fruit weight (0.2508), number of seeds per fruit (0.3009), relative water content (0.5981) and positive and non significant association was registered for capsaicin (0.1015). The number of fruits per plant had positive and significant association with fruit length (0.3530), single dry fruit weight (0.3582), number of seeds per fruit (0.4053), relative water content (0.8641) and positive and negligible association was registered for capsaicin (0.1037). Similar kinds of findings were found by Rani *et al.* (1996) [10] in chilli.

Although correlation studies are helpful in determining components of yield, with the inclusion of more variables in correlation studies, the indirect association becomes more complex. Two characters may show a correlation because they correlate with a common third one. Under such circumstances, path analysis helps in partitioning of correlation coefficient into direct and indirect effects, permitting a critical examination of the relative importance of each trait. The path coefficient analysis in (Table 2) revealed that high positive direct effect on fruit yield per plant was exerted by number of fruits per plant (0.7577) and single dry fruit weight (0.3367). The negligible direct effect on fruit yield per plant was exerted by plant height (0.0124), number of branches per plant (0.0124), number of seeds per fruit (0.0274), relative water content (0.0207) and capsaicin (0.0096). Similar kind of results of direct positive effects for those traits was reported by Meena and Bahadur (2015) [7], Ullah *et al.* (2015) [11] and Nagariya *et al.* (2015) [8].

Table 2: Direct and indirect effects of different characters on fruit yield in F_2 generation of the cross P_1xP_9

	Plant height	branches per plant	Number of fruits per plant	Fruit length (cm)	Single dry fruit weight	Number of seeds per fruit	Relative water content	capsaicin	Fruit yield per plant
Plant height (cm)	0.0124	0.002	0.1622	0.0003	-0.0006	0.0014	0.0023	0.0013	0.1813*
branches per plant	0.002	0.0124	0.5516	0.0047	0.0845	0.0082	0.0124	0.001	0.6768*
No. of fruits per plant	0.0026	0.0091	0.7577	0.0063	0.1206	0.0111	0.0179	0.001	0.9263*
Fruit length (cm)	0.0002	0.0033	0.2675	0.0179	0.3127	0.0241	0.011	0.0014	0.638*
Single dry fruit weight	-0.000	0.0031	0.2714	0.0166	0.3367	0.0254	0.011	0.0014	0.6655*
No. of seeds per fruit	0.0006	0.0037	0.3071	0.0157	0.3115	0.0274	0.0113	0.0015	0.6789*
Relative water content	0.0014	0.0074	0.6547	0.0094	0.179	0.0149	0.0207	-0.0002	0.8875*
capsaicin	0.0016	0.0013	0.0785	0.0027	0.0474	0.0043	-0.0004	0.0096	0.145*

∗ Significant at 5 per cent level
Residual effects: 0.1166
Diagonal values indicate direct effects and half diagonal values indicate indirect effects

The plant height exerted lowest positive indirect effect on fruit yield per plant through number of fruits per plant (0.1622). The number of branches per plant recorded highest positive indirect effect on fruit yield per plant through number of fruits per plant (0.5516). The indirect effect of number of fruits per plant was lowest and positive on fruit yield per plant through single dry fruit weight (0.1206). The highest indirect effect of fruit length through single dry fruit weight (0.3127) and number of fruits per plant (0.2675) was positive and moderate. The characters *viz*., plant height, number of branches per plant, number of fruits per plant, fruit length, individual fruit weight, relative water content and capsaicin the influenced fruit yield per plant indirectly and positively through number of fruits per plant. Similar results for indirect

effects were recorded by Firas *et al.* (2012) [3], Islam *et al.* (2010) [4] and Meena and Bahadur (2015) [7]. The highest indirect effect of fruit length through single dry fruit weight (0.3127) and number of fruits per plant (0.2675) was positive and moderate. Fruit length influence dry fruit yield per plant through number of fruits per plant, individual dry fruit weight. Similar findings were noticed by Vijaya *et al.* (2014) [12].

Conclusion
In correlation study dry fruit yield per plant was positive and significantly correlated with plant height, number of branches per plant, number of fruits per plant, pod length, single dry fruit weight, number of seeds per fruit, relative water content and capsaicin. In path coefficient analysis the highest positive direct effect was noted in number of fruits per plant and single dry fruit weight. Hence, these traits can further be exploited by direct selection for genetic improvement in chilli to bring about the improvement in yield.

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