Study on Character Association and Path Analysis in King Chilli (*Capsicum chinense* Jacq.)

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A B S T R A C T

Information regarding the character association is of great importance in simultaneous selection of traits for any breeding programs. However, quantification and interpretation of the correlations magnitude do not provide information on direct and indirect effects. In this context, the path analysis is considered as an alternative and viable tool for the selection process. The objective of the present study was to evaluate the phenotypic correlations between ten major horticultural traits in King chilli (*Capsicum chinense* Jacq.) lines and its consequences in direct and indirect effects by path analysis. The experiment was laid out in RBD with three replications. The results indicate that the correlation of fruit yield per plant with number of fruits per plant, days to 50% flowering and plant height is highly positive and significant. The number of fruits per plant and days to 50% flowering also exhibited high direct effect on fruit yield per plant. Therefore, for direct improvement of fruit yield per plant in King chilli emphasis should be given to these traits.

Introduction

The agro-climatic condition of the Meghalaya is favourable for cultivation of wide range of horticultural crops including *Capsicum* species. In recent years, the *Capsicum* species found in Northeastern region of India is gaining importance in the scientific community because of their huge diversity and unique characteristics such as extreme pungency in King chilli (*Capsicum chinense* Jacq.) which has been reported to be one of the hottest chilli in the world. The market for King chilli is a segment with great potential for growth both for fresh consumption and for processing. The area of King chilli in North eastern region is increasing substantially. However, the production and productivity is still not up to the mark considering the potential of the crop in both domestic and international market. Hence, there is a need for development of area specific new varieties and hybrids with high productivity.

Fruit yield, disease resistance and capsaicin content are the main parameters evaluated in any breeding programs for chillies (Rodrigues *et al.,* 2012). However, the yield is a complex

character, determined by the interaction of several factors, including genetic, physiological and environmental factors (Zecevic *et al.,* 2011). The study of the correlations of yield with other horticultural traits will help in simultaneous selection for more than one trait.

Despite the usefulness of the correlation coefficient estimations for the understanding of a complex trait, such as yield, this analysis is insufficient to explain the true association between the traits (Saores *et al.,* 2017). Path coefficient analysis (Wright, 1923) partitioned the estimated correlations into direct and indirect effects of traits on a basic dependent variable. Therefore, path coefficient analysis helps breeders to develop appropriate strategies to select superior genotypes in various agricultural crops (Saores *et al.,* 2017). Despite the potential of the crop, there is limited research regarding the genotype selection using correlations and path analysis in King chilli. Therefore, there is a need to generate more information on correlations of yield with other related traits and their direct and indirect effects. Thus, the aim of present study was to estimate the correlations between ten main horticultural traits of King chilli (*Capsicum chinense* Jacq.) lines and the direct and indirect effects of primary components by path analysis.

Materials and Methods

The experiment was conducted at the Horticulture Experimental Farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya under low cost polyhouse. The experiment was laid out in Randomized Block Design with three replications during *rabi* season, 2017. The experimental site is situated at an elevation of 950 m above the mean sea level (MSL) with 25°41'N latitude and 91°54'E longitude. The location is characterized by subtropical climate and

receives an average annual rainfall of 150-250 cm with 80% of the rainfall occurring during the period from April to September. The experimental material comprised of 15 King chilli lines *viz.,* ML-1, ML-2, ML-3, ML-4, ML-5, ML-6, ML-7 (Manipur); NL-1, NL-2, NL-3, NL-4 (Nagaland); TL-1, TL-2, TL-3 and TL-4 (Tripura). The crop was grown on 20 cm raised bed having 90 cm width. Each bed consisted of two rows of 1.5 m length accommodating ten plants per genotype of each entry. The plants were spaced at (75 × 45) cm inter and intra row spacing. Five randomly selected plants of each entry were used for recording data on yield and horticultural traits *viz.,* days to 50 % flowering, days to first harvest, fruit width (cm), fruit length (cm), pericarp thickness (mm), plant height (cm), number of primary branches per plant, average fruit weight (g), number of fruits per plant and fruit yield per plant (kg). The Phenotypic correlation coefficient and direct and indirect effects were computed by using procedure given by Dewey and Lu (1959).

Results and Discussion

Phenotypic correlation coefficient among different pairs of traits is given in Table 1. The results revealed highly significant positive correlation for fruit yield per plant with number of fruits per plant, days to 50% flowering and plant height. The horticultural traits *viz.,* number of primary branches per plant, fruit width and fruit length also exhibited positive but non significant correlation with fruit yield per plant. Saores *et al.,* 2017 also reported significant positive correlation of number of fruits per plant and plant height with fruit yield in King chilli lines. Positive correlation of fruit yield per plant with number of fruits per plant, fruit width and fruit length has also been reported by Shrestha *et al.,* (2010), Yadeda *et al.,* (2011), and Luitel *et al.,* (2013). The strong

association of number of fruits per plant, days to 50% flowering and plant height with fruit yield indicated that lines with more number of fruits per plant, early flowering and taller plant should be given emphasis for improving fruit yield. Days to 50% flowering was positively and significantly correlated with days to first harvest indicating that early flowering lines would be an appropriate selection criterion to get early crop and fetch premium price in market. The results corroborate the findings of Bijalwan and Mishra (2016). Correlation between number of fruits per plant and most of the other traits *viz.,* fruit width, fruit length, pericarp thickness and plant height were highly positive and hence of significant consequence in improvement of King chilli lines through selection procedure.

Table.1 Phenotypic correlation coefficients involving ten horticultural traits in King chilli (*Capsicum chinense* Jacq.)

Traits	2	3	4	5	6	7	8	9	Fruit yield per plant
1	0.43*	-0.03	0.04	0.29	0.04	0.30*	-0.22	0.10	**0.51***
2		0.05	0.29	0.41*	0.26	0.21	-0.24	0.21	**0.16**
3			0.58*	0.26	0.29*	0.30*	-0.27	0.40*	**0.26**
4				0.33*	0.31*	0.26	-0.15	0.34*	**0.04**
5					-0.05	0.20	0.09	0.30*	**-0.03**
6						0.35*	-0.38*	0.58*	**0.47***
7							-0.88*	0.13	**0.22**
8								0.39	**-0.31**
9									**0.69***

1. Days to 50% flowering	2. Days to first harvest	3. Fruit Width	4. Fruit Length	5. Pericarp thickness
6. Plant Height	**7. Number primary branches per plant**	**8. Average Fruit Weight**	**9. Number of fruit per plant**	

Table.2 Path coefficients analysis for different horticultural traits with fruit yield in King chilli (*Capsicum chinense* Jacq.)

Traits	1	2	3	4	5	6	7	8	9
1	**0.56**	0.24	-0.02	0.02	0.17	0.02	0.16	-0.13	0.06
2	-0.02	**-0.04**	-0.01	-0.01	-0.02	-0.01	-0.01	0.01	-0.01
3	-0.01	0.01	**0.21**	0.12	0.05	0.06	0.06	-0.06	0.08
4	-0.01	-0.06	-0.13	**-0.23**	-0.07	-0.07	-0.06	0.03	-0.08
5	-0.10	-0.15	-0.10	-0.12	**-0.37**	0.02	-0.07	-0.03	-0.11
6	0.00	0.01	0.01	0.01	-0.00	**0.01**	0.01	-0.01	0.01
7	0.01	0.01	0.01	0.01	0.01	0.01	**0.03**	0.03	-0.01
8	0.01	0.01	0.02	0.01	-0.01	0.02	0.05	**-0.06**	0.01
9	0.07	0.15	0.29	0.25	0.22	0.43	0.09	-0.09	**0.74**

1. Days to 50% flowering	2. Days to first harvest	3. Fruit Width	4. Fruit Length	5. Pericarp thickness
6. Plant Height	**7. Number of primary branches per plant**	**8. Average Fruit Weight**	**9. Number of fruit per plant**	

In view of the fact that correlation coefficients do not take into account extremely complex inter-relationships between various traits, path analysis was applied to partition the correlation coefficients into direct and indirect effects. The result of path analysis (Table 2) revealed highest positive direct effect of number of fruits per plant on fruit yield per plant followed by days to 50% flowering.

All the indirect effects exhibited by the other traits were of little significance as they are too low in magnitude and hence do not explain any phenomenon. The traits showing high direct effect on fruit yield per plant indicated that the direct selection of these traits might be effective in improvement of King chilli lines. Therefore, it may be suggested that for effective improvement in fruit yield per plant in King chilli lines, the selection should preferably be done for more number of fruits per plant and early flowering genotypes. Corroborating the findings of present investigation positive and direct effect on fruit yield per plant has also been reported by Saores *et al.,* 2017 for number of fruits per plant in King chilli; Rathod *et al.,* (2002), Ullah *et al.,* (2011) and Bijalwan and Mishra (2016) for days to 50% flowering in chilli.

From the present study it is concluded that traits *viz.,* number of fruit per plant, days to 50% flowering and plant height showed positive and significant correlation with fruit yield per plant hence selection for these traits could be helpful for the improvement of King chilli lines. Number of fruit per plant, days to 50% flowering, fruit width, number of primary branch per plant and plant height displayed positive direct effect on fruit yield per plant. This justifies the presence of true relationship between these traits and fruit yield, thereby direct selection through these characters would result significant effect on improvement of fruit yield in King chilli.

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