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STUDY ON CORRELATION AND PATH ANALYSIS IN BIRD'S EYE CHILLI (*CAPSICUM FRUTESCENS* L.) FOR YIELD AND YIELD ATTRIBUTING TRAITS

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ABSTRACT

A field experiment was conducted using ten landraces of bird's eye chilli (*Capsicum frutescens* L.) to evaluate the phenotypic, genotypic correlation and path analysis for different growth and yield parameters. Upon the assessment, it was found genotypic correlation coefficient was slightly higher than the phenotypic correlation coefficient for all the characters studied. The yield attributing characters *viz*., number of fruits per plant (0.429 and 0.433), fruit length (0.402 and 0.406), fruit girth (0.496 and 0.500), average fruit weight (0.437 and 0.440) and number of seeds per fruit (0.400 and 0.408) exhibited a positive and significant association with fruit yield per plant both at phenotypic and genotypic level respectively. Also, among the ten characters studied, positive direct effect on fruit yield per plant was noticed in plant height (0.703), number of fruits per plant (3.332), fruit length (3.277) and average fruit weight (0.795). Therefore, the strong association of fruit related traits would contribute in increasing the yield of the crop.
***Keywords*:** Bird's eye chilli, correlation, path analysis

Introduction

Chilli is a widely used vegetable/spice crop cultivated throughout India. The domestication of chilli first occurred in Central America, most likely in Mexico, with secondary centers in Guatemala and Bulgaria (Srinivas *et al*., 2017). India is not only the largest producer but also the largest consumer and exporter of chilli in the world. It alone contributes to about 42% of the total spice export quantity of the country and is predominantly exported to countries like China, Vietnam, Thailand, Sri Lanka, Indonesia and Malaysia. In India, chillies were grown in 8.52 lakh hectares with a production of 19.57 lakh tonnes (MOCI, 2022).

A wide variability in chilli fruit morphology, pungency, bearing habit and crop duration is found throughout India. The genus *Capsicum* includes 22 wild species, many varieties and five domesticated species. Bird's eye chilli (*Capsicum frutescens* L.) is one among the five cultivated species of the genus *Capsicum* (Olatunji and Afolayan 2020). The bird's eye chilli has many other synonyms like African pepper, chilli pepper, goat's pod, Mexican chilli, red pepper, Tabasco pepper, Zanibar pepper and Cayenne pepper (Rathod *et al.*, 2023). In India, Mizoram and Manipur are the two north-eastern states where maximum diversity of *Capsicum frutescens* L. is found. These chilles are grown in the hilly slopes mainly during shifting cultivation and the harvesting time of these chillies is between November and March. (Dutta *et al*., 2017).

The plant typically grows as shrub and may survive upto 10 years. The peppers produced by *Capsicum frutescens L.* are usually small, upright growing and can be red, green, yellow, or orange when ripe. It is consumed both in unripe (green) and ripe (red) forms. Capsanthin, the major carotenoid in ripe fruits, contributes up to 60% of the total carotenoids The sharp taste of Capsicum peppers is due to a mixture of seven related alkaloids of which, an alkaloid capsaicin (8- Methyl-N-vanillyl-trans-6-nonenamide) which is present in the pericarp and placenta of the is

the most prevalent (Bhoomika *et al*., 2022). In traditional medicine, due to presence of phytochemicals, it has been used for the treatment of cough, toothache, sore throat, parasitic infections, rheumatism and wound healing. Other effects such as antibacterial and anticancer are also their properties. Most bird's eye chilies are processed to extract the oleoresin for sale to the food and pharmaceutical industries due to its high pungency, colour and medicinal properties (Kaur *et al*., 2023)

Fruit yield is a complex quantitative trait that is influenced by a number of yield contributing characters. Information on the mutual association of traits is important for effective selection in plant-breeding program. Development of improved cultivar with capability of producing better yield under various agro-climatic conditions depends upon the amount of genotypic variability present in a population for the traits (Ahmad *et al*., 2018). Also, knowledge of correlations is important in plant breeding for simultaneous and/or indirect improvement of characters that are difficult to quantify especially for those traits, which exhibit low heritability. Therefore, it is essential to make preliminary investigation of the characters to be used for the development of superior hybrids (Asati *et al*., 2008)

Correlation coefficient is a necessary statistical tool used to identify the degree and direction of relationship between growth dependent and independent variables. The association analysis gives an idea about relationship among the various characters and determines the component characters, on which selection can be used for genetic improvement. This is important in the improvement of complex character like yield. Also, upon the assessment of apparent relationship between yield and other components, it was felt necessary to partition the direct and indirect effects of each character on yield to understand the nature of association at the genotypic level. In order to fulfil the requirement, the path coefficient analysis was computed (Bijalwan and Mishra, 2016). Keeping this in view, the present investigation was carried out to evaluate the correlation and path analysis for various yield and yield attributing traits.

Materials and Methods

The present investigation was carried out at Department of Horticulture, Faculty of Agriculture, Annamalai University, Tamil Nadu. The experiment was conducted with ten landraces of bird's eye chilli in a Completely Randomized Design (CRD) with three replications. Forty-five-day old seedlings of bird's eye chilli were transplanted at the experimental site. The crop was raised as per the recommended package of practices. Five plants from each landrace were selected randomly, tagged and observations were recorded for different traits. The experimental data recorded on various characteristics during the investigation were statistically computed by using procedure given by Dewey and Lu (1959).

Results and Discussion

The phenotypic (P) and genotypic correlation (G) coefficients were worked out for 10 characters and the results are presented in the Table 1. On this analysis, among ten landraces the genotypic correlation is slightly higher than the phenotypic correlation indicating a strong inherent association of the characters under study. The fruit yield per plant exhibited a positive and significant association with yield attributing characters *viz*., number of fruits per plant (0.429 and 0.433), fruit length (0.402 and 0.406), fruit girth (0.496 and 0.500), average fruit weight (0.437 and 0.440) and number of seeds per fruit (0.400 and 0.408) both at phenotypic and genotypic level respectively. The number of flowers per plant also exhibited a positive and significant association with fruit yield per plant both at phenotypic (0.316) and genotypic (0.321) level. The results suggest that these traits are considered as the major yield contributing characters. The results also correlate with the findings of Chavan *et al*. (2021), Gulzar and Malik (2022) and Patel and Chaurasiya (2023). The growth characters *viz*., plant height (0.196 and 0.203) and number of primary branches per plant (0.172 and 0.169) exhibited a positive and non-significant association with fruit yield per plant both at phenotypic and genotypic level respectively. Days to 50 % flowering exhibited a negative and significant association with fruit yield plant^{-1} both at phenotypic (-0.530) and genotypic (-0.539) level. Therefore, studies on the association of characters through correlation revealed that, earlier flowering with higher number of primary branches and maximum number of fruits per plant and its components are considered as important criteria for selecting superior landraces.

Table 1 : Phenotypic and genotypic correlation coefficients between yield and its component characters in bird's eye chilli (*Capsicum frutescens* L.)

Ch.		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	P	1.00	-0.150	-0.302	-0.599	-0.587	-0.716	-0.759	-0.754	-0.756	-0.530
	G	1.00	-0.148	-0.321	-0.611	-0.598	-0.728	-0.778	-0.772	-0.769	-0.539
X2	P		1.00	0.842**	0.753**	0.718**	0.319	0.302	0.368	0.401*	0.196
	G		1.00	0.881**	0.758**	0.733**	0.327	0.305	0.390*	0.407*	0.203
X3	P			1.00	0.892**	0.839**	0.536**	0.507*	0.611**	0.634**	0.172
	G			1.00	0.927**	0.867**	0.540**	0.507*	0.629**	0.658**	0.169
X4	P				1.00	0.929**	0.720**	0.709**	0.734**	0.822**	0.316
	G				1.00	0.947**	0.739**	0.718**	0.769**	0.858**	0.321
X5	P					1.00	0.574**	0.579**	0.629**	0.755**	0.429*
	G					1.00	0.586**	0.592**	0.647**	0.774**	0.433*
X6	P						1.00	0.988**	0.916**	0.902**	0.402*
	G						1.00	0.992**	0.930**	0.919**	0.406*
X7	P							1.00	0.926**	0.898**	0.496*
	G							1.00	0.948**	0.922**	0.500*
X8	P								1.00	0.916**	0.437*
	G								1.00	0.934**	0.440*
X9	P									1.00	0.400*
	G									1.00	0.408*

CH- Character
X1- Days to 50% flowering
X2- Plant height
X3- No. of branches plant^{-1}
X4- No. of flowers plant^{-1}
X5- No. of fruits plant^{-1}
X6- Fruit length
X7- Fruit girth
X8- Average fruit weight
X9- No. of seeds fruit^{-1}
X10- Fruit yield plant^{-1}

*-Significant at 5% level, **-Significant at 1% level

Path analysis

In the present investigation, path analysis was carried out at phenotypic and genotypic level between yield and its component characters. The estimates of direct and indirect effects of various characters on fruit yield per plant are presented in Table 2. Among the ten characters studied, positive direct effect on fruit yield per plant was noticed in plant height (0.703), number of fruits per plant (3.332), fruit length (3.277) and average fruit weight (0.795). Days to 50 per cent flowering (-0.328), number of seeds per fruit (-0.528), number of primary branches per plant (-0.083), number of flowers per plant (-4.503) and fruit girth (-2.179) registered negative direct effect on fruit yield per plant. These results were in conformity with the findings of Kumar *et al*. (2021), Lakshmidevamma *et al*. (2021) and Lata and Sharma (2022). Thus the greater emphasis could be made for the parameters *viz*., plant height, number of fruits per plant, fruit length and average fruit weight which had higher direct effect on fruit yield per plant.

Table 2 : Path coefficient analysis indicating the direct and indirect effect on fruit yield

Ch.	X1	X2	X3	X4	X5	X6	X7	X8	X9
X1	**-0.328**	-0.105	0.027	2.753	-1.994	-2.389	1.697	-0.614	0.414
X2	0.049	**0.703**	-0.073	-3.416	2.441	1.072	-0.666	0.310	-0.219
X3	0.105	0.614	**-0.083**	-4.175	2.890	1.772	-1.106	0.507	-0.354
X4	0.200	0.533	-0.077	**-4.503**	3.159	2.425	-1.567	0.612	-0.462
X5	0.196	0.515	-0.072	-4.267	**3.332**	1.922	-1.292	0.515	-0.417
X6	0.239	0.230	-0.045	-3.331	1.956	**3.277**	-2.163	0.739	-0.495
X7	0.255	0.215	-0.042	-3.236	1.976	3.253	**-2.179**	0.754	-0.496
X8	0.253	0.274	-0.052	-3.466	2.158	3.049	-2.068	**0.795**	-0.503
X9	0.252	0.286	-0.054	-3.866	2.561	3.015	-2.100	0.743	**-0.538**

CH- Character
X1- Days to 50% flowering
X2- Plant height
X3- No. of branches plant^{-1}
X4- No. of flowers plant^{-1}
X5- No. of fruits plant^{-1}
X6- Fruit lengthX7- Fruit girth
X8- Average fruit weight
X9- No. of seeds fruit^{-1}

RESIDUE= 0.5681

*-Significant at 5% level, **-Significant at 1% level

Conclusion

From the results it was evident that correlation and path analysis between number of fruits per plant and most of the other traits *viz*., fruit length, average fruit weight, number of seeds per fruit and plant height were highly positive and hence of significant consequence in improvement of bird's eye chilli landraces in the further breeding program.

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