Character association in Chilli (*Capsicum annuum* L.)

Asociación entre caracteres en pimentón (*Capsicum annuum* L.)

Nayeema JABEEN[1], Parvaze A. SOFI[2] and Shafiq A. WANI[2]

[1]Division of Olericulture, Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Shalimar, 191121, India and [2]Directorate of Research, SKUAST, Shalimar, 191121, India.
E-mail: phdpbg@yahoo.com ✉ Corresponding author

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ABSTRACT

The present investigation was carried out in 2007-08 using 25 chilli genotypes to elucidate the association of various yield attributing traits to develop a reliable set of traits for indirect selection. The data were observed from five randomly selected competitive plants from each replication for eight quantitative traits. The genotypic coefficients were higher in the magnitudes relative to corresponding estimates of phenotypic coefficients, which indicated high heritability of the traits under study. The fruits yield/plant exhibited highly significant correlation with number of fruits/plant, number of branches/plant and height of the plant, indicating the usefulness of these traits for improving upon fruit yield in chilli. Path coefficient analysis revealed that the highest direct effect on fruit yield/plant was exerted by average fruit weight followed by number of fruits/plant, number of branches/plant and plant spread, while as highest indirect effect on fruit yield/plant was exerted by number of branches/plant through number of fruits/plant, fruit length and fruit breadth through average fruit weight and plant height through number of fruits/plant. These traits can be used to develop an optimally reliable selection index for realizing improvements in fruit yield in chilli.

Key words: Chilli, character association, correlation, path analysis

RESUMEN

La presente investigación se llevó a cabo en 2007-2008 utilizando 25 genotipos de pimentón para dilucidar la asociación de diversos componentes del rendimiento para desarrollar un conjunto confiable de caracteres para la selección indirecta. Los datos se observaron en cinco plantas bajo competencia y seleccionadas al azar de cada replicación para ocho caracteres cuantitativos. Los coeficientes genotípicos fueron mayores en magnitud relativa en comparación con las estimaciones del coeficiente fenotípico, lo cual indica una alta heredabilidad de los caracteres bajo estudio. El rendimiento de frutos/planta exhibió una correlación altamente significativa con el número de frutos/planta, número de reamas/planta y altura, indicando la utilidad de estos caracteres para mejorar el rendimiento de frutos en pimentón. El análisis de los coeficientes de trayectoria reveló que el mayor efecto directo sobre el rendimiento de frutos/planta fue ejercido por el peso promedio del fruto seguido por el número de frutos/planta, número de reamas/planta y el dosel de la planta, mientras, mientras que los mayores efectos indirectos sobre el rendimiento de frutos/planta fue ejercido por el número de ramas/planta a través del número de frutos/planta, longitud del fruto y ancho del fruto a través del peso promedio del fruto y la altura de la planta a través del número de frutos/planta. Estos caracteres pueden ser usados para desarrollar un índice de selección óptimamente confiable para realizar mejoras en el rendimiento de frutos en pimentón.

Palabras clave: Pimentón, asociación de caracteres, correlación, análisis de trayectoria.

INTRODUCTION

Chilli pepper (*Capsicum annuum* L.) is one of the most important spice crops of India and finds a variety of uses. India is the leading producer and exporter of chillies followed by China, Indonesia, Korea, Pakistan, Turkey, Sri Lanka, Nigeria, Ghana, Tunisia, Egypt, Mexico, the US, Yugoslavia, Spain, Romania, Bulgaria, Italy, Hungary, Argentina, Peru and Brazil. Andhra Pradesh leads the country both in acreage (49%) and production (49%). In J&K state, the chillies occupy an area of 2.812 h with a production of 12.423 t (Anonymous, 2006). Some chillies are used as colorants (capsanthin) while some are used for pungency (capsaicin). Paprika, also known as Hungarian pepper or pimento pepper, is a less pungent type of chillies or sweet red pepper type for grinding used as colorant attributed to the pigment

oleoresin. It is native of South America, and though originally of tropical origin, can grow in cooler climates also. In India, the available Paprika types are not suitable for cultivation in all chilli growing areas (Prasath and Ponnuswami, 2008). Therefore, there is an urgent need to develop location specific cultivars for enhanced adaptability and productivity.

Since yield is a complex trait, governed by a large number of component traits, it is imperative to know the interrelationship between yield and its component traits to arrive at an optimal selection index for improvement of yield. Wright (1921) was first to propose the correlation and path analysis to organize the relationship between predictor variables and the response variable. Correlation simply measures the association between yield and other traits, while as path coefficient analysis permits the separation of correlation into direct effects (path coefficient) and indirect effects (effects exerted through other variables). It is basically a standardized partial regression and deals with the closed set of variables which are linearly related. Such an analysis provides for realistic basis of allocation of appropriate weightage to various yield components. Since not many studies have been conducted in case of paprika, the present study was undertaken to study the association of various yield attributing traits to develop a reliable set of traits for indirect selection.

MATERIALS AND METHODS

The present investigation was carried out in 2007-2008 at Vegetable Research Farm of SKUAST-K, Shalimar. The material consisted of 25 chilli genotypes namely P-2, P-4, P-7, P-9, P-19, P-20, P-29, P-37, P-59, P-101, P-104, P-201, P-444, P-1005, PL-7, LCA-436, LCA-443, KTPL-19, ACS-2001-01, ACS-2001-04, Arka Abhir, Bayadagi Dabbi, IVPBC-535, IVPBC-553 and Bayadagi Kaddi. Each entry was represented by two replications in a randomized block design with a spacing of 60 x 40 cm. Recommended package of practices was adopted to raise a good crop. The data was observed from five randomly selected competitive plants from each replication for eight quantitative traits *viz*, plant height (cm), plant spread (cm), number of branches/plant, number of fruits/plant, average fruit weight (g), fruit length (cm), fruit breadth (cm), and fruit yield/plant (g). The data was statistically analyzed following Aljibouri *et al* (1958) for estimation of correlation coefficient, while as path analysis was done by method of Dewey and Lu (1959).

RESULTS AND DISCUSSION

The results of correlation coefficients are presented in Table 1, which revealed that genotypic

Table 1. Genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficients for eight quantitative traits in chilli (*Capsicum annuum* L.).

Trait	Plant height (cm)	Plant spread (cm)	Number of branches/ plant	Number of fruits/plant	Average fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Fruit yield/ plant (g)
Plant height	1.000	0.093	0.311**	0.379**	-0.191	0.201	-0.108	0.286**
Plant spread	0.087	1.000	-0.277*	-0.130	0.004	-0.088	-0.098	-0.152
Number of branches/plant	0.272*	-0.263	1.000	0.478**	0.117	-0.083	-0.137	0.449**
Number of fruits/plant	0.368**	-0.089	0.468**	1.000	-0.076	-0.348**	-0.061	0.557**
Average fruit weight	-0.159	0.002	0.109	-0.070	1.000	0.207	0.296**	0.219
Fruit length	0.189	-0.073	-0.076	-0.344**	0.199	1.000	-0.133	-0.143
Fruit breadth	-0.093	-0.089	-0.133	-0.049	0.293**	-0.122	1.000	0.233
Fruit yield/ plant	0.468**	-0.138	0.446**	0.551**	0.214	-0.135	0.214	1.000

** Significant ($p \leq 0.01$) and * Significant ($p \leq 0.05$)

coefficients were higher in magnitudes relative to corresponding estimates of phenotypic coefficients, which indicates high heritability of the traits under study. Moreover, it may be due to masking effect of environment causing differential genotypic and phenotypic expression of these traits. The fruits yield/plant exhibited highly significant correlation with no. of fruits /plant, number of branches/plant and height, indicating the usefulness of these traits for improving upon fruit yield in chilli. Similar results have been reported in chillies by Palsudesai *et al*. (2006), Hosamani and Shivkumar (2008) and Ganeshreddy *et al* (2008), who have observed significant correlation of various yield attributing traits with fruit yield. The present study also revealed significant interrelationship among various yield components. Since the component traits do not define the limit of yield by their direct effects only but also indirect effects due to interrelationship between them.

Path coefficient analysis is a method of investigating such cause and effect relationships through partitioning correlation into direct and indirect effects. The perusal of path analysis (Table 2) revealed that the highest direct effect on fruit yield/plant was exerted by average fruit weight followed by number of fruits/plant, number of branches/plant and plant spread, while as the highest indirect effect on fruit yield /plant was exerted by number of branches/plant through number of fruits/plant, fruit length and fruit breadth through average fruit weight and plant height through number of fruits/plant. These traits can be used to develop an optimally reliable selection index for realizing improvements in fruit yield in chilli. Thus an ideal plant type should have higher values for these traits. Similar results have been reported by Khader and Jose (2002) and Ganeshreddy *et al* (2008).

The conventional path analysis, as carried out in present investigation, suffers from non-independence of predictor variables leading to high multicolinearity. Thus the multiple regression based path analysis can be improved by stepwise removal of no-significant predictor variables in a sequential manner as proposed by Samonte *et al* (1998). Moreover, the number pf predictor variables in such studies need to be enhance to decrease the residual effects in such analyses.

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Table 2. Direct (diagonal) and indirect effects for eight quantitative traits in chilli (*Capsicum annuum* L.).

Trait	Plant height (cm)	Plant spread (cm)	Number of branches/ plant	Number of fruits/plant	Average fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Effect on fruit yield/ plant (g)
Plant height	0.109	0.014	0.036	0.337	0.079	-0.049	-0.039	0.486
Plant spread	-0.114	0.227	-0.062	-0.008	-0.134	-0.040	0.026	-0.152
Number of branches/plant	0.009	-0.121	-0.263	0.512	0.047	0.073	0.192	0.449
Number of fruits/ plant	0.061	-0.139	-0.201	0.483	0.002	0.317	0.014	0.557
Average fruit weight	-0.007	0.023	-0.048	-0.167	0.538	-0.139	0.018	0.219
Fruit length	-0.103	0.032	-0.193	-0.214	0.446	-0.079	-0.112	-0.143
Fruit breadth	-0.068	0.133	-0.241	0.036	0.379	-0.044	-0.195	0.233

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