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CHARACTER ASSOCIATION AND PATH ANALYSIS STUDIES FOR YIELD AND YIELD ATTRIBUTES IN INDUSTRIALLY VALUED ELITE DRY CHILLI (*CAPSICUM ANNUUM* L.) GENOTYPES

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ABSTRACT

The correlation and path co-efficient analysis for growth and yield traits in chilli (*Capsicum annuum* L.) was studied in 20 genotypes of chilli including 5 new mutants for 13 different growth and yield characters at Horticultural Research and Extension Centre, Haveri (Devihosur) during *kharif* 2020-21. Correlation provides information on nature and extent of relationship among the characters. The computation of correlation coefficient at genotypic level revealed that significant and positive correlation between dry fruit yield per plant with all the characters except days to first flowering, days to red fruit harvest and fruit width. Path-coefficient analysis of different characters contributing towards dry yield per plant had significant positive direct effect *via* plant height, plant spread, plant branches, number of fruits per plant, fruit length and green fruit yield.
***Keywords* :** *Capsicum annuum,* Stalk-less, Correlation, Path co-efficient analysis, yield.

Introduction

Chilli (*capsicum annuum* L.) is also known as hot pepper and is one of the most important vegetables as well as spice crop. Chilli belongs to the genus *Capsicum* under the Solanaceae family, with chromosome number of 2n = 24. Green fruit of chilli are one of the richest sources of antioxidant and vitamins such as vitamin A, C and E. The capsaicin alkaloid is responsible for pungency and it has medicinal value also. It is sometimes referred as capsule of vitamin C because of rich vitamin C content in the fruit (Saisupriya *et al.,* 2021). It is mainly used for its pungency and pleasant flavor. India is the world leader in dry chilli production with total area of 7.21 lakh hectare and production of 16.90 lakh tonnes. In India, among all states Andhra Pradesh stood first in chilli cultivation followed by Karnataka, West Bengal, Madhya Pradesh, Orissa, Tamil Nadu (NHB, 2020).

The genus *capsicum* is often cross-pollinated crop and therefore exhibits wide variability for different qualitative and quantitative traits (Tanksley, 1984). So, India is considered to be the secondary centre of diversity for chilli, especially for *Capsicum annuum* L. (Dhaliwal *et al.*, 2014). The majority of crop plants' agronomic traits are quantitative in nature. One such figure that emerges from the interactions and actions of various component characters is yield (Bekele *et al.*, 2014). It is also commonly acknowledged that by examining its constituent features, the genetic architecture of yield may be better understood. The aim of any breeding program depends on genetic diversity, character association and direct and indirect effects on yield and its component characters. Before going to apply any breeding programme and selection of any newly bred traits it is essential to know the importance and inter association of various components and their association with yield.

Therefore, knowledge on correlation and path coefficient analysis is much important for the direct selection of parents in plant breeding for crop improvement (Wright, 1921). Hence the present investigation was carried out to with a view to study the character association and direct and indirect effect of different independent characters on dependent variable, green chilli yield in chilli genotypes.

Material and Methods

The experiment was conducted at the Horticultural Research and Extension Centre, Devihosur, Haveri, University of Horticultural Sciences, Bagalkot - 581110 during *kharif* season of 2020-21. The experiment comprised 20 genotypes of chilli including five newly developed mutants with a character of easy separation traits of red ripened chilli (non-persistent calyx). The genotypes were raised in randomized complete block design with three replications. Seeds were sown in raised beds on 22nd May 2020 and thirty-eight days old seedlings were transplanted at spacing of 75 cm × 45 cm to the experimental field. All recommended agronomic package of practices were carried out. In each genotype, five plants were selected at random for recording the observations on 13 different quantitative characters. Correlation coefficients was worked out as per Al- jibourie*et al.* (1958) and path coefficient were calculated according to Dewey and Lu (1959). Correlation and path analysis analyzed through software(Wright, 1921).

Results and Discussion

Correlation coefficient analysis

The estimates of genotypic and phenotypic correlation coefficient (Table-1) depicted that the genotypic correlations were higher than the phenotypic correlations ones for all the character combinations reveals that predominant role of heritable factors. This might be due to the masking effect of the environment in the total expression of the genotypes resulting in reduced phenotypic association. The results are in agreement with the findings of Srinivas *et al.* (2020), Kadwey *et al.* (2015), and Ajjappalavara *et al.* (2005). Dry fruit yield per plant was significantly and positively correlated with plant height (0.839), plant spread (0.554), number of primary branches (0.912), number of secondary branches (0.819), fruit length (0.574), number of fruits per plant (0.672), average red fruit weight (0.356), average dry fruit weight (0.506) and green fruit yield (0.759). The results of the present study indicated that these traits had certain inherent relationship with yield and suggested the importance of these characters in determining fruit yield. The traits such as days to first flowering (-1.268), days to red fruit harvest (-0.793) and fruit width (-0.297) parameters were negatively associated with dry fruit yield perplant. Indicating that earliness and early picking might be associated with increasing fruit yield. This is in agreement with the finding of Srinivas *et al.* (2020), Kadwey *et al.* (2015), and Ajjappalavara *et al.* (2005).

The high correlation between dry fruit yield per plant with main yield attributing traits like number of fruits per plant positively correlated (at p=0.01) with fruit length (0.568), average wet fruit weight (0.358) and green fruit yield (0.754). Fruit length had positive relation (at p=0.01) with average red fruit weight (0.643), and average dry fruit weight (0.463), green fruit yield (0.751) and colour value (0.510). These results indicated that selection for higher number of fruits and longer fruited plants would simultaneously result in selection for higher total fruit yield. All characters contributing to the fruit weight would have to be considered, as they show influence on fruit weight. The average red fruit weight was positively correlated (at p=0.01) with average dry fruit weight (0.796) and green fruit yield (0.676). The average dry fruit weight was positively correlated (at p=0.05) with number of fruits per plant (0.259) and green chilli fruit yield (0.796 at p=0.01). The similar results were supported by the studies of Kadwey *et al.* (2015), Pujar *et al.* (2017), and Ajjappalavara *et al.* (2005).

Path co-efficient analysis

The genotypic correlation sometimes is misleading because correlation between two characters is not a simple relationship but is rather the product of interaction of the direct and indirect cause. Path coefficient analysis permits partitioning of the correlation coefficients into components of direct and indirect effects. It's an analysis of standardized partial regression coefficients. As a result, it assesses the direct impact of one variable on another. Such information would be extremely useful in allowing the breeder to detect important yield component traits and use the genetic stock for improvement in an organized manner. In general, it was observed that genotypic direct and indirect effects were higher than their corresponding phenotypic values. The results obtained in phenotypic direct and indirect effects are presented in (Table 1).

Path analysis was used in this study to determine the direct and indirect effects of growth and yield-related characteristics on dry fruit yield. Among the 12 traits chosen for path analysis, height of plant, plant spread, number of primary branches per plant, number of secondary branches per plant, days to first flowering, number of fruits per plant, fruit length, average red fruit weight, average dry fruit weight and green fruit yield had positive direct effect and also significant with fruit yield. Therefore, direct selection for these traits would be rewarding for improvement of fruit yield. However, days red to fruit harvestand fruit width had negative direct effect with fruit yield. Similar findings were reported by Kadwey *et al.* (2015), Shweta *et al.* (2018), and Srinivas *et al.* (2020),

The direct effects of number of fruits per plant were positive (0.295) on dry fruit yield. Whereas the positive indirect effect of fruit length (0.736), average red fruit weight (0.464), average dry fruit weight (0.335) and green fruit yield (0.977) were recorded. Its indirect effect through fruit length, fruit weights and green fruit yields were high and positive indicating that the direct selection for number of fruits per plant and indirect selection for fruit length, fruit weights and green fruit yield has increased dry yield per plant Kadwey *et al.* (2015) and Ajjappalavara *et al.* (2005), also reported direct effect of fruit weight. Days to first flowering showed a negative direct effect on yield though in correlation with yield was much smaller and negative. This led to the conclusion that early flowering varieties produced higher yields. Similar results were supported by Kadwey *et al.* (2015), Shweta *et al.* (2018) and Ajjappalavara *et al.* (2005). Based on correlation and path analysis studies, it could be concluded that selection for high fruit weight, number of fruits per plant, early flowering lead to increase in dry yield.

Conclusion

The plant dry yield showed a positive and significant correlation with traits such as plant height, plant spread, number of primary and secondary branches, fruit length, number of fruits per plant, average wet fruit weight, average weight of five dry fruits, and green fruit yield at both genotypic and phenotypic levels (p=0.01). This suggests that improving these traits can simultaneously enhance fruit yield. Among these traits, path analysis revealed that plant spread (0.684), number of secondary branches (0.953), red wet fruit weight (0.019), dry fruit weight (0.064), and green fruit yield (0.652) had a positive direct impact, confirming their strong and significant influence on total yield. Therefore, all these traits should be prioritized in direct selection for improving fruit yield in chilli.

Table 1: Genotypic correlation coefficients among growth and yield parameters with dry fruit yield in chilli genotypes.

	1	2	3	4	5	6	7	8	9	10	11	12	Rg
1	**1.0000**	0.5577**	0.5933**	0.6086**	-1.1064	-0.8161	0.8069**	0.7775**	-0.1767	0.4733**	0.4062**	0.8390**	0.8393**
2		**1.0000**	0.3461**	0.3972**	-0.9985	-0.5610	0.7185**	0.7115**	-0.1516	0.6063**	0.4407**	0.6434**	0.5545**
3			**1.0000**	1.0176**	-1.0495	-0.5120	0.6296**	0.3790**	-0.4554	0.1187	0.3779**	0.6464**	0.9122**
4				**1.0000**	-1.0867	-0.4460	0.6516**	0.4212**	-0.4320	0.1421	0.3082**	0.6335**	0.8192**
5					**1.0000**	1.1251**	-1.1498	-0.8958	0.4485**	-0.6778	-0.7119	-1.1186	-1.2679
6						**1.0000**	-0.4067	-0.4951	-0.1688	-0.3510	-0.3739	-0.3646	-0.7929
7							**1.0000**	0.5685**	-0.3938	0.3588**	0.2592*	0.7542**	0.6726**
8								**1.0000**	-0.0780	0.6431**	0.4639**	0.7518**	0.5746**
9									**1.0000**	0.4133**	0.2465*	-0.0814	-0.2970
10										**1.0000**	0.7966**	0.6768**	0.3562**
11											**1.0000**	0.6753**	0.5067**
12												**1.0000**	0.7596**

1 : Plant height (cm)
2 : Plant spread (cm)
3 : Number of primary branches
4 : Number of secondary branches
5 : Days to first flowering
6 : Days to red fruit harvest
7 : Number of fruits/plant
8 : Fruit length (cm)
9 : Fruit width (cm)
10 : Avg. red fruit weight (g)
11 : Avg. dry fruit weight (g)
12 : Green fruit yield (g)
Rg : Genotypic correlation with dry yield

*: Significance at 0.05 **: Significance at 0.01

Table 2: Genotypic path coefficient analysis among growth and yield parameters with dry fruit yield of chilli genotypes

	1	2	3	4	5	6	7	8	9	10	11	12	Rg
1	**1.0185**	0.5680	0.6043	0.6198	-1.1268	-0.8312	0.8218	0.7918	-0.1799	0.4820	0.4137	0.8545	0.8393**
2	0.3815	**0.6841**	0.2368	0.2717	-0.6831	-0.3837	0.4915	0.4867	-0.1037	0.4148	0.3014	0.4402	0.5545**
3	-0.2922	-0.1705	**0.4925**	-0.5011	0.5168	0.2521	-0.3101	-0.1867	0.2243	-0.0585	-0.1861	-0.3183	0.9122**
4	0.5802	0.3787	0.9702	**0.9534**	-1.0361	-0.4252	0.6213	0.4016	-0.4119	0.1355	0.2938	0.6040	0.8192**
5	-0.0167	-0.0150	-0.0158	-0.0164	**0.0151**	0.0169	-0.0173	-0.0135	0.0068	-0.0102	-0.0107	-0.0169	-1.2679
6	0.2868	0.1971	0.1799	0.1567	-0.3953	**-0.3514**	0.1429	0.1740	0.0593	0.1234	0.1314	0.1281	-0.7929
7	-1.0454	0.9308	0.8157	0.8442	-1.4896	-0.5269	**0.2956**	-0.7365	0.5101	0.4648	0.3358	0.9771	0.6726**
8	-0.8888	-0.8134	-0.4333	-0.4815	1.0241	0.5660	-0.6499	**1.1432**	0.0891	-0.7352	-0.5303	-0.8595	0.5746**
9	0.1150	0.0987	0.2964	0.2812	-0.2920	0.1099	0.2563	0.0507	**-0.6510**	-0.2690	-0.1604	0.0530	-0.2970
10	0.0094	0.0121	0.0024	0.0028	-0.0135	-0.0070	0.0071	0.0128	0.0082	**0.0199**	0.0159	0.0135	0.3562**
11	0.0260	0.0282	0.0242	0.0197	-0.0456	-0.0240	0.0166	0.0297	0.0158	0.0510	**0.0641**	0.0433	0.5067**
12	0.5470	0.4195	0.4215	0.4131	-0.7293	-0.2377	0.4917	0.4902	-0.0531	0.4412	0.4403	**0.6520**	0.7596**

Residual effect: 0.024

1 : Plant height (cm)
2 : Plant spread (cm)
3 : Number of primary branches
4 : Number of secondary branches
5 : Days to first flowering
6 : Days to red fruit harvest
7 : Number of fruits/plant
8 : Fruit length (cm)
9 : Fruit width (cm)
10 : Avg. red fruit weight (g)
11 : Avg. dry fruit weight (g)
12 : Green fruit yield (g)
Rg: Genotypic correlation with dry yield

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