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Correlation and path coefficient analysis in yield contributing characters in chilli, *Capsicum annum* L

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ABSTRACT

Twenty three genotypes were used to study the correlation and path analysis for growth and yield contributing characters in chilli under Kashmir conditions. The experiment was laid out in randomized block design at KVK farm Pulwama, SKUAST-K during Kharif season of 2010 and 2011. The number of fruits per plant was significantly and positively correlated with fruit weight per plant and red ripened fruit yield. Green fruit yield per plant and dry yield per plant was positively and highly significantly correlated with number of fruits per plant (0.6585) and fruit weight (0.9839). The path coefficient analysis brought out the number of fruits per plant, fruit width and average fruit weight as major yield components which could be considered selection indices for improvement. The results suggested that due emphasis should be on to the genotypes that are having maximum number of fruits per plant, fruit length, fruit girth and fruit weight in the selection process due to their high positive direct effect on dry fruit yield.

Keywords: Chilli; correlation; path coefficient; genotypes; yield

INTRODUCTION

Chilli is an important vegetable and spice crop grown in almost all parts of tropical, subtropical and temperate regions of the world. Early flowering is generally an indication of early yield which is most preferred by the growers to fetch the high market price prevailing in the early cropping season and also reduce the risk of crop maintenance in late season (Patil et al 2012). Even though India ranks first in area and production of chilli its productivity is low as compared to other countries. 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 the predictor and

response variables. Correlation simply measures the association between yield and other traits whereas path coefficient analysis permits the separation of correlation into direct effects (path coefficient) and indirect effects (effects exerted through other variables). Therefore field investigation was carried out with a view to study the character association and direct and indirect effect of independent characters on dependent green chilli yield by assessing the chilli germplasm at KVK, Pulwama (Jammu and Kashmir).

MATERIAL and METHODS

The seeds of the planting material for the present study comprised of twenty three genotypes (released varieties, breeding lines and local collection) collected from different sources (Table 1). The experiment was laid out in randomized block design with three replications at the experimental farm of Krishi Vigyan Kendra, Pulwama, SKUAST-Kashmir during Kharif season 2010 and 2011. The Krishi Vigyan Kendra is located at 33^{o} North and 74^{o} East at an altitude of 1601 m amsl. The mean annual rainfall in the area ranges from 500 mm to 850 mm and the minimum and maximum temperature of the station during summers ranges between 10^{o}C to 30^{o}C. Sowing of seeds was done in the first week of April and transplanting in the last week of May during both the years. Row to row and plant to plant distance was kept 75 cm x 45 cm and all the recommended agronomic package of practices to raise chilli crop in temperate region of Kashmir valley were followed. In each genotype 10 plants were randomly selected for recording the observations. Observations were recorded on days to first flowering, days to 50 per cent flowering, fruit length (cm), fruit girth (cm), fruit weight (g), plant height (cm), number of branches/plant, number of fruits/ plant, number of seeds/fruit, maturation days (green), maturation days (red), 1000-seed weight (g), green fruit yield (g/plant) and dry (red) yield (g/plant). Statistical analysis for calculation of correlation was worked out as per Al-Jibouri et al (1958) and path coefficient of various characters was calculated according to Deway and Lu (1959).

RESULTS and DISCUSSION

The magnitude of genotypic correlation coefficients in general was higher than the phenotypic correlation coefficients (Table 1). Highest positive genotypic and phenotypic correlation coefficients were observed between fruit length and fruit girth (0.9913 and 0.9761 respectively). Highest negative and significant genotypic correlation coefficient was observed between 1000-seed weight and green fruit yield (-0.7497) and highest negative and significant between days taken to first flowering and 1000-seed weight (- 0.5875).

Days taken to first flowering exhibited highest positive significant correlation at genotypic and phenotypic levels with days taken to 50 per cent

flowering (0.9726 and 0.9436 respectively), maturation days (green chilli) (0.5297 and 0.5166 respectively) and maturation days (red chilli) (0.5272 and 0.5048 respectively). Days taken to first flowering exhibited non-significant correlation with other characters under study. Days taken to 50 per cent flowering showed significant and positive correlation both at genotypic and phenotypic levels with maturation days (red chilli) (0.5850 and 0.5456 respectively) and maturation days (green chilli) (0.5782 and 0.5582 respectively) whereas it exhibited non-significant correlation with other characters.

Fruit length exhibited positive and significant genotypic and phenotypic correlation with fruit girth (0.9913 and 0.9761 respectively), fruit weight (0.9729 and 0.9695 respectively), number of seeds per fruit (0.7421 and 0.7072 respectively), number of fruits per plant (0.5774 and 0.5524 respectively) and 1000-seed weight (0.6751 and 0.6677 respectively). Fruit length and fruit girth also showed positive and significant association showing that more length and girth of fruit increases weight of fruit thus total fruit yield per plant. Significant association of plant height with yield can be justified by high total yield per plant that is due to the more number of branches per plant that increases number of fruits per plant (Ukkund et al 2007). There was positive and significant genotypic and phenotypic correlation coefficient of fruit girth with fruit weight (0.9708 and 0.9531 respectively), number of fruits per plant (0.5403 and 0.5073 respectively), number of seeds per fruit (0.7649 and 0.7152 respectively) and 1000-seed weight (0.6613 and 0.6478 respectively). Fruit weight showed a positive significant genotypic and phenotypic correlation with number of fruits per plant (0.6635 and 0.6342 respectively) and number of seeds per fruit (0.7684 and 0.7310 respectively). Positive and significant correlation at both phenotypic and genotypic levels was observed between number of fruits per plant and fruit weight (Ukkund et al 2007).

Green fruit yield and dry yield per plant exhibited highly significant correlation with fruit length (0.9443 and 0.8791 respectively), fruit girth (0.9459 and 0.8844 respectively), fruit weight (0.9839 and 0.9219 respectively), number of fruits per plant (0.6585 and 0.6245 respectively), number of seeds per fruit (0.7654 and 0.7458 respectively) and 1000-seed weight (0.7497 and 0.7856 respectively) indicating the usefulness of these traits for improving fruit yield in chilli. Similar results have been reported in chillies by Pasudesai et al (2006), Hosamani and Shivkumar (2008), Ganeshreddy et al (2008) and Jabeen et al (2009) who have observed significance of various yield attributing traits with fruit yield.

Path coefficient analysis permitting a critical examination of direct and indirect contribution of component characters towards fruit yield was analyzed using the

Table 1. List of chilli genotypes and their sources used in the study

Genotype	Source	Genotype	Source
Arka Lohit	IIHR, Banglore, Karnataka	DCL-520	IARI, New Delhi
CH-1	PAU, Ludhiana, Punjab	Kashmir Long	SKUAST-Kashmir (J&K)
Bhagyalakshami	RARS, Lam, Guntur, AP	PUP-CH-08	CSKHPKV, Palampur, HP
Pusa Sadabahar	IARI, New Delhi	NCH-162	CSKHPKV, Palampur, HP
Anugraha	KAU, Kerala	DCL-352	IARI, New Delhi
PCP-CH-4-08	CSK HPKV, Palampur	Pusa Jawala	IARI, New Delhi
K-1	Kovilpatti, Tamil Nadu	AG-08	CSKHPKV, Palampur, HP
LCA-357	RARS, Lam, Guntur, AP	1118-14	CSKHPKV, Palampur, HP
Pant C-1	GBPUAT, Pantnagar, UK	PKM-1	Kovilpatti, Tamil Nadu
CPC-08-E	CSKHPKV, Palampur, HP	PCP-08-CH	CSKHPKV, Palampur, HP
PH-08	CSKHPKV, Palampur, HP	Surajmukhi	CSKHPKV, Palampur, HP
CCH-05	SKUAST-Jammu (J&K)		

genotypic correlation coefficients and their results are presented in Table 3. For path analysis at the genotypic level dry yield per plant was taken as dependent variable and all other traits used for correlation were considered as causal variables. The direct effect of days taken to first flowering on dry yield/plant was positive (0.9162). It had positive indirect effect via traits like days taken to 50 per cent flowering, maturation days (green) and maturation days (red) and negative indirect effect on rest of the characters studied.

The correlation of fruit length (0.8791), fruit girth (0.8844), fruit weight (0.9219), number of fruits per plant (0.6245), 1000-seed weight (0.7856) and green fruit yield (0.9354) with dry fruit yield was positive and their direct effect on dry fruit yield was also positive. Direct and positive effect on dry fruit yield was observed for fruit length, fruit girth, fruit weight, number of fruits per plant, 1000-seed weight and green fruit yield (Kumar et al 2003, Leaya and Khader 2002, Verma et al 2004, Krishnamurthy et al 2013) emphasizing importance of these characters in chilli improvement. For green and dry fruit yield selection on the basis of fruit length, fruit girth, fruit weight and number of fruits per plant would be worthwhile. Khurana et al (2003) and Kharad et al (2006) also observed direct and positive effect of fruit length, fruit girth, fruit weight and number of fruits per plant on dry fruit yield per plant. Days to maturity (green) exhibited a good amount of direct

Table 2. Genotypic and phenotypic correlation coefficient of different characters in chilli germplasm

Character		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	(G)	1.0000	0.9726**	- 0.4440	- 0.4559	- 0.5081	- 0.4643	- 0.5401*	- 0.5183	- 0.5657*	0.5297	0.5272	- 0.6018*	- 0.5917*	- 0.5973*
	(P)	-	0.9436**	- 0.4379	-0.4425	- 0.4985	- 0.4582	- 0.5248	- 0.4952	- 0.5279	0.5166	0.5048	- 0.5875*	- 0.5856*	- 0.5888*
2	(G)	-	1.0000	- 0.4553	- 0.4403	- 0.5149	- 0.5020	- 0.5682*	- 0.5276	- 0.5725*	0.5782*	0.5850*	- 0.5819*	- 0.5874*	- 0.5960*
	(P)	-	-	- 0.4454	- 0.4220	- 0.5052	- 0.4926	- 0.5443*	- 0.4929	- 0.5196	0.5582*	0.5456*	- 0.5728*	- 0.5810*	-0.5776*
3	(G)	-	-	1.0000	0.9913**	0.9729**	0.5188	0.4679	0.5774*	0.7421**	- 0.2201	- 0.2361	0.6751**	0.9443**	0.8791**
	(P)	-	-	-	0.9761**	0.9695**	0.5174	0.4611	0.5524*	0.7072**	- 0.2123	- 0.2257	0.6677**	0.9426**	0.8693**
4	(G)	-	-	-	1.0000	0.9708**	0.4729	0.4185	0.5403*	0.7649**	- 0.2532	- 0.2706	0.6613**	0.9459**	0.8844**
	(P)	-	-	-	-	0.9531**	0.4631	0.4142	0.5073	0.7152**	- 0.2517	- 0.2632	0.6478**	0.9300**	0.8497**
5	(G)	-	-	-	-	1.0000	0.5796*	0.5428*	0.6635**	0.7684**	- 0.2571	- 0.2547	0.7320**	0.9839**	0.9219**
	(P)	-	-	-	-	-	0.5776*	0.5315	0.6342*	0.7310**	- 0.2441	- 0.2423	0.7190**	0.9799**	0.9079**
6	(G)	-	-	-	-	-	1.0000	0.7659**	0.8464**	0.5440*	- 0.1598	- 0.1799	0.5574*	0.5603*	0.4904
	(P)	-	-	-	-	-	-	0.7473**	0.8087**	0.5145	- 0.1544	- 0.1657	0.5523*	0.5590*	0.4812
7	(G)	-	-	-	-	-	-	1.0000	0.9211**	0.5446*	- 0.3195	- 0.2810	0.5784*	0.5601*	0.4838
	(P)	-	-	-	-	-	-	-	0.8808**	0.4864	- 0.3021	- 0.2745	0.5631*	0.5504*	0.4665
8	(G)	-	-	-	-	-	-	-	1.0000	0.6225*	- 0.3555	0.3283	0.6681**	0.6585*	0.6245*
	(P)	-	-	-	-	-	-	-	-	0.5763*	- 0.3388	- 0.2995	0.6430*	0.6302*	0.5896*
9	(G)	-	-	-	-	-	-	-	-	1.0000	- 0.4546	- 0.4765	0.5249	0.7654**	0.7458**
	(P)	-	-	-	-	-	-	-	-	-	- 0.4417	- 0.4070	0.4961	0.7225**	0.7020**
10	(G)	-	-	-	-	-	-	-	-	-	1.0000	0.9947**	- 0.2040	- 0.2720	- 0.3894
	(P)	-	-	-	-	-	-	-	-	-	-	0.9364**	- 0.2110	- 0.2657	- 0.3647
11	(G)	-	-	-	-	-	-	-	-	-	-	1.0000	- 0.2043	- 0.2675	- 0.3817
	(P)	-	-	-	-	-	-	-	-	-	-	-	- 0.1789	- 0.2562	- 0.3664
12	(G)	-	-	-	-	-	-	-	-	-	-	-	1.0000	- 0.7497**	0.7856**
	(P)	-	-	-	-	-	-	-	-	-	-	-	-	0.7422**	0.7596**
13	(G)	-	-	-	-	-	-	-	-	-	-	-	-	1.0000	0.9354**
	(P)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9237**
14	(G)	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0000
	(P)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 Days taken to first flowering
2 Days taken to 50% flowering
3 Fruit length (cm)
4 Fruit girth (cm)
5 Fruit weight (g)
6 Branches (#)
7 Plant height (cm)
8 Fruits/plant (#)
9 Seeds/fruit (#)
10 Maturation days (green)
11 Maturation days (red)
12 1000-seed weight (g)
13 Green fruit yield (g/plant)
14 Dry yield (g/plant)

**Significant at 1%, *Significant at 5%, G = genotype, P = phenotype

Table 3. Path coefficient analysis of direct (below diagonal) and indirect (above diagonal) effects of component traits in chilli germplasm

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	rg
1	**0.9162**	0.8911	- 0.4067	- 0.4177	- 0.4656	- 0.4254	- 0.4949	- 0.4749	- 0.5183	0.4854	0.4830	- 0.5514	-0.5421	- 0.5973*
2	-1.1325	**- 1.1644**	0.5302	0.5127	-0.5996	0.5845	0.6616	0.6144	0.6666	-0.6732	-0.6839	0.6775	0.6839	- 0.5960*
3	1.1092	1.1377	**- 2.4985**	- 2.4767	- 2.4309	- 1.2963	- 1.1690	- 1.4426	- 1.8541	0.5499	0.5899	- 1.6868	- 2.3594	0.8791**
4	- 0.9103	- 0.8791	1.9791	**1.9966**	1.9382	0.9441	0.8355	1.0788	1.5272	- 0.5056	- 0.5402	1.3202	1.8885	0.8844**
5	- 0.5888	- 0.5967	1.1275	1.1250	**1.1589**	0.6717	0.6290	0.7689	0.8905	- 0.2980	- 0.2952	0.8483	1.1402	0.9219**
6	0.3196	0.3455	- 0.3571	- 0.3255	- 0.3990	**- 0.6884**	- 0.5272	- 0.5826	- 0.3745	0.1100	0.1239	- 0.3837	- 0.3857	0.4904
7	0.0793	0.8340	- 0.0687	- 0.0614	- 0.0797	- 0.1124	**- 0.1468**	- 0.1352	- 0.7990	0.0469	0.0412	- 0.0849	- 0.0822	0.4838
8	- 0.4802	- 0.4888	0.5349	0.5006	0.6147	0.7841	0.8533	**0.9264**	0.5767	- 0.3293	- 0.3041	0.6190	0.6100	0.6245*
9	0.1415	0.1432	- 0.1857	-0.1914	- 0.1923	- 0.1361	- 0.1363	- 0.1558	**- 0.2502**	0.1137	0.1192	- 0.1313	- 0.1915	0.7458**
10	1.5427	1.6837	- 0.6410	- 0.7375	- 0.7488	- 0.4652	- 0.9304	- 1.0352	- 1.3238	**2.9122**	2.8968	- 0.5942	- 0.7922	- 0.3894
11	-1.4517	- 1.6109	0.6501	0.7450	0.7013	0.4955	0.7736	0.9039	1.3122	- 2.7390	**- 2.7535**	0.5625	0.7366	- 0.3817
12	-0.0255	- 0.2460	0.0286	0.0280	0.0310	0.0236	0.0245	0.0283	0.0222	- 0.0086	- 0.0086	**0.0423**	0.0317	0.7856**
13	-0.1169	- 0.1160	0.1865	0.1868	0.1943	0.1107	0.1106	0.1300	0.1512	- 0.0537	- 0.0528	0.1481	**0.1975**	0.9354**

1 Days taken to first flowering (g/plant)
2 Days taken to 50% flowering
3 Fruit length (cm)
4 Fruit girth (cm)
5 Fruit weight (g)
6 Branches (#)
7 Plant height (cm)
8 Fruits/plant (#)
9 Seeds/fruit (#)
10 Maturation days (green)
11 Maturation days (red)
12 1000-seed weight (g)
13 Green fruit yield

rg= Genotypic correlation co-efficient with dry fruit yield

effect on dry fruit per plant and its correlation with dry fruit yield was positive. Thus this character can be considered for selection for high yield. Similar results were reported by Rani et al (1996) and Gogoi and Gautam (2003) in chilli. The results suggested that due emphasis should be given to the genotypes that are having maximum number of fruits per plant, fruit length, fruit girth and fruit weight in the selection process due to their high positive direct effect on dry fruit yield. The remaining characters also exerted considerable direct effect on yield revealing the scope for considering these traits in selection.

The correlation studies with 23 genotypes of chilli revealed the importance of number of fruits per plant, number of branches, plant height and fruit weight in determining fruit yield. The path coefficient analysis brought out the number of fruits per plant, fruit length, fruit girth and fruit weight as major yield components. Hence a perusal of correlation and path analysis studies of the present investigation reveal that the number of fruits per plant, fruit length, fruit girth, fruit weight are highly important yield components of having direct bearing on improvement of dry fruit yield per plant of chilli.

REFERENCES

Al-Jibouri HR, Miller PA and Robinson HF 1958. Genotypic and environmental variance and covariance in an upland cotton crop of inter-specific origin. Agronomy Journal **50:** 633-637.

Dewey DR and Lu KH 1959. Correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal **51:** 515-518.

Ganeshreddy M, Kumar H and Salimath P 2008. Correlation and path analysis in chilli. Karnatka Journal of Agricultural Sciences **21:** 259-261.

Gogoi D and Gautam BP 2003. Correlation and path coefficient analysis in chilli (*Capsicum annuum* L). Agriculture Science Digest **23:** 162-166.

Hosamani RM and Shivkumar 2008. Correlation and path coefficient analysis in chilli. Indian Journal of Horticulture **65(3):** 349-352.

Jabeen N, Sofi PA and Wani SA 2009. Character association in chilli (*Capsicum annuum* L). Revista UDO Agrícola **9(3):** 487-490.

Kharad SR, Navale PA and Kadam DE 2006. Variability and path-coefficient analysis in chilli (*Capsicum annuum* L). International Journal of Agricultural Science **2(1):** 90-92.

Khurana DS, Singh P and Hundal JS 2003. Studies on genetic diversity for growth, yield and quality traits in chilli (*Capsicum annuum* L). Indian Journal of Horticulture **60(3):** 277–282.

Krishnamurthy SL, Reddy KM and Rao AM 2013. Genetic variation, path and correlation analysis in crosses among Indian and Taiwan parents in chilli. Vegetable Science **40(2):** 210-213

Kumar BK, Munshi AD, Joshi S and Kaur C 2003. Correlation and path coefficient analysis for yield and biochemical characters in chilli (*Capsicum annuum* L). Capsicum Eggplant Newsletter **22:** 67-70.

Leaya J and Khader KMA 2002. Correlation and path coefficient analysis in chilli (*Capsicum annum* L). Capsicum Eggplant Newsletter **21:** 56-59.

Pasudesai M, Bendale V, Bhave S, Sawant S and Desai S 2006. Association analysis for fruit yield and its components in chilli. Crop Research **31:** 291-294.

Patil BT, Bhalekar MN and Shinde KG 2012. Heterosis studies in chilli (*Capsicum annuum*

L) for earliness, growth and green fruit yield. Vegetable Science **39(1):** 73-75.

Rani K, Natarajan S and Thamburaj S 1996. Correlation and path analysis in chilli (*Capsicum annuum* L). South Indian Horticulture **44:** 8-11.

Ukkund Krishna C, Patil MP, Madalageri MB, Mulage R and Jagadeesh C 2007. Character association and path analysis studies in green chilli for yield and yield attributes (*Capsicum annum* L). Karnataka Journal of Agricultural Sciences **20(1):** 99-101.

Verma SK, Singh RK and Arya RR 2004. Genetic variability and correlation studies in chillies. Progressive Horticulture **36: 1**13-117.s

Wright S 1921. Correlation and causation. Journal of Agricultural Research **20:** 557-585.

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