I J P S INTERNATIONAL JOURNAL OF PLANT SCIENCES
ISSN-0973-1547 Volume 16 | Issue 1 | January, 2021 | 1-6

DOI: 10.15740/HAS/IJPS/16.1/1-6
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RESEARCH ARTICLE

Correlation and path-coefficient analysis in Ramnad Mundu chilli (*Capsicum annuum* L.) for yield and quality traits

■ J. Phani Kumar, P. Paramaguru, T. Arumugam, N. Manikanda Boopathi and K. Venkatesan

SUMMARY

The present investigation was conducted to find the correlation and path-coefficient analysis for yield and yield contributing characters in Ramnad Mundu chilli (*Capsicum annuum* L.) during *Kharif* 2018-19. The experiment was conducted on Forty-seven Mundu chilli genotypes for 15 characters, which was laid out in Randomized Complete Block Design with two replications. From correlation study dry fruit yield per plant showed highly positive correlation with number of fruits per plant (0.971 G, 0.894 P), ripened fruit yield per plant (0.991 G, 0.949 P), number of seeds per fruits (0.383 G, 0.32 P), 1000 seed weight (0.369 G, 0.332 P), capsaicin % (0.302 G, 0.256 P) and number of primary branches per plant (0.267 G, 0.251 P) at both genotypic and phenotypic level. Path-coefficient analysis of different characters contributing towards the highest positive direct effect *via* number of fruits per plant (0.973), ripened fruit yield per plant (0.991), no. of seeds per fruit (0.383), 1000 seed weight (0.364), capsaicin % (0.302) and number of primary branches per plant (0.267). Hence, direct selection based on these characters would be effective in crop improvement through plant breeding in Mundu chilli.

Key Words : Ramnad mundu chilli, Anthracnose, *Colletotrichum* species, Correlation, Path co-efficient analysis

How to cite this article : Kumar, J. Phani, Paramaguru, P., Arumugam, T., Boopathi, N. Manikanda and Venkatesan, K. (2021). Correlation and path-coefficient analysis in Ramnad Mundu chilli (*Capsicum annuum* L.) for yield and quality traits. *Internat. J. Plant Sci.*, **16** (1): 1-6, **DOI: 10.15740/HAS/IJPS/16.1/1-6,**

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Article chronicle : Received : 22.10.2020; **Revised :** 02.11.2020; **Accepted :** 01.12.2020

Chilli (*Capsicum annuum* L., 2n=24) is an important spice in the world (Pickersgill,1997). It has been told that chilli shighly appreciated for its spicy flavour and nutritional value (Amare, 2013). Chilli, also known as hot pepper, was introduced into India from Brazil during 1584 by the Portuguese. Chilli is the indispensable spice, essentially used in every Indian

cuisine as they provide heat, colour and flavour. It is valued for its pungency, which is due to crystalline acrid volatile alkaloid capsaicin, present in the placenta of fruits. Capsaicin has diverse prophylactic and therapeutic uses in allopathic and ayurvedic medicine (Sumathy Kutty and Mathew, 1984). It is sometimes referred as capsule of vitamin C because of rich vitamin C content in the fruit (Durust *et al.,* 1997). Besides, it also contains higher amount of carotene (pro-vitamin A), vitamin E, B_1 (thiamine), B_2 (riboflavin), B_3 (niacin) and small quantity of proteins, fats, carbohydrates and traces of minerals (Hosmani, 1993). India is the world leader in dry chilli production with total area of 7.21 lakh hectare and production of 16.90 lakh tonnes. Among all states Andhra Pradesh stood top first in chilli cultivation followed by Karnataka, West Bengal, Madhya Pradesh, Orissa, Tamil Nadu (NHB, 2020). Ramnad Mundu chilli is a local round/oblong type especially grown as a rainfed crop exclusively for spice in Tamil Nadu, India. It measures 0.6-1.5-inch in length, 2.7-5.11-inch diameter with thick pericarp (0.25 mm). Mundu chilli is mainly grown as a rainfed crop under the coastal saline belt of Ramanathapuram, Viruthunagar and Tuticorin districts of Tamil Nadu, where soils are moderate to high alkalinity (soil pH 7.5-9.0) with less annual rainfall (460.0 mm). Mundu chilli has moderate pungency (Capsaicin content 0.26-0.38%) with rich oleoresin content (13%), and ASTA colour value of -70.95 units, which is most suitable for spice. Hence, farmers preferred this type for rainfed regions, since it fetches higher price in the than the samba type and tolerates drought and salinity. The productivity of the Mundu chilli in Tamil Nadu is low (1.2 t/ha) (Anonymous, 2019). Since yield is a complex character, governed by a large number of components traits, it is imperative to know the interrelationship between yield and its component traits. Correlation simply measures the association between yield and other traits, whereas path co-efficient analysis permits the separation of correlation into direct effects (path co-efficient) and indirect effects (effects exerted through other variables). This technique, which aims to improve a dependent character (like yield when the independent characters have a significant relation in desirable direction) through other component traits on the dependent characters, became routine in plant breeding programme since its use by Dewey and Lu (1959). Therefore, knowledge on correlation and path co-efficient 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 Western Block, Horticultural College and Research Institute, Periyakulam, during *Kharif*, September, 2018-March, 19. Forty-seven Mundu chilli genotypes were evaluated in Randomized Block Design with two replications. The nursery was raised during last week of September, 2018 and the seedlings were transplanted at a spacing of 60 cm × 30 cm in a row of 10 m length during last week of October, 2018. The crop was raised as per the recommended package of practices outlined by TNAU Agri Portal (https://agritech.tnau.ac.in/horticulture/horti_vegetables_chilli_index.html).

The observations were recorded on the following 15 yield and quality contributing characters: plant height (cm), days to 50 % flowering, number of primary branches per plant, fruit length (cm), fruits girth (cm), number of fruits per plant, ripened fruit yield per plant (g), number of seeds per fruits, 1000-seed weight (g), ascorbic acid (mg/100g), oleoresin (%), capsanthin (ASTA), colour value (ASTA), capsaicin content (%) and dry fruit yield per plant (g) and the collected data were statistically analysed to calculate correlation and path-coefficient analysisas suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Correlation co-efficient analysis:

Correlation co-efficient was calculated workout at genotypic and phenotypic level for all possible combination of yield and its attributing traits in Mundu chilli. The results indicated that genotypic co-efficient of correlation in general were of higher magnitude than the corresponding phenotypic ones.

The correlation co-efficient at both genotypic and phenotypic levels indicated that fruit yield per plant was significantly and positively correlated with dry fruit yield per plant at number of fruits per plant (0.971 G, 0.894

P), ripened fruit yield per plant (0.991 G, 0.949 P), number of seeds per fruits (0.383 G, 0.32 P), 1000 seed weight (0.369 G, 0.332 P), capsaicin % (0.302 G, 0.256 P) and number of primary branches per plant (0.267 G, 0.251 P) (Table 1). Similar results were reported by Gupta *et al.* (2009); Ullah *et al.* (2011); Chattopadhyay *et al.* (2011), Kumar *et al.* (2012) and Yatung *et al.* (2014). Farhad *et al.* (2008) and Amit *et al.* (2014) reported parallel character association with fruit yield per plant and number of primary branches per plant. Nazir *et al.* (2005) and Hosamani and Shivkumar (2008) showed similar association with 1000 seed weight and number of seeds per fruit.

Ripened fruits yield per plant showed highly significant positive correlation with number of fruits per plant (0.941 G, 0.927 P) number of primary branches per plant (0.306 G, 0.296 P) also 1000 seed weight showed significantly positive correlation with number of fruits per plant (0.482 G, 0.437 P), ripened fruit yield per plant (0.335 G, 0.316 P), number of seeds per fruit (0.892 G, 0.756 P). Similar results were reported by Rani *et al.* (1996). Capsaicin has showed positive correlation, both at genotypic and phenotypic levels with number of primary branches per plant (0.350 G, 0.295 P), no. of fruits per plant (0.403 G, 0.361 P), ripened fruits yield per plant (0.353 G, 0.310 P), number of seeds per fruit (0.242 G, 0.247 P), ascorbic acid (0.319 G, 0.255 P) and capsanthin ASTA (0.358 G, 0.314 P). Likewise,

Table 1 : Estimate of genotypic (G) and phenotypic (P) correlation co-efficient between dry fruit yield and its components in Mundu chilli

		2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	G	-0.053	-0.041	0.335*	-0.268*	0.070	0.123	-0.019	-0.122	-0.060	0.034	0.007	0.089	-0.386*	0.131
	P	-0.068	-0.008	0.282*	-0.255*	0.074	0.111	-0.006	-0.097	-0.065	0.080	0.060	0.038	-0.344*	0.128
2	G		-0.061	-0.003	0.077	0.086	0.003	0.006	0.069	0.133	0.084	-0.295*	-0.203*	0.380**	-0.043
	P		-0.026	0.016	0.073	0.086	0.010	0.032	0.008	0.152	0.060	-0.251*	-0.077	0.332**	-0.058
3	G			-0.046	0.150	0.307*	0.306*	0.168	0.223*	0.142	0.350*	0.051	0.171	0.264*	0.267*
	P			-0.015	0.124	0.297*	0.296*	0.171	0.190	0.149	0.295**	0.057	0.157	0.257 *	0.251*
4	G				-0.416**	-0.246*	-0.200	-0.465**	-0.303*	-0.141	-0.426**	-0.365*	-0.094	-0.255*	-0.122
	P				-0.326**	-0.216*	-0.181	-0.422**	-0.264*	-0.117	-0.356**	-0.233*	-0.012	-0.197	-0.101
5	G					-0.015	0.014	-0.013	-0.126	-0.181	0.191	0.056	0.051	0.115	-0.061
	P					-0.022	0.007	-0.008	-0.115	-0.171	0.148	0.040	0.059	0.111	-0.050
6	G						0.941**	0.484**	0.482**	0.199	0.403**	0.062	0.182	0.264*	0.973**
	P						0.927**	0.472**	0.437**	0.174	0.361**	0.070	0.145	0.241*	0.894**
7	G							0.369**	0.335**	0.177	0.353**	0.170	0.175	0.149	0.991**
	P							0.355*	0.316**	0.168	0.310**	0.129	0.140	0.140	0.949**
8	G								0.892**	0.329*	0.242*	-0.030	0.032	0.228*	0.383**
	P								0.756**	0.281**	0.247*	0.009	0.025	0.205*	0.323*
9	G									0.387**	0.036	-0.015	-0.088	0.264*	0.364**
	P									0.345**	0.089	-0.006	-0.091	0.229*	0.332*
10	G										0.094	0.319*	0.044	0.313*	0.129
	P										0.071	0.255*	0.045	0.290*	0.130
11	G											0.153	0.370*	0.358*	0.302*
	P											0.176	0.187	0.314*	0.256*
12	G												0.319*	0.015	0.143
	P												0.166	0.015	0.119
13	G													0.096	0.190
	P													0.079	0.132
14	G														0.090
	P														0.093

* and ** indicate significance of values at P=0.01 and 0.05, respectively

1- Days to 50% flowering, 2- plant height (cm), 3- Number of primary branches per plant, 4- Fruit length (cm), 5- Fruit girth (cm), 6- Number of fruits per plant, 7- Ripened fruits yield per plant (g), 8- Number of seeds per fruit, 9-1000 seed weight (g), 10- Ascorbic acid (mg/100g), 11- Capsaicin (%), 12- Oleoresin (%), 13- Colour value (ASTA), 14- Capsanthin (ASTA), 15- Dry fruit yield per plant (g)

Table 2 : Genotypic path co-efficient analysis showing direct and indirect effect on dry fruit yield plant^{-1} in Mundu chilli

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-0.113	0.006	0.005	-0.038	0.030	-0.008	-0.014	0.002	0.014	0.007	-0.004	-0.001	-0.010	0.044	0.131
2	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	0.001	-0.043
3	-0.001	-0.001	0.014	-0.001	0.002	0.004	0.004	0.002	0.003	0.002	0.005	0.001	0.002	0.004	0.267*
4	0.072	-0.001	-0.010	0.216	-0.090	-0.053	-0.043	-0.100	-0.066	-0.031	-0.092	-0.079	-0.020	-0.055	-0.122
5	0.007	-0.002	-0.004	0.011	-0.027	0.000	0.000	0.000	0.003	0.005	-0.005	-0.002	-0.001	-0.003	-0.061
6	0.058	0.070	0.252	-0.202	-0.012	0.820	0.772	0.397	0.395	0.163	0.331	0.051	0.150	0.216	0.973**
7	0.035	0.001	0.088	-0.058	0.004	0.270	0.287	0.106	0.096	0.051	0.101	0.049	0.050	0.043	0.991**
8	-0.007	0.002	0.058	-0.161	-0.005	0.167	0.128	0.346	0.308	0.114	0.084	-0.010	0.011	0.079	0.383**
9	0.041	-0.023	-0.075	0.102	0.042	-0.162	-0.112	-0.299	-0.336	-0.130	-0.012	0.005	0.030	-0.089	0.364**
10	0.004	-0.009	-0.010	0.010	0.012	-0.014	-0.012	-0.023	-0.027	-0.068	-0.006	-0.022	-0.003	-0.021	0.129
11	-0.003	-0.007	-0.027	0.033	-0.015	-0.031	-0.028	-0.019	-0.003	-0.007	-0.078	-0.012	-0.029	-0.028	0.302*
12	0.001	-0.052	0.009	-0.065	0.010	0.011	0.030	-0.005	-0.003	0.056	0.027	0.177	0.056	0.003	0.143
13	-0.003	0.007	-0.006	0.003	-0.002	-0.007	-0.006	-0.001	0.003	-0.002	-0.013	-0.011	-0.035	-0.003	0.190
14	0.039	-0.038	-0.026	0.026	-0.012	-0.026	-0.015	-0.023	-0.026	-0.031	-0.036	-0.002	-0.010	-0.100	0.090
15	0.131	-0.043	0.267*	-0.122	-0.061	0.973**	0.991**	0.383**	0.364**	0.129	0.302*	0.143	0.190	0.090	1.000

(R square = 0.474 Residual effect G = 0.312) 1- Days to 50% flowering, 2- plant height (cm), 3- Number of primary branches per plant, 4- Fruit length (cm), 5- Fruit girth (cm), 6- Number of fruits per plant, 7- Ripened fruits yield per plant (g), 8- Number of seeds per fruit, 9-1000 seed weight (g), 10- Ascorbic acid (mg/100g), 11- Capsaicin (%), 12- Oleoresin (%), 13- Colour value (ASTA), 14- Capsanthin (ASTA), 15- Dry fruit yield per plant (g)

capsanthin showed positive correlation with plant height (0.380 G, 0.332 P), number of primary branches per plant (0.264 G, 0.257 P), number of fruits per plant (0.264 G, 0.241 P) also with ascorbic acid (0.321 G, 0.290 P). Sharma *et al.* (2010) reported similar results with number of primary branches per plant and capsanthin (ASTA) content. Kaur and Singh (2009) showed similar results with number of fruits per plant and capsanthin content.

Highly significant but negative correlation associated with oleoresin % with plant height (-0.295 G, -0.251 P) and fruit length (-0.365 G, -0.233 P). These results corroborated the findings of Karad *et al.* (2002). Also, fruit length showed significantly negative correlation with number of seeds per fruit (-0.465 G, -0.422 P), no. of fruits per plant (-0.246 G, -0.216 P) and fruit girth (-0.416 G, -0.326 P). Similar results were also reported by Benchaim and Paran (2000).

Path-coefficient analysis:

Direct effect:

Path co-efficient analysis of different characters contributing towards the highest positive direct effect *via* number of fruits per plant (0.973), ripened fruit yield per plant (0.991), no. of seeds per fruit (0.383), 1000 seed weight (0.364), capsaicin % (0.302) and number of primary branches per plant (0.267). The results corroborated the findings of Sreelathakumar and Rajamony (2004); Vani *et al.* (2007) and Pandit *et al.* (2009).

Indirect effect:

Number of fruits per plant was reported to have positive indirect effect on ripened fruits yield per plant (0.772), 1000 seed weight (0.397), capsaicin % (0.331) and capsanthin ASTS (0.216). While negative indirect effect via fruit length (-0.206), ripened fruit yield per plant (-0.112) and number of seeds per fruit (-0.299). Similar results were also reported by Singh and Singh (2004); Sarkar *et al.* (2009); Datta and Jana (2010) and Shabarish and Dharmatti (2014).

Conclusion:

The results obtained in this investigation revealed the occurrence of considerable positive direct effect ofnumber of fruits per plant, ripened fruit yield per plant on dry fruit yield per plant at both phenotypic and genotypic levels. Ripened fruits yield per plant showed highly significant positive correlation with number of fruits per plant, number of primary branches per plantalso 1000 seed weight showed significantly positive correlation with number of fruits per plant, ripened fruit yield per plant, number of seeds per fruit. Thus, it can be concluded that all these traits should be duly considered as direct selection to develop high yielding varieties in Mundu chilli through plant breeding.

Acknowledgements:

The first author expresses his gratitude to Tamil Nadu Agricultural University, Coimbatore for providing financial assistance as Ph.D., Fellowship to complete this work.

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