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Correlation study for fruit yield and its attributing traits in segregating generation (F_2) of Brinjal (*Solanum melongena* L.)

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Abstract
Brinjal is an important vegetable can grow through the year. Fruits found in varying colours like purple, green, white and their combinations. Rich in medicinal properties as well as broad genetic base. The experiment was conducted during *Rabi* 2020-21 at the Research cum Instructional Farm, Dau Kalyan Singh College of Agriculture and Reseach station Bhatapara, I.G.K.V., Chhattisgarh. Correlation study was estimated in twenty four F_2 population, where there is high level of segregation obtained. Mean sum of square due to genotype found highly significant for all the traits. Genotypic correlations were higher than the phenotypic correlation coefficients indicating the strong association between characters. Fruit yield per plant showed highly significant and positive correlation with number of primary branches, number of cluster per plant, number of flower per inflorescence, number of fruits per cluster, number of fruits per plant, fruit length, fruit girth, average fruit weight, pericarp thickness and number of fruit per plant per picking at both phenotypic and genotypic levels.

Keywords: fruit yield, Brinjal (*Solanum melongena* L.), phenotypic and genotypic

Introduction
Brinjal (*Solanum melongena* L.), one of the most popular and principal vegetable crops grown in India and other parts of the world which belongs to the family solanaceae. Eggplant was known to India from ancient times (De Candolle, 1883) [8] and is may be a native of India (Vivilov, 1928) [24]. Brinjal is nutritious vegetable fairly good source of all essentials elements, including Calcium, Iron, phosphorus and vitamins specially 'B' complex. A knowledge of genetics correlation among the characters contributing to the yield leads to the most effectives method of selection (Feyzian *et al.*, 2009) [9]. By this way combinations of favorable character could be brought out by minimizing the effect of antagonistic relations. Yield components characters exhibits associations among themselves and with yield. Hence, study of correlation of components characters with yields would aid in planning of an effectives selection. Therefore, the present study was aimed at to study correlation among twenty four F_2 population.

Material Methods
The experiment was conducted during *Rabi* 2020-21 at the Research cum Instructional Farm, Dau Kalyan Singh College of Agriculture and Reseach station Bhatapara, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, India. Twenty four F_2's (Table I) were transplanted in a randomized block design with three replications. Every replication comprised of 24 genotypes. Each plot comprised of two rows of 6 m long and 10 plants in each line. The spacing given was 75 cm between rows and 60 cm between plants inside a line. Five arbitrarily tagged competitive plants from every entry were labeled and observations on sixteen characters *viz.* Days to 50 per cent flowering, Days to first fruit harvest, Plant height (cm), Plant spread (cm), No. of primary branches per plant, number of clusters per plant, number of flowers per inflorescence No. of fruits per cluster, number of fruits per plant, Fruit length (cm), Fruit girth (cm), Average fruit weight (g), Pericarp thickness (mm), number of fruits per plant per picking, Fruit yield per plant (kg) were recorded on labeled plants only. The data were statistically analyzed for computation of Correlation coefficients for all possible combinations among the characters at genotypic and phenotypic levels as method suggested by Searle (1961) [18].

Results and Discussion

The correlation study was estimated in F_2 population, where there is high level of segregation, under such circumstances the correlation among the fruit yield and component characters will be worth useful. Analysis of variance for fruit yield and its component characters is presented in Table II for all genotypes under study *i.e.* F_2. Data as per the table revealed that mean sum of square due to genotype found highly significant for all the traits, indicated presence of remarkable variability within the genotypes for the characters under study.

The phenotypic (P) and genotypic (G) correlation coefficient were analyzed for fifteen characters of brinjal and the findings are presented in Table III and only significant correlations are explained. In general, genotypic correlations were higher than the phenotypic correlation coefficients indicating the strong association between two characters genetically.

Days to 50 percent flowering recorded positive and highly significant correlation with days to first fruit harvest (0.540 and 0.798) as well as with plant height (0.383 and 0.447) at both phenotypic and genotypic levels, whereas, it exhibited negative significant correlation was reported with numbers of primary branches per plant (-0.213 and -0.248) at both phenotypic and genotypic levels. It also showed negative significant and highly significant correlation with pericarp thickness (-0.241 and -0.296) at phenotypic and genotypic levels respectively. These results are closely with the finding of Sharma and Krishna Swaroop (2000) [19], Bansal and Mehta (2008) [4], Shinde *et al.* (2009) [20], Ansari *et al.* (2011) [1], Sujin *et al.* (2017) [23].

Days to first fruit harvest exhibited positive highly significant correlation with plant height (0.322 and 0.411) at both phenotypic and genotypic levels. It also showed negative highly significant correlation with number of primary branches per plant (-0.352 and -0.422) at both phenotypic and genotypic levels, whereas it shows negative significant and highly significant correlation with numbers of fruits per plant per picking (-0.215 and -0.254) at phenotypic and genotypic levels respectively. Sarnaik *et al.* (1999) [17], Shinde *et al.* (2009) [20], Ansari *et al.* (2011) [1], Shivkumar *et al.* (2016), Sujin *et al.* (2017) [23] stated the close finding for days to first fruit harvest associated with marketable fruit yield per plant.

Plant height exhibited highly positive correlation with plant spread (0.397 and 0.452) at both phonotypic and genotypic levels. Plant height showed negative highly significant correlation with number of primary branches per plant (-0.279 and -0.303) in both phenotypic and genotypic levels, while it showed negative significant correlation with number of fruits per pant per picking (-0.200 and -0.215) at both phenotypic and genotypic levels. The results are in conformity with the finds of Rajput *et al.* (1996) [15], Sarnaik *et al.* (1999) [17], Sharma and Krishna Swaroop (2000) [19], Bansal and Mehta (2008) [4], Shinde *et al.* (2009) [20], Konyak *et al.* (2020) [10].

Significant positive correlation shown by plant spread with number of cluster per plant (0.211 and 0.231) as well as number of fruits per plant (0.219 and 0.226) for both at phenotypic and genotypic levels, whereas highly significant negative correlation was recorded with number of primary branches per plant (-0.259 and -0.281), fruit girth (-0.339 and -0.368) and average fruit weight (-0.413 and -0.444) at both phenotypic and genotypic levels. It also exhibited significant and highly significant negative correlation with pericarp thickness (-0.250 and -0.273) at phenotypic and genotypic levels respectively. These results are closely associated with the findings of Sarnaik *et al.* (1999) [17], Sharma and Krishna Swaroop (2000) [19], Asati (2001) [2], Bansal and Mehta (2008) [4].

Number of primary branches per plant exhibited positive highly significant correlation with fruit length (0.255 and 0.272), fruit girth (0.293 and 0.309) and average fruit weigh (0.293 and 0.301) at both phenotypic and genotypic levels. This character also showed positive significant correlation with number of fruit per cluster (0.194 and 0.207), pericarp thickness (0.199 and 0.214) and number of fruits per plant per picking (0.197 and 0.207) at both genotypic and phenotypic levels, while it showed significant and highly significant positive correlation with fruit yield per plant (0.248 and 0.270) at phenotypic and genotypic levels respectively. Sarnaik *et al.* (1999) [17], Sharma and Krishna Swaroop (2000) [19], Asati (2001) [2], Pratibha *et al.* (2004) [14], Bansal and Mehta (2008) [4], Shinde *et al.* (2009) [20], Ansari *et al.* (2011) [1], Bashar *et al.* (2015) [5], Konyak *et al.* (2020) [10] reported similar findings with fruit yield per plant.

Number of cluster per plant showed highly significant positive correlation with fruit yield per plant (0.371 and 0.385), number of fruits per plant per picking (0.490 and 0.509), fruit length (0.322 and 0.338), number of fruits per plant (0.443 and 0.461), number of fruits per cluster (0.451 and 0.465) and number of flower per inflorescence (0.423 and 0.444) at both phenotypic and genotypic levels. Sao (2006) [16], Sasmita (2017) reported the similar rfindings with fruit yield per plant.

Number of flower per inflorescence was found highly significant positive correlation with fruit yield per plant (0.515 and 0.540), number of fruits per plant per picking (0.412 and 0.437), number of fruits per cluster (0.510 and 0.529) and number of fruits per plant for both phenotypic and genotypic levels. Number of flower per inflorescence also showed significant positive correlation with average fruit weight (0.201) but only at genotypic levels. These results are closely associated with the findings of Asati (2001) [2], Lakshmi *et al.* (2014), Sao (2006) [16], Sasmita (2017).

Highly significant positive correlation was shown by number of fruits per cluster with fruit yield per plant (0.595 and 0.614), number of fruits per plant (0.597 and 0.631), fruit length (0.331 and 0.347) and number of fruits per plant per picking (0.573 and 0.593) both at phenotypic and genotypic levels. It also exhibited positive significant correlation with average fruit weight (0.205 and 0.218) at both phenotypic and genotypic levels. Finding are also agreed with the results of Ansari *et al.* (2011) [1], Lakshmi *et al.* (2014), Bashar *et al.* (2015) [5], Sao (2006) [16], Sasmita (2017).

Number of fruits per plant exhibited highly significant positive correlation for fruit yield per plant (0.647 and 0.676), number of fruits per plant (0.534 and 0.549) and fruit length (0.389 and 0.415) for both phenotypic and genotypic levels. Negative highly significant correlation was also shown by this trait with fruit girth (-0.278 and -0.301) for both phenotypic and genotypic levels. Average fruit weight (0.231 and 0.242) found also significant positive correlation with this trait at both phenotypic and genotypic levels. These findings are similar with the results of Rajput *et al.* (1996) [15], Badea *et al.* (1996) [3], Sarnaik *et al.* (1999) [17], Sharma and Krishna Swaroop (2000) [19], Asati (2001) [2], Patel and Sarnaik (2004) [13], Pratibha *et al.* (2004) [14], Ansari *et al.* (2011) [1], Lakshmi *et al.* (2014), Bashar *et al.* (2015) [5], Chaitanya (2015) [6], Shivkumar *et al.* (2016), Singh and Singh (2016), Sujin *et al.* (2017) [23], Nazir *et al.* (2019), Vethamonai *et al.* (2020).

Highly significant positive correlation was recorded for fruit length with fruit yield per plant (0.427 and 0.447), number of fruits per plant per picking (0.423 and 0.441), pericarp thickness (0.308 and 0.328) and average fruit weight (0.622 and 0.663) both at phenotypic and genotypic levels. Rajput *et al.* (1996) [15], Badea *et al.* (1996) [3], Sarnaik *et al.* (1999) [17], Sharma and Krishan Swaroop (2000) [19], Pratibha *et al.* (2004) [14], Patel and Sarnaik (2004) [13], Shinde *et al.* (2009) [20], Lakshmi *et al.* (2014), Bashar *et al.* (2015) [5], Chaitanya (2015) [6], Vethamonai *et al.* (2020) reported similar findings for fruit length.

Fruit girth was found highly significant and positive correlation with average fruit weight (0.542 and 0.59) and pericarp thickness (0.631 and 0.666) for both phenotypic and genotypic levels, whereas fruit yield per plant (0.193 and 0.197) found significant positive correlation with this trait at both genotypic and phenotypic levels. The results are closely similar with the finding of Sharma and Krishan Swaroop (2000) [19], Bashar *et al.* (2015) [5], Singh and Singh (2016), Sujin *et al.* (2017) [23].

Average fruit weight exhibited positive and highly significant with fruit yield per plant (0.477 and 0.489) and pericarp thickness (0.640 and 0.659) at both levels phenotypic and genotypic whereas number of fruit per plant per picking (0.204 and 0.212) showed positive significant correlated with this trait at both phenotypic and genotypic levels. Rajput *et al.* (1996) [15], Patel and Sarnaik (2004) [13], Shinde *et al.* (2009) [20], Bashar *et al.* (2015) [5], Chaitanya (2015) [6], Shivkumar *et al.* (2016), Singh and Singh (2016), Nazir *et al.* (2019), Konyak *et al.* (2020) [10] confirm the above findings.

Pericarp thickness exhibited highly significant and positive correlation with fruit yield per plant (0.378 and 0.395) at both phenotypic and genotypic levels. Sao (2006) [16] and Sasmita (2017) was general agreed with the findings.

Highly significant and positive correlation was recorded for this trait with fruit yield per plant (0.605 and 0.620) at both levels phenotypic and genotypic. These findings are conformity with the results of Ansari *et al.* (2011) [1] and Sasmita (2017).

Fruit yield per plant showed highly significant and positive correlation with number of primary branches, number of cluster per plant, number of flower per inflorescence, number of fruits per cluster, number of fruits per plant, fruit length, fruit girth, average fruit weight, pericarp thickness and number of fruit per plant per picking at both phenotypic and genotypic levels. Fruit girth also found positive significant correlated with this trait at both levels phenotypic and genotypic. The results are closely similar with the finding of Sarnaik (1999) [17], Sharma and Krishan Swaroop (2000) [19], Pratibha *et al.* (2004) [14], Patel and Sarnaik (2004) [13], Sao (2006) [16], Shinde *et al.* (2009) [20], Ansari *et al.* (2011) [1], Chaitanya (2015) [6], Shivkumar *et al.* (2016), Sasmita (2017) Vethamonai *et al.* (2020).

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Table 1: Segregating populations

S. No.	Genotype/ F_2 population	S. No.	Genotype/ F_2 population
1	IGB-03 X UA	13	IGB-24 X UA
2	IGB-03 X UK	14	IGB-24 X UK
3	IGB-03 X PPL	15	IGB-24 X PPL
4	IGB-03 X IBWL	16	IGB-24 X IBWL
5	IGB-16 X UA	17	IGB-50 X UA
6	IGB-16 X UK	18	IGB-50 X UK
7	IGB-16 X PPL	19	IGB-50 X PPL
8	IGB-16 X IBWL	20	IGB-50 X IBWL
9	IGB-17 X UA	21	IGB-76 X UA
10	IGB-17 X UK	22	IGB-76 X UK
11	IGB-17 X PPL	23	IGB-76 X PPL
12	IGB-17 X IBWL	24	IGB-76 X IBWL

Table 2: Analysis of variance for fruit yield and its component in brinjal (F_2)

Sl. No.	Source	Replication	Treatment	Error
	Degrees of freedom	**2**	**23**	**46**
1	Days to 50 percent flowering	0.2330	90.145**	19.367
2	Days to first fruit harvest	29.6350	126.618**	40.31
3	Plant height (cm)	17.4690	189.822**	19.659
4	Plant spread (cm)	15.1550	210.199**	22.746
5	Number of primary branches per plant	0.1540	4.018**	0.367
6	Number of clusters per plant	0.0190	34.469**	0.423
7	Numbers of flower per inflorescence	0.0810	1.617**	0.08
8	Number of fruits per cluster	0.0090	3.854**	0.028
9	Number of fruits per plant	0.7140	28.466**	0.54
10	Fruit length (cm)	1.890	107.094**	2.911
11	Fruit girth (cm)	1.3110	23.906**	2.288
12	Average fruit weight (g)	71.8210	12366.956**	257.291
13	Pericarp thickness (mm)	0.1840	20.103**	0.237
14	Number of fruits per plant per picking	0.4740	24.647**	0.197
15	Fruit yield per plant (kg)	0.0130	1.08**	0.005
16	Fruit yield per hectare (q)	379.70	53326.892**	667.129

Table 3: Correlation coefficient analysis (Phenotypic and genotypic) among fruit yield and its component in brinjal

S. No.	Characters/ Parameters		2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Days to 50 per cent flowering	P	0.540**	0.383**	0.053	-0.213*	0.038	0.159	0.045	0.056	-0.009	-0.049	-0.061	-0.241*	-0.108	-0.146
		G	0.798**	0.447**	0.069	-0.248*	0.042	0.176	0.049	0.065	0.008	-0.045	-0.066	-0.296**	-0.118	-0.158
2	Days to first fruit harvest	P		0.322**	-0.051	-0.352**	0.016	0.057	0.011	0.038	0.051	-0.066	-0.015	-0.133	-0.215*	-0.114
		G		0.411**	-0.039	-0.422**	0.049	0.029	-0.002	0.052	0.028	-0.111	0.017	-0.135	-0.254**	-0.153
3	Plant height (cm)	P			0.397**	-0.279**	0.159	-0.099	-0.097	-0.063	0.002	-0.173	-0.169	-0.135	-0.200*	-0.129
		G			0.452**	-0.303**	0.163	-0.094	-0.097	-0.068	-0.006	-0.179	-0.188	-0.133	-0.215*	-0.138
4	Plant spread (cm)	P				-0.259**	0.211*	0.117	-0.001	0.219*	-0.099	-0.339**	-0.413**	-0.250*	0.062	0.167
		G				-0.281**	0.231*	0.115	0.007	0.226*	-0.109	-0.368**	-0.444**	-0.273**	0.064	0.186
5	No. of primary branches per plant	P					0.173	0.094	0.194*	0.091	0.255**	0.293**	0.293**	0.199*	0.197*	0.248*
		G					0.168	0.113	0.207*	0.097	0.272**	0.309**	0.301**	0.214*	0.207*	0.270**
6	No. of cluster per plant	P						0.423**	0.451**	0.443**	0.322**	-0.036	0.098	0.025	0.490**	0.371**
		G						0.444**	0.465**	0.461**	0.338**	-0.039	0.105	0.037	0.509**	0.385**
7	No. of flowers per inflorescence	P							0.510**	0.416**	0.131	0.053	0.181	0.056	0.412**	0.515**
		G							0.529**	0.430**	0.139	0.052	0.201*	0.065	0.437**	0.540**
8	No. of fruits per cluster	P								0.597**	0.331**	-0.135	0.205*	-0.103	0.573**	0.595**
		G								0.631**	0.347**	-0.144	0.218*	-0.107	0.593**	0.614**
9	No. of fruits per plant	P									0.389**	-0.278**	0.231*	0.074	0.534**	0.647**
		G									0.415**	-0.301**	0.242*	0.0902	0.549**	0.676**
10	Fruit length (cm)	P										0.163	0.622**	0.308**	0.423**	0.427**
		G										0.172	0.663**	0.328**	0.441**	0.447**
11	Fruit girth (cm)	P											0.542**	0.631**	0.093	0.193*
		G											0.569**	0.666**	0.098	0.197*
12	Average fruit weight (g)	P												0.640**	0.204*	0.477**
		G												0.659**	0.212*	0.489**
13	Pericarp thickness (mm)	P													0.086	0.378**
		G													0.088	0.395**
14	No. of fruits per plant per picking	P														0.605**
		G														0.620**

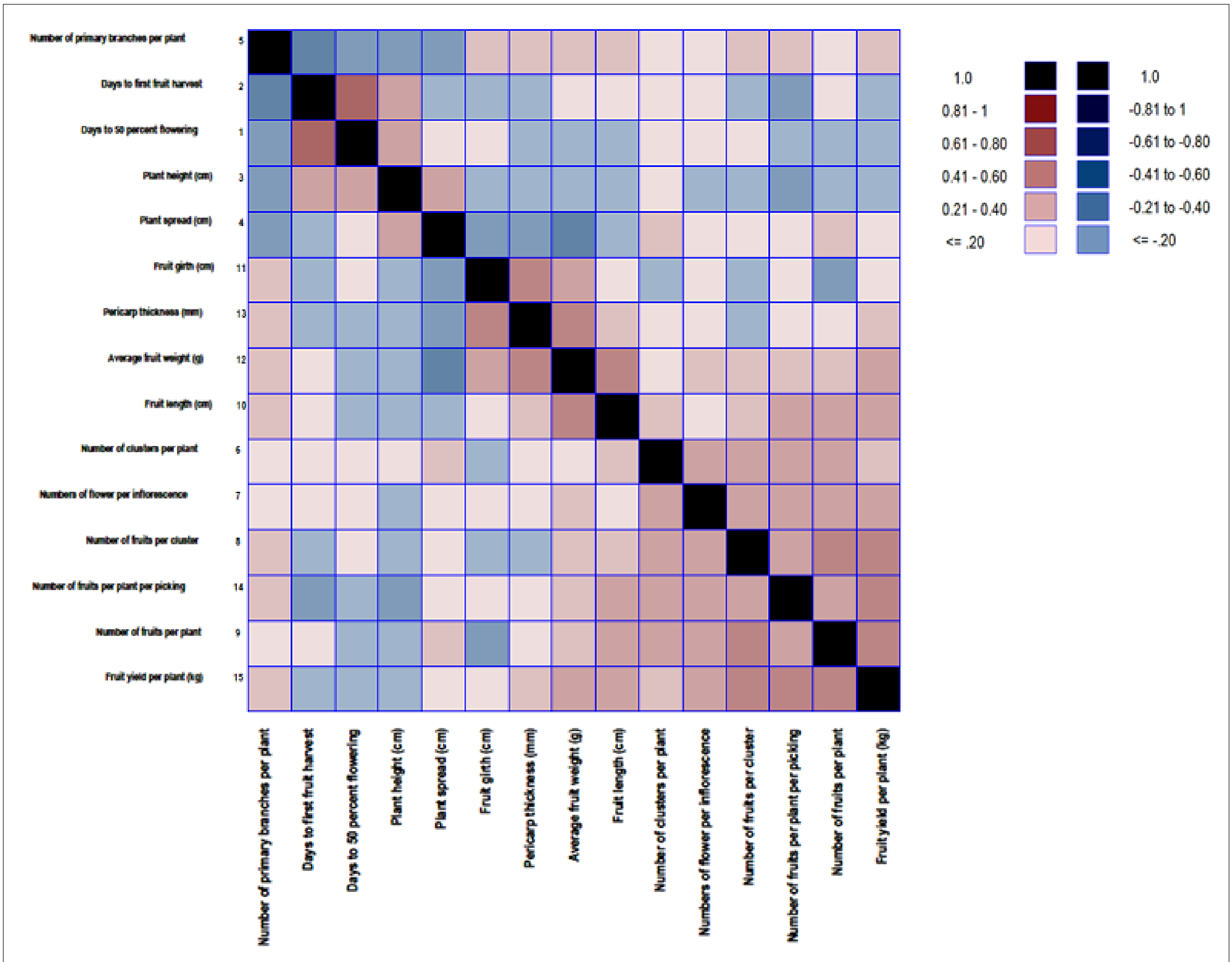

Fig 1: Shaded Correlation Matrix

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