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To Study Correlation Between Yield and Its Components in Eggplant (*Solanum melongena* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation, was conducted to evaluate 74 different genotypes, including 14 lines, 4 tests, and 56 F1 hybrids, along with two control checks. The study was carried out using a randomized block design with three replications at the Vegetable Research Farm, Department of Vegetable Science, Sunrise University, located in Alwar, Rajasthan, India. The evaluations

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spanned two summer seasons in 2022 and 2023. Various traits such as days to 50% flowering, days to first fruit harvest, plant height, number of primary branches per plant, pedicel length, number of fruits per cluster, average fruit weight, number of fruits per plant, total phenolic content, dry matter content, reducing sugar content, non-reducing sugar content, total sugar content, TSS (total soluble solids), ascorbic acid content, total fruit yield per plant, and yield per hectare (Q/Ha) were recorded. Ancillary traits were also observed. The findings indicated that during the first year, there was a strong positive correlation between average fruit weight and several traits, including total fruit yield per plant, yield per hectare, non-reducing sugar content, and the number of fruits per plant. Similarly, in the second year, average fruit weight exhibited significant positive correlations with total fruit yield per plant, yield per hectare, number of fruits per cluster, and TSS. Pooling the data from both years also showed a strong positive correlation between average fruit weight and total fruit yield per plant, yield per hectare, non-reducing sugar content, and the number of fruits per plant. In terms of genotypic correlations during the first year, average fruit weight displayed strong positive correlations with total fruit yield per plant, yield per hectare, non-reducing sugar content, the number of fruits per plant, and total phenolic content.

Keywords: Genotypic; phenotypic traits; correlation.

1. INTRODUCTION

"Brinjal or eggplant (*Solanum melongena* L., 2n=2x=24) is one of the most popular Solanaceous vegetable crops. It is worldwide known as aubergine or guinea squash which is one of the most popular and major vegetable crops in India and other parts of the world. It is probably originated in India and showed secondary diversity in South East Asia. *Solanum incanum*, a wild species and having wide distribution in at least 10 habitats in India is the progenitor of the cultivated species, *Solanum melongena*. The first record of brinjal in India was from 300 B.C. to 300 A.D. It is being grown extensively in India, Bangladesh, Pakistan, China, Philippines. India is the second largest producer of brinjal in the world after China. In India, brinjal occupies an area of 0.733 million hectares with an annual production of 13.55 million tonnes accounting for an average productivity of 19.1 tonnes per hectare. The area covered by brinjal crop in Tamil Nadu is 0.015 million hectares with a production of 0.302 million tonnes and productivity of 20.05 MT/ha. NHB, [1]. "Due to its highest production potential and availability of the product to consumers, it is also termed as a poor man's vegetable" (Kumar et al., 2014). "It is grown for its unripe fruits which are used in variety of ways as a cooked vegetable in curries. It is popular among people of all social strata and hence, it is rightly called as a vegetable of the masses" [2]. Correlation and path co-efficient analysis are important to determine the association between the yield and yield components. The characters that are positively correlated with yield are considerably important to plant breeder for selection purpose. Correlation provides a measure of genetic association between the characters and reveals the traits that might be useful as an index of the selection. According to Feyzian et al. [3]. Calculating the correlation coefficient between yield-contributing traits is essential for deciphering the direction of selection and optimizing yield within a condensed time frame. Path coefficients provide a streamlined approach to disentangling both direct and indirect factors influencing selection associations, thereby measuring the relative significance of each causal factor. As yield is a multifaceted trait influenced by many attributes, understanding the relationship between different traits and both yield and its contributing factors is vital for effective selection processes.

2. MATERIALS AND METHODS

The study used 56 F1 hybrids, obtained from crosses between 14 different lines (Rampur local-1, Rampur local-2, Bareilly local-1, Bareilly local-2, Alwar local, Jaipur local, Udaipur local, Moradabad local, Delhi local, Suvad Shakti, Suvad Sri, Mukta Keshi, Pant brinjal hybrid-1, MDU-1) and 4 testers (Pant Samrat, Pant Rituraj, Annamalai, Azad Kranti), along with 2 control varieties (Punjab Barsati, Pusa Bharav) during the summers of 2022 and 2023. The performance of these hybrids and lines was evaluated using a Randomized Complete Block Design (RCBD) with three replications (each replication 76 plots). Plants were spaced at 0.60 meters apart in rows. The trials were conducted during summer seasons of 2022 and 2023. Various parameters including days to 50% flowering, days to first fruit harvest, plant height (cm), number of primary branches per plant, pedicle length, number of fruits per cluster, average fruit weight, number of fruits per plant, total phenolic content, dry matter content, reducing sugar content, non-reducing sugar content, total sugar content, TSS (Brix), ascorbic acid content, total fruit yield per plant, and yield per hectare were recorded. Ancillary characteristics were also recorded. The paraphrased sources for this information are Suyin et al., [4], Goto k et al., [5], Pandey et al. [6], and Prabhu et. al.

3. RESULTS AND DISCUSSION

3.1 Phenotypic Correlation Coefficient

In the first year, days to 50% flowering displayed a notably positive and significant correlation with days to first fruit harvesting (0.336), TSS (274), and reducing sugar (0.184) at the phenotypic level. Conversely, yield Q/Ha (-0.258), number of primary branches per plant (-0.195), and number of fruits per cluster (-0.140) exhibited negative and significant correlations with this trait. No other traits showed significant correlations with days to 50% flowering. Similarly, in the second year, days to 50% flowering demonstrated strong positive correlations with days to first fruit harvest (0.550), reducing sugar (0.268), and total sugar (0.202), while number of primary branches per plant (-0.275) and number of fruits per cluster (-0.143) displayed negative and significant correlations. Again, no other traits were significantly correlated with days to 50% flowering. In the pooled data, days to 50% flowering maintained highly positive and significant correlations with days to first fruit harvest (0.514) and reducing sugar (0.259), while number of primary branches per plant (-0.299) and number of fruits per cluster (-0.161) showed negative and significant correlations. No other traits showed significant correlations with days to 50% flowering.

Regarding days to first fruit harvest in the first year, it exhibited strong positive and significant correlations with length of pedicle (0.203) and total fruit yield per plant (0.173), whereas plant height (-0.224) and number of fruits per cluster (-0.203) displayed negative and significant correlations. No other traits were significantly correlated with days to first fruit harvest. In the second year, days to first fruit harvest exhibited a notably positive and significant correlation with ascorbic acid (0.178). Conversely, number of primary branches per plant (-0.370), number of fruits per cluster (-0.327), and plant height (-0.326) displayed negative and significant correlations with this trait. No other traits showed significant correlations with days to first fruit harvest. When considering pooled data, days to first fruit harvest demonstrated positive and significant correlations with ascorbic acid (0.156), length of pedicle (0.149), and average fruit weight (0.147). However, number of fruits per cluster (-0.418), number of primary branches (-0.349), and plant height (-0.260) exhibited highly negative and significant correlations with the trait. No other traits were significantly correlated with days to first fruit harvest. Chauhan A et al. [7], Devendra Upadhyay et al. [8], Gupta RA et al. [9].

Regarding plant height in the first year, it showed notably positive and significant correlations with reducing sugar (0.262) and dry matter content (0.220). Conversely, total fruit yield per plant (-0.368), average fruit weight (-0.291), and number of fruits per plant (-0.219) displayed negative and significant correlations with this trait. No other traits were significantly correlated with plant height. In the second year, plant height displayed a positive and significant correlation at the phenotypic level with number of primary branches per plant (0.162). Conversely, total phenolic content (-0.311), dry matter content (-0.182), and length of pedicle (-0.175) exhibited highly negative and significant correlations with the trait. No other traits showed significant correlations with plant height. In pooled data, plant height demonstrated a positive and significant correlation at the phenotypic level with number of fruits per plant (0.143). However, total fruit yield per plant (-0.312), average fruit weight (-0.287), total phenolic content (-0.269), length of pedicle (-0.241), and number of fruits per plant (-0.233) showed highly negative and significant correlations with the trait. No other traits were significantly correlated with plant height. Konyak WL et al. [5], Lakshmi RR et al. [10].

In the first year, number of primary branches per plant exhibited highly positive and significant correlations at the phenotypic level with average fruit weight (0.449), number of fruits per cluster (0.422), total fruit yield per plant (0.356), length of pedicle (0.235), and number of fruits per plant (0.228). No data showed negative and significant correlations with the trait.

In all other cases, there were no significant correlations found with the number of primary branches per plant. In the second year, the number of primary branches per plant exhibited a positive and significant correlation at the phenotypic level with the number of fruits per cluster (0.154). However, yield Q/Ha (-0.181) displayed a highly negative and significant correlation with this trait. No other traits were significantly correlated with the number of primary branches per plant. In pooled data, the number of primary branches per plant showed a highly positive and significant correlation at the phenotypic level with the Conversely, yield Q/Ha (-0.204) displayed a highly negative and significant correlation with the trait. Not all other traits were significantly correlated with the number of primary branches per plant.

In the first year, the length of pedicle demonstrated highly positive and significant correlations at the phenotypic level with number of fruits per plant (0.286), average fruit weight (0.239), and total fruit yield per plant (0.184). Conversely, ascorbic acid (-0.172) displayed a negative and significant correlation with the trait. For all other traits, there were no significant correlations found with the length of pedicle. In the second year, the length of pedicle exhibited highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.365), yield Q/Ha (0.351), average fruit weight (0.341), number of fruits per cluster (0.289), and TSS (0.188). Conversely, total sugar (-0.220) and reducing sugar (-0.184) displayed highly negative and significant correlations with the trait. No other traits were significantly correlated with the length of pedicle. In pooled data, the length of pedicle demonstrated highly positive and significant correlations at the phenotypic level with number of fruits per plant (0.257), TSS (0.240), total fruit yield per plant (0.207), and average fruit weight (0.199). However, total sugar (-0.228) showed a highly negative and significant correlation with the trait. No other traits were significantly correlated with the length of pedicle. Nazir G et al. [11], Sujin GS et al. [12], Saha S et al. [13].

In the first year, number of fruits per cluster exhibited highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.312), average fruit weight (0.279), number of fruits per plant (0.263), non-reducing sugar (0.235), and total phenolic content (0.199). No data showed negative and significant correlations with the trait. No other traits were significantly correlated with the days to number of fruits per cluster. In the second year, number of fruits per cluster displayed highly positive and significant correlations at the phenotypic level with total phenolic content (0.289), number of fruits per cluster (0.203), total fruit yield per plant (0.189), and yield Q/Ha (0.176). No traits showed highly negative and significant correlations with the trait, and all other traits were not significantly correlated with the number of fruits per cluster. In pooled data, number of fruits per cluster showed highly positive and significant correlations at the phenotypic level with average fruit weight (0.247), while no traits showed highly negative and significant correlations with the trait. All other traits were not significantly correlated with the number of fruits per cluster.

In the first year, average fruit weight demonstrated highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.467), yield Q/Ha (0.390), non-reducing sugar (0.338), and number of fruits per plant (0.268). No traits showed negative and significant correlations with the trait, and all other traits were not significantly correlated with the days to average fruit weight. In the second year, average fruit weight displayed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.365), yield Q/Ha (0.351), average fruit weight (0.341), number of fruits per cluster (0.289), and TSS (0.188). Conversely, total Sugar (-0.220) and reducing sugar (-0.184) showed highly negative and significant correlations with the trait, while all other traits were not significantly correlated with average fruit weight.

In pooled data, average fruit weight displayed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.442), yield Q/Ha (0.360), non-reducing sugar (0.337), and number of fruits per plant (0.257). Conversely, total sugar (-0.228) exhibited a highly negative and significant correlation with the trait, while all other traits were not significantly correlated with average fruit weight. Shalini Singh et al. [4], Saleh MM. et al. [14], Savita Darpan et al. [15].

In the first year, number of fruits per plant exhibited highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.736), yield Q/Ha (0.348), non-reducing sugar (0.217), and total phenolic content (0.191). No data showed negative and significant correlations with the trait, and no traits were significantly correlated with the days to number of fruits per plant. In the second year, number of fruits per plant displayed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.701), yield Q/ha (0.700), and ascorbic acid (0.179). Conversely, total phenolic content showed a highly negative and significant correlation with the trait, while all other traits were not significantly correlated with the number of fruits per plant. In pooled data, number of fruits per plant showed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.723) and yield Q/Ha (0.540). No data showed highly negative and significant correlations with the trait, and all other traits were not significantly correlated with the number of fruits per plant.

In the first year, total phenolic content exhibited highly positive and significant correlations at the phenotypic level with non-reducing sugar (0.438), total sugar (0.330), total fruit yield per plant (0.262), and dry matter (0.186). No data showed negative and significant correlations with the trait, and all other traits were not significantly correlated with the days to total phenolic content. In pooled data, average fruit weight displayed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.442), yield Q/Ha (0.360), non-reducing Sugar (0.337), and number of fruits per plant (0.257). Conversely, total sugar (-0.228) exhibited a highly negative and significant correlation with the trait, while all other traits were not significantly correlated with average fruit weight.

In the first year, number of fruits per plant exhibited highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.736), yield Q/Ha (0.348), non-reducing sugar (0.217), and total phenolic content (0.191). No data showed negative and significant correlations with the trait, and no traits were significantly correlated with the days to number of fruits per plant. In the second year, number of fruits per plant displayed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.701), yield Q/ha (0.700), and ascorbic acid (0.179). Conversely, total phenolic content showed a highly negative and significant correlation with the trait, while all other traits were not significantly correlated with the number of fruits per plant. In pooled data, number of fruits per plant showed highly positive and significant correlations at the phenotypic level with total fruit yield per plant (0.723) and yield Q/Ha (0.540). No data showed highly negative and significant correlations with the trait, and all other traits were not significantly correlated with the number of fruits per plant.

In the first year, total phenolic content exhibited highly positive and significant correlations at the phenotypic level with non-reducing sugar (0.438), total sugar (0.330), total fruit yield per plant (0.262), and dry matter (0.186). No data showed negative and significant correlations with the trait, and all other traits were not significantly correlated with the days to total phenolic content. For all other traits, there were no significant correlations found with the dry matter content %.

In the first year, reducing sugar % displayed a highly positive and significant correlation at the phenotypic level with total sugar (0.786), while TSS (-0.180) showed a negative and significant correlation with the trait. All other traits were not significantly correlated with the days to reducing sugar %. In the second year, reducing sugar % exhibited a highly positive and significant correlation at the phenotypic level with total sugar (0.805), while non-reducing sugar (-0.171) showed a highly negative and significant correlation with the trait. All other traits were not significantly correlated with the reducing sugar %. In pooled data, reducing sugar % showed a highly positive and significant correlation at the phenotypic level with total sugar (0.828), while TSS (-0.220) and non-reducing sugar (-0.176) showed highly negative and significant correlations with the trait. All other traits were not significantly correlated with the reducing sugar %.

In Y1, the percentage of non-reducing sugar exhibited a highly positive and significant phenotypic correlation with total fruit yield per plant (0.326) and yield per hectare (0.180). No data demonstrated a negative and significant correlation with this trait. In addition, no other traits were significantly correlated with the days to non-reducing sugar percentage. In Y2, the non-reducing sugar percentage had a highly positive and significant phenotypic correlation with total sugar (0.352), with no data showing a highly negative and significant correlation with the trait. No other traits showed significant correlation with the non-reducing sugar percentage. When pooled, the non-reducing sugar percentage displayed a highly positive and significant phenotypic correlation with total sugar (0.268), with no data showing a highly negative and significant correlation. Again, no other traits were significantly correlated with the non-reducing sugar percentage.

Table 1. Genotypic and phenotypic correlation coefficients between different characters of brinjal in Y1 (2022)

Characters		Days to 50% Flowering	Days to first fruit harvest	Plant hight	Number of primary branches per plant	Length of pedicle (cm)	Number of fruits per cluster	Average fruit weight (gm)	Number of fruits per plant	Total Phenolic Content (mg/100 gm)	Dry matter content (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugar (%)	TSS (Brix)	Ascorbic acid (mg/100gm)	Total fruit yield per plant (kg)	Yield Q/Ha
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	G	1.000	0.460**	0.061	-0.236**	0.143*	-0.226**	0.107	-0.034	-0.074	0.073	0.215**	0.062	0.094	0.158*	0.090	-0.109	-0.214**
	P	1.000	0.336**	0.065	-0.195**	0.031	-0.140*	0.043	-0.032	-0.031	0.008	0.184**	0.072	0.066	0.274**	0.066	0.003	-0.258**
2	G			-0.204**	-0.151*	0.256**	-0.135*	0.099	0.117	-0.023	0.050	0.092	0.085	0.032	0.099	0.074	0.201**	-0.137*
	P			-0.224**	-0.131*	0.244**	-0.203**	0.151*	0.071	-0.069	0.095	0.070	0.063	0.051	-0.006	0.158*	0.173**	0.022
3	G				-0.091	-0.124	0.012	-0.236**	-0.295**	-0.213**	0.330**	0.268**	-0.116	0.185**	-0.144*	0.222**	-0.395**	-0.152*
	P				-0.109	-0.113	0.030	-0.291**	-0.219**	-0.135*	0.220**	0.262**	-0.122	0.160*	-0.017	0.156*	-0.368**	-0.120
4	G					0.297**	0.458**	0.486**	0.313**	0.010	-0.176**	-0.113	0.147*	0.003	0.072	-0.102	0.353**	0.251**
	P					0.235**	0.422**	0.449**	0.228**	0.012	-0.099	-0.119	0.146*	-0.020	0.021	-0.065	0.356**	0.170*
5	G						0.007	0.269**	0.291**	-0.001	-0.025	-0.071	0.168*	-0.138*	0.392**	-0.181**	0.327**	0.010
	P						-0.030	0.239**	0.286**	-0.022	-0.018	-0.049	0.146*	-0.111	0.160*	-0.172**	0.184**	0.087
6	G							0.369**	0.297**	0.176**	0.045	0.061	0.232**	0.203**	-0.029	0.038	0.331**	0.358**
	P							0.279**	0.263**	0.199**	0.016	0.059	0.235**	0.170*	0.038	-0.034	0.312**	0.161*
7	G								0.348**	0.183**	-0.062	-0.112	0.366**	-0.031	0.107	-0.161*	0.569**	0.454**
	P								0.268**	0.090	0.024	-0.111	0.338**	-0.004	-0.009	-0.091	0.467**	0.390**
8	G									0.202**	0.101	-0.068	0.237**	-0.078	0.073	0.030	0.905**	0.453**
	P									0.191**	0.009	-0.049	0.217**	-0.061	0.110	-0.005	0.736**	0.348**
9	G										0.255**	0.198**	0.460**	0.381**	-0.085	0.035	0.307**	0.273**
	P										0.186**	0.187**	0.438**	0.330**	0.031	-0.003	0.262**	0.157*
10	G											0.350**	0.156*	0.437**	0.110	0.060	0.140*	0.185**
	P											0.305**	0.142*	0.389**	-0.078	0.118	0.122	0.134*
11	G												-0.141*	0.802**	-0.244**	0.185**	0.047	-0.101
	P												-0.142*	0.786**	-0.180**	0.152*	0.018	-0.083
12	G													0.140*	0.076	0.066	0.341**	0.263**
	P													0.132*	0.057	0.058	0.326**	0.180**
13	G														-0.275**	0.073	0.025	0.008
	P														-0.229**	0.071	0.005	0.054
14	G															-0.275**	0.113	0.240**
	P															-0.260**	0.130*	0.051
15	G																-0.044	-0.015
	P																-0.003	0.047
16	G																	0.570**
	P																	0.351**
17	G																	1.000
	P																	1.000

Table 2. Genotypic and phenotypic correlation coefficients between different characters of brinjal in Y2 (2023)

Characters		Days to 50% Flowering	Days to first fruit harvest	Plant hight	Number of primary branches per plant	Length of pedicle (cm)	Number of fruits per cluster	Average fruit weight (gm)	Number of fruits per plant	Total Phenolic Content (mg/100 gm)	Dry matter content (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugar (%)	TSS (Brix)	Ascorbic acid (mg/100gm)	Total fruit yield per plant (kg)	Yield Q/Ha
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
1	G	1.000	0.695**	0.089	-0.270**	0.006	-0.157*	-0.010	0.136*	0.001	-0.030	0.297**	0.078	0.233**	0.088	0.188**	0.120	0.177**
	P	1.000	0.550**	0.091	-0.275**	0.007	-0.143*	0.053	0.098	0.006	-0.034	0.268**	0.096	0.202**	0.068	0.109	0.129	0.102
2	G			-0.324**	-0.417**	0.059	-0.357**	0.154*	0.030	-0.031	0.104	0.138*	0.049	0.067	0.035	0.182**	0.006	0.088
	P			-0.326**	-0.370**	0.018	-0.327**	0.136*	0.056	-0.054	0.087	0.121	0.037	0.087	-0.008	0.178**	-0.043	0.113
3	G				0.194**	-0.199**	0.115	-0.146*	0.053	-0.360**	-0.187**	0.083	-0.146*	-0.046	-0.086	0.066	-0.003	0.067
	P				0.162*	-0.175**	0.094	-0.133*	0.061	-0.311**	-0.182**	0.077	-0.145*	-0.050	0.026	0.049	0.007	0.024
4	G					0.089	0.160*	-0.072	-0.038	-0.125	0.029	-0.075	-0.097	-0.151*	0.182**	-0.113	-0.090	-0.213**
	P					0.047	0.154*	-0.110	-0.043	-0.099	0.057	-0.076	-0.099	-0.150*	0.113	-0.053	-0.091	-0.181**
5	G						0.181**	0.340**	0.414**	-0.154*	0.043	-0.207**	-0.140*	-0.235**	0.314**	0.106	0.355**	0.413**
	P						0.135*	0.289**	0.341**	-0.152*	0.058	-0.184**	-0.132*	-0.220**	0.188**	0.065	0.365**	0.351**
6	G							0.339**	0.104	-0.025	0.341**	-0.004	-0.108	-0.007	0.123	0.055	0.221**	0.153*
	P							0.203**	0.107	-0.047	0.289**	0.001	-0.093	-0.017	0.065	0.045	0.189**	0.176**
7	G								0.445**	0.071	0.160*	0.139*	0.013	0.180**	0.195**	0.150*	0.409**	0.478**
	P								0.285**	0.060	0.046	0.104	0.018	0.187**	0.034	0.055	0.297**	0.324**
8	G									-0.298**	-0.098	0.089	-0.108	0.030	-0.108	0.210**	0.793**	0.787**
	P									-0.297**	-0.085	0.074	-0.108	0.034	0.008	0.179**	0.701**	0.700**
9	G										-0.015	0.058	0.545**	0.406**	0.069	-0.153*	-0.114	-0.137*
	P										-0.054	0.057	0.500**	0.371**	0.075	-0.079	-0.109	-0.145*
10	G											-0.006	-0.163*	-0.065	0.208**	0.227**	-0.104	-0.094
	P											-0.014	-0.148*	-0.080	0.112	0.195**	-0.033	-0.097
11	G												-0.170*	0.821**	-0.179**	0.085	0.050	0.023
	P												-0.171**	0.805**	-0.158*	0.076	0.048	0.038
12	G													0.367**	-0.034	0.064	-0.034	-0.015
	P													0.352**	-0.028	0.043	-0.030	-0.014
13	G														-0.221**	0.092	0.050	0.062
	P														-0.179**	0.080	0.033	0.047
14	G															-0.134*	0.035	-0.017
	P															-0.155*	0.017	-0.090
15	G																0.243**	0.280**
	P																0.182**	0.244**
16	G																	0.883**
	P																	0.752**
17	G																	1.000
	P																	1.000

Table 3. Genotypic and phenotypic correlation coefficients between different characters of brinjal in pooled (2022-2023)

Characters		Days to 50% Flowering	Days to first fruit harvest	plant hight	Number of primary branches per plant	Length of pedicle (cm)	Number of fruits per cluster	Average fruit weight (gm)	Number of fruits per plant	Total Phenolic Content (mg/100 gm)	Dry matter content (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Total Sugar (%)	TSS (Brix)	Ascorbic acid (mg/100g m)	Total fruit yield per plant (kg)	Yield Q/Ha
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
1	G	1.000	0.584**	0.102	-0.315**	0.085	-0.198**	0.083	0.052	-0.051	0.095	0.273**	0.058	0.154*	0.139*	0.136*	0.034	-0.005
	P	1.000	0.514**	0.101	-0.299**	0.052	-0.161*	0.056	0.039	-0.033	0.057	0.259**	0.066	0.142*	0.153*	0.110	0.074	-0.062
2	G			-0.259**	-0.370**	0.166*	-0.417**	0.127	0.133*	-0.031	0.102	0.114	0.047	0.018	0.004	0.138*	0.132*	0.009
	P			-0.260**	-0.349**	0.149*	-0.418**	0.147*	0.127	-0.055	0.098	0.104	0.038	0.029	0.002	0.156*	0.115	0.067
3	G				0.044	-0.256**	0.155*	-0.289**	-0.265**	-0.305**	0.069	0.141*	-0.153*	0.091	-0.042	0.160*	-0.331**	-0.078
	P				0.029	-0.241**	0.143*	-0.287**	-0.233**	-0.269**	0.047	0.137*	-0.155*	0.084	0.013	0.152*	-0.312**	-0.086
4	G					0.185**	0.268**	0.183**	0.006	-0.052	-0.055	-0.128	0.080	-0.035	0.091	-0.123	-0.015	-0.204**
	P					0.148*	0.256**	0.155*	-0.022	-0.046	-0.021	-0.126	0.076	-0.043	0.062	-0.101	0.008	-0.178**
5	G						0.026	0.207**	0.275**	-0.093	-0.062	-0.167*	0.009	-0.244**	0.345**	-0.079	0.262**	0.110
	P						-0.005	0.199**	0.257**	-0.096	-0.041	-0.153*	0.006	-0.228**	0.240**	-0.080	0.207**	0.112
6	G							0.328**	0.040	0.142*	0.150*	0.041	0.071	0.086	0.115	0.007	0.158*	0.190**
	P							0.247**	0.032	0.139*	0.118	0.040	0.079	0.073	0.092	-0.016	0.149*	0.145*
7	G								0.332**	0.200**	0.128	-0.012	0.368**	0.065	0.147*	-0.013	0.535**	0.435**
	P								0.257**	0.149*	0.111	-0.012	0.337**	0.077	0.069	-0.023	0.442**	0.360**
8	G									-0.078	-0.084	0.014	0.024	-0.038	0.035	0.183**	0.859**	0.618**
	P									-0.089	-0.102	0.010	0.019	-0.028	0.073	0.166*	0.723**	0.540**
9	G										0.125	0.133*	0.538**	0.411**	-0.032	-0.063	0.092	0.079
	P										0.086	0.130	0.513**	0.387**	-0.001	-0.058	0.082	0.036
10	G											0.235**	0.052	0.231**	0.147*	0.172**	-0.059	0.010
	P											0.211**	0.047	0.197**	0.078	0.170*	-0.023	0.018
11	G												-0.177**	0.835**	-0.240**	0.139*	0.042	-0.040
	P												-0.176**	0.828**	-0.220**	0.132*	0.031	-0.033
12	G													0.273**	0.046	0.062	0.146*	0.147*
	P													0.268**	0.032	0.052	0.141*	0.120
13	G														-0.273**	0.073	0.040	0.004
	P														-0.238**	0.068	0.031	0.008
14	G															-0.262**	0.109	0.069
	P															-0.232**	0.103	0.014
15	G																0.145*	0.222**
	P																0.125	0.220**
16	G																	0.759**
	P																	0.591**
17	G																	1.000
	P																	1.000

In Y1, total sugar percentage was highly positive and significantly correlated at the phenotypic level with no positive combinations, while TSS (-0.229) showed a negative and significant correlation with the trait. No other traits were significantly correlated with the days to total sugar percentage. In Y2, total sugar percentage was highly positive and significantly correlated at the phenotypic level with no positive combinations, with TSS (-0.179) showing a highly negative and significant correlation with the trait.

All other traits were not significantly correlated with the total sugar percentage. In the pooled data, the total sugar percentage showed a highly positive and significant phenotypic correlation with no positive combinations, while TSS (-0.238) exhibited a highly negative and significant correlation with the trait. No other traits were significantly correlated with the total sugar percentage.

In Y1, TSS had a highly positive and significant phenotypic correlation with no positive combinations, whereas ascorbic acid (-0.260) showed a negative and significant correlation with the trait. No other traits were significantly correlated with the days to TSS. In Y2, TSS had a highly positive and significant phenotypic correlation with no positive combinations, with ascorbic acid (-0.134) showing a negative and significant correlation. No other traits were significantly correlated with TSS.

When pooled, TSS showed a highly positive and significant phenotypic correlation with no positive combinations, while ascorbic acid (-0.232) exhibited a highly negative and significant correlation with the trait. No other traits were significantly correlated with the reducing sugar percentage.

In Y1, ascorbic acid displayed a highly positive and significant phenotypic correlation with no combinations, with no combinations showing a negative and significant correlation. No other traits were significantly correlated with the days to ascorbic acid.

In Y2, ascorbic acid showed a highly positive and significant phenotypic correlation with no other combinations, and no combinations showed a highly negative and significant correlation with this trait. No other traits were significantly correlated with ascorbic acid. In the pooled data, ascorbic acid exhibited a highly positive and significant phenotypic correlation with no other combinations, and again, no combinations showed a highly negative and significant correlation. No other traits were significantly correlated with ascorbic acid.

In Y1, total fruit yield per plant demonstrated a highly positive and significant phenotypic correlation with yield per hectare (0.351), with no combinations showing a negative and significant correlation. No other traits were significantly correlated with total fruit yield per plant. In Y2, total fruit yield per plant had a highly positive and significant phenotypic correlation with yield per hectare (0.752), with no combinations showing a highly negative and significant correlation. No other traits were significantly correlated with total fruit yield per plant. In the pooled data, total fruit yield per plant showed a highly positive and significant phenotypic correlation with yield per hectare (0.591), and no combinations showed a highly negative and significant correlation. No other traits were significantly correlated with total fruit yield per plant.

In Y1, yield per hectare (Yield Q/Ha) showed a highly positive and significant phenotypic correlation with no other combinations, and no combinations exhibited a negative and significant correlation with this trait. No other traits were significantly correlated with yield per hectare. In Y2, yield per hectare again displayed a highly positive and significant phenotypic correlation with no other combinations, and no combinations showed a highly negative and significant correlation with the trait. No other traits were significantly correlated with yield per hectare. In the pooled data, yield per hectare maintained a highly positive and significant phenotypic correlation with no other combinations, and no combinations showed a highly negative and significant correlation with the trait. No other traits were significantly correlated with yield per hectare.

3.2 Genotype Correlation Coefficient

In Y1, days to 50% flowering demonstrated a highly positive and significant genotypic correlation with days to first fruit harvest (0.460) and reducing sugar (0.215). Conversely, it showed a negative and significant correlation with the number of primary branches per plant (-0.236), the number of fruits per cluster (-0.226), and yield per hectare (-0.214). No other traits were significantly correlated with days to 50% flowering.

In Y2, days to 50% flowering exhibited a highly positive and significant genotypic correlation with days to first fruit harvest (0.695), reducing sugar (0.297), total sugar (0.233), ascorbic acid (0.188), and yield per hectare (0.177). It showed a highly negative and significant correlation with the number of primary branches per plant (-0.270). No other traits were significantly correlated with days to 50% flowering.

In the pooled data, days to 50% flowering had a highly positive and significant genotypic correlation with days to first fruit flowering (0.584) and reducing sugar (0.273). It showed a highly negative and significant correlation with the number of primary branches per plant (-0.315) and the number of fruits per cluster (-0.198). No other traits were significantly correlated with days to 50% flowering.

In Y1, days to first fruit harvest showed a highly positive and significant genotypic correlation with pedicle length (0.256) and total fruit yield per plant (0.201). In contrast, plant height (-0.204) had a negative and significant correlation with this trait. No other traits were significantly correlated with days to first fruit harvest.

In Y2, days to first fruit harvest exhibited a highly positive and significant genotypic correlation with ascorbic acid (0.182). Conversely, it showed highly negative and significant correlations with the number of primary branches per plant (-0.417), the number of fruits per cluster (-0.357), and plant height (-0.324). No other traits were significantly correlated with days to first fruit harvest.

In the pooled data, days to first fruit harvest showed positive and significant genotypic correlations with pedicle length (0.149), ascorbic acid (0.138), number of fruits per plant (0.133), and total fruit yield per plant (0.132). On the other hand, it exhibited highly negative and significant correlations with the number of fruits per cluster (-0.418), the number of primary branches per plant (-0.349), and plant height (-0.260). No other traits were significantly correlated with days to first fruit harvest.

In Y1, plant height showed highly positive and significant genotypic correlations with dry matter (0.330), reducing sugar (0.268), ascorbic acid (0.222), and total sugar (0.185). Conversely, it had negative and significant correlations with total fruit yield per plant (-0.395), the number of fruits per plant (-0.295), average fruit weight per plant (-0.236), and total phenolic content (-0.213). No other traits were significantly correlated with plant height.

In Y2, plant height displayed a highly positive and significant genotypic correlation with the number of primary branches (0.194). It showed highly negative and significant correlations with total phenolic content (-0.360), pedicle length (-0.199), and dry matter content (-0.187). No other traits were significantly correlated with plant height.

In the pooled data, plant height showed highly positive and significant genotypic correlations with ascorbic acid (0.160) and the number of fruits per cluster (0.155). Conversely, it exhibited highly negative and significant correlations with total fruit yield per plant (-0.331), average fruit weight (-0.289), number of fruits per plant (-0.265), and pedicle length (-0.256). No other traits were significantly correlated with plant height. Tripathy B et. al. [16], Vincent N et. al. [17].

In Y1, the number of primary branches per plant showed highly positive and significant genotypic correlations with average fruit weight (0.486), number of fruits per cluster (0.458), total fruit yield per plant (0.353), number of fruits per plant (0.313), pedicle length (0.297), and yield per hectare (0.251). On the other hand, dry matter content (-0.176) exhibited a negative and significant correlation with this trait. No other traits were significantly correlated with the number of primary branches.

In Y2, the number of primary branches showed a highly positive and significant genotypic correlation with TSS (0.182). Conversely, it had a highly negative and significant correlation with yield per hectare (-0.213). No other traits were significantly correlated with the number of primary branches.

In the pooled data, the number of primary branches showed highly positive and significant genotypic correlations with the number of fruits per cluster (0.268), pedicle length (0.185), and average fruit weight per plant (0.183). Conversely, yield per hectare (Yield Q/Ha) had a highly negative and significant correlation with this trait (-0.204). No other traits were significantly correlated with the number of primary branches.

In Y1, pedicle length exhibited highly positive and significant genotypic correlations with TSS

(0.392), total fruit yield per plant (0.327), number of fruits per plant (0.291), and average fruit weight (0.269). In contrast, ascorbic acid (-0.181) showed a highly negative and significant correlation with pedicle length. No other traits were significantly correlated with pedicle length.

In Y2, pedicle length showed highly positive and significant genotypic correlations with the number of fruits per plant (0.414), yield per hectare (0.413), total fruit yield per plant (0.355), average fruit weight (0.340), TSS (0.314), and the number of fruits per cluster (0.184). On the other hand, total sugar (-0.235) and reducing sugar (-0.207) exhibited highly negative and significant correlations with pedicle length. No other traits were significantly correlated with pedicle length.

In the pooled data, pedicle length showed highly positive and significant genotypic correlations with TSS (0.345), the number of fruits per plant (0.275), total fruit yield per plant (0.262), and average fruit weight (0.207). Conversely, it exhibited a highly negative and significant correlation with total sugar (-0.244). No other traits were significantly correlated with pedicle length.

In Y1, the number of fruits per cluster demonstrated highly positive and significant genotypic correlations with average fruit weight (0.369), yield per hectare (0.358), number of fruits per plant (0.297), non-reducing sugar (0.232), total sugar (0.203), and total phenolic content (0.176). There were no highly negative and significant correlations for this trait. No other traits were significantly correlated with the number of fruits per cluster.

In Y2, the number of fruits per cluster showed highly positive and significant genotypic correlations with dry matter content (0.341), average fruit weight (0.339), and total fruit yield per plant (0.221). There were no highly negative and significant correlations for this trait. No other traits were significantly correlated with the number of fruits per cluster.

In the pooled data, the number of fruits per cluster displayed highly positive and significant genotypic correlations with average fruit weight (0.328) and yield per hectare (0.190). There were no highly negative and significant correlations for this trait. No other traits were significantly correlated with the number of fruits per cluster.

In Y1, average fruit weight showed highly positive and significant genotypic correlations with total fruit yield per plant (0.569), yield per hectare (0.454), non-reducing sugar (0.366), number of fruits per plant (0.348), and total phenolic content (0.183). There were no highly negative and significant correlations for this trait. No other traits were significantly correlated with average fruit weight.

In Y2, average fruit weight displayed strong positive correlations at the genotypic level with Yield Q/Ha (0.478), number of fruits per plant (0.445), total fruit yield per plant (0.409), TSS (0.195), and total sugar (0.180). No significant negative correlations were found for any trait. Other traits did not show significant correlations with average fruit weight.

In pooled data, average fruit weight showed significant positive correlations at the genotypic level with total fruit yield per plant (0.535), yield Q/Ha (0.435), non-reducing sugar (0.368), number of fruits per plant (0.332), and total phenolic content (0.200). There were no significant negative correlations found for any trait. All other traits did not show significant correlations with average fruit weight.

In Y1, number of fruits per plant exhibited strong positive correlations at the genotypic level with total fruit yield per plant (0.905), yield Q/Ha (0.453), non-reducing sugar (0.237), and total phenolic content (0.202). No significant negative correlations were observed for any trait. Other traits did not show significant correlations with number of fruits per plant.

In Y2, number of fruits per plant showed strong positive correlations at the genotypic level with total fruit yield per plant (0.793), yield Q/Ha (0.787), and ascorbic acid (0.210). There was a significant negative correlation (-0.298) found with number of fruits per plant.

In pooled data, all other characteristics did not exhibit significant correlations with the number of fruits per plant. Among these, number of fruits per plant displayed notably strong positive correlations at the genotypic level with total fruit yield per plant (0.859), yield Q/Ha (0.618), and ascorbic acid (0.183). There were no instances of highly negative and significant correlations with this trait. All other traits did not show significant correlations with the number of fruits per plant.

In Y1, total phenolic content demonstrated strong positive correlations at the genotypic level with total non-reducing sugar (0.460), total yield per plant (0.307), yield Q/Ha (0.273), dry matter content (0.255), and reducing sugar (0.198). No significant negative correlations were identified for this trait. All other traits did not exhibit significant correlations with total phenolic content.

In Y2, total phenolic content exhibited strong positive and significant correlations at the genotypic level with total non-reducing sugar (0.545) and total sugar (0.406). Conversely, ascorbic acid (-0.153) and yield Q/Ha (-0.137) showed negative and significant correlations with this trait. No other traits showed significant correlations with total phenolic content.

In pooled data, total phenolic content showed strong positive and significant correlations at the genotypic level with non-reducing sugar (0.538), total sugar (0.411), and reducing sugar (0.133). There were no instances of highly negative and significant correlations with this trait. No other traits were found to be significantly correlated with total phenolic content.

In Y1, dry matter content displayed strong positive and significant correlations at the genotypic level with total sugar (0.437), reducing sugar (0.350), and yield Q/Ha (0.185). No significant negative correlations were observed for this trait. All other traits did not show significant correlations with dry matter content.

In Y2, dry matter content showed strong positive and significant correlations at the genotypic level with ascorbic acid (0.277) and TSS (0.208). Conversely, non-reducing sugar (-0.163) exhibited a negative and significant correlation with this trait. No other traits were found to be significantly correlated with dry matter content.

In pooled data, dry matter content displayed strong positive and significant correlations at the genotypic level with reducing sugar (0.235), total sugar (0.231), and ascorbic acid (0.172). There were no instances of highly negative and significant correlations with this trait. All other traits did not show significant correlations with dry matter content.

In Y1, reducing sugar exhibited strong positive and significant correlations at the genotypic level with total sugar (0.802), yield Q/Ha (0.453), and ascorbic acid (0.185). However, TSS (-0.244) showed a strong negative and significant correlation with this trait. All other traits did not show significant correlations with reducing sugar.

In Y2, reducing sugar showed strong positive and significant correlations at the genotypic level with total sugar (0.821). However, TSS (-0.179) showed a strong negative and significant correlation with this trait. All other traits did not show significant correlations with reducing sugar.

In pooled data, reducing sugar demonstrated strong positive and significant correlations at the genotypic level with total sugar (0.835). However, TSS (-0.240) and non-reducing sugar (-0.176) exhibited strong negative and significant correlations with this trait. All other traits did not show significant correlations with reducing sugar.

In Y1, non-reducing sugar demonstrated strong positive and significant correlations at the genotypic level with total fruit yield per plant (0.341) and yield Q/Ha (0.263). No significant negative correlations were found for this trait. All other traits did not show significant correlations with non-reducing sugar.

In Y2, non-reducing sugar showed strong positive and significant correlations at the genotypic level with total sugar (0.367). No significant negative correlations were found for this trait. All other traits did not show significant correlations with non-reducing sugar.

In pooled data, non-reducing sugar exhibited strong positive and significant correlations at the genotypic level with total sugar (0.273). No significant negative correlations were found for this trait. All other traits did not show significant correlations with non-reducing sugar.

In Y1, total sugar displayed strong positive and significant correlations at the genotypic level with total fruit yield per plant. However, TSS (-0.275) showed a strong negative and significant correlation with this trait.

In Y1, total sugar did not show significant correlations with any other traits. However, TSS (-0.221) exhibited a strong negative and significant correlation with this trait. All other traits did not demonstrate significant correlations with total sugar.

In pooled data, total sugar did not show significant correlations with any other traits, but TSS (-0.273) displayed a strong negative and significant correlation with this trait. All other traits did not demonstrate significant correlations with total sugar.

In Y2, total sugar did not show significant correlations with any other traits. However, TSS (-0.221) exhibited a strong negative and significant correlation with this trait. All other traits did not demonstrate significant correlations with total sugar.

In Y1, TSS showed a strong positive and significant correlation at the genotypic level with yield Q/Ha (0.240). However, ascorbic acid (-0.275) showed a strong negative and significant correlation with this trait. All other traits did not demonstrate significant correlations with TSS.

In Y2, TSS did not show significant correlations with any other traits. However, ascorbic acid (-0.134) exhibited a negative and significant correlation with this trait. All other traits did not demonstrate significant correlations with TSS brix.

In pooled data, TSS exhibited a strong positive and significant correlation at the genotypic level with no positive associations. However, ascorbic acid (-0.262) showed a strong negative and significant correlation with this trait. All other traits did not show significant correlations with TSS.

In Y1, ascorbic acid demonstrated a strong positive and significant correlation at the genotypic level with no positive relationships observed. There were no instances of highly negative and significant correlations with this trait. All other traits did not show significant correlations with ascorbic acid.

In Y2, ascorbic acid showed a strong positive and significant correlation at the genotypic level with no positive relationships identified. However, ascorbic acid (-0.155) exhibited a negative and significant correlation with this trait. All other traits did not show significant correlations with ascorbic acid.

In pooled data, ascorbic acid displayed a strong positive and significant correlation at the genotypic level with yield Q/Ha (0.222). There were no instances of highly negative and significant correlations with this trait. All other traits did not show significant correlations with ascorbic acid.

In Y1, total fruit yield per plant demonstrated a strong positive and significant correlation at the genotypic level with yield Q/Ha (0.570). There were no instances of highly negative and significant correlations with this trait. All other traits did not show significant correlations with total fruit yield per plant.

In Y2, total fruit yield per plant exhibited a strong positive and significant correlation at the genotypic level with yield Q/Ha (0.883). There were no instances of a negative and significant correlation with this trait. All other traits did not show significant correlations with total fruit yield per plant.

In pooled data, total fruit yield per plant showed a strong positive and significant correlation at the genotypic level with yield Q/Ha (0.759). There were no instances of a negative and significant correlation with this trait. All other traits did not show significant correlations with total fruit yield per plant [18,19].

In Y1, yield Q/Ha demonstrated a strong positive and significant correlation at the genotypic level with no positive relationships observed. However, there were no instances of a highly negative and significant correlation with this trait. All other traits did not show significant correlations with yield Q/Ha [20,21].

In Y2, yield Q/Ha showed a strong positive and significant correlation at the genotypic level with no positive relationships identified. However, there were no instances of a negative and significant correlation with this trait. All other traits did not show significant correlations with yield Q/Ha. In pooled data, yield Q/Ha exhibited a strong positive and significant correlation at the genotypic level with no positive relationships observed. However, there were no instances of a highly negative and significant correlation with this trait. All other traits did not show significant correlations with yield Q/Ha. These findings were earlier reported by Vethamoni PI et al. [22], Yadav S et al. [23], Zakari et al. [24].

4. CONCLUSION

Correlation coefficients were calculated between yield and its attributes at both genotypic and phenotypic levels to understand the relationships among these characteristics. This analysis provides insights into the extent and direction of selection pressure needed for practical applications. Generally, genotypic correlations are emphasized due to the masking effect of genotypes on trait expression. In pooled data, average fruit weight exhibited strong positive and significant correlations at the phenotypic level with total fruit yield per plant (0.442), yield Q/Ha (0.360), non-reducing Sugar (0.337), and number of fruits per plant (0.257). At the genotypic level across pooled data, average fruit weight showed strong positive and significant correlations with total fruits yield per plant (0.535), yield Q/Ha (0.435), non-reducing sugar (0.368), number of fruits per plant (0.332), and total phenolic content (0.200). No significant negative correlations were observed for any trait. All other traits did not show significant correlations with average fruit weight.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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