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Identification of Key Traits for Yield Improvement in Brinjal Through Correlation and Path Coefficient Analysis

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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

Brinjal (*Solanum melongena* L.), also known as poor man's vegetable, is widely distributed and grown in almost all parts of India. The assessment of genetic variation, correlation and path analysis for various yield and yield attributing traits in the available germplasm is crucial for selecting superior genotypes with desired traits such as yield, fruit quality, disease resistance, and adaptability to environmental conditions, thereby enhancing the potential for further crop improvement through breeding. Therefore, the present study was conducted to assess the phenotypic correlation and path coefficient among various yield and yield related traits for 42 genotypes of brinjal at the Horticulture Research Centre, SVPUA&T, Meerut (U.P.), India, over two

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consecutive *Kharif* seasons in 2022 and 2023 in Randomized Complete Block Design with three replications. The analysis of variance indicated significant variability across all the traits examined. In general, magnitudes of genotypic correlation coefficient were higher than their corresponding phenotypic correlation coefficient, implying a significant inherent relationship in different pair of traits. Based on the correlation coefficient analysis, fruit yield per plant had significant and positive association with fruit yield per plot, fruit yield per hectare, fruit weight, number of fruits per plant, fruit length and fruit girth both at genotypic and phenotypic levels. Path coefficient analysis showed that the traits *viz*., number of fruits per plant, fruit weight, fruit girth and fruit length exhibited highest direct effects on fruit yield and also indirectly influenced by the other yield contributing traits of brinjal. It is concluded from the study that these traits may be used as key indices towards the direct selection of elite genotypes for the successful breeding programme for yield improvement of brinjal germplasm.

Keywords: Brinjal; analysis of variance; correlation coefficient; path coefficient; yield.

1. INTRODUCTION

Brinjal (*Solanum melongena* L.), a member of the Solanaceae family, typically exists as a diploid with a chromosome count of 2n=2x=24. However, despite efforts to cultivate polyploid varieties with chromosome numbers of 2n=36 and 48, these variants have not shown significant economic relevance. The crop is a native of India and Sri Lanka. The genus Solanum encompasses nearly 2000 species, including both tuber-bearing and non-tuber-bearing forms. Among the important edible species in the non-tuber-bearing category are *Solanum melongena*, *S. torvum, S. nigrum, S. macrocarpon, S. ferox* and *S. aethiopicum*. A wild type of brinjal with deeply variegated leaves, S*. siymbriifolium* Lam., is considered the ancestral species of *S. melongena*. “Based on growth habit and fruit shape, four botanical varieties are recognized within *S. melongena- S. melongena* var. *melongena* (includes cultivars with round and egg-shaped fruits), *S. melongena* var. *serpentinum* Desf. (includes long and slender-fruited cultivars, often referred to as "snake brinjal" due to the presence of spiny leaves) and *S. melongena* var. *depressum* (encompasses early and dwarf cultivars)” [1].

The plant is described as an annual herbaceous species with inflorescences that can be solitary or form clusters of 2-5 flowers, depending on the variety. The flowers are complete, actinomorphic, and hermaphrodite, featuring a five-lobed, gamosepalous calyx and a five-lobed, gamopetalous corolla with incurved margins. The flowers are categorized based on style length into four types: long-styled, medium-styled, pseudo-short-styled, and true short-styled. Long-styled flowers have a high fruit-setting rate (70%-85%) due to a large ovary, while medium-styled flowers have a 12%-55% fruit-setting rate with a medium-sized ovary. However, short-styled flowers, with smaller stigmas and underdeveloped papillae, do not set fruit at all [2].

“Brinjal has a healthy nutritional profile. The fruits are low in calories and contain a good amount of minerals like potassium, calcium, sodium, iron, zinc and copper as well as dietary fibre” (USDA, 2014). “Besides this, brinjal fruits are reported to be a rich source of ascorbic acid and phenolics” [3,4]. “Brinjal is a fair source of fatty acids and has got de-cholesterolizing property, due to the presence of 65.1 per cent linoleic and lenolenic poly-3-unsaturated fatty acids” [5]. “White brinjal is said to be good for diabetic patients” [4].

It is easily cultivated in almost all parts of India except higher altitudes. Orissa, West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Karnataka, and Andhra Pradesh are the major brinjal growing states. Brinjal thrives in a warm, long growing season, with the main crop grown in autumn-winter. It grows best at 25-30°C and below 15°C its growth is adversely affected. The optimum temperature is 25°C for seed germination while seeds may germinate at 15°C to 30°C. Seedlings are transplanted best when the temperature is around 20°C [6].

The primary aim of crop improvement programs is to boost yield potential. To achieve this, it's crucial to understand the physiological characteristics of the current plant genetic pool and identify key traits that impact yield. While yield is the ultimate goal for breeders, selecting genotypes based solely on yield is ineffective because yield is a complex trait influenced by many factors. Therefore, understanding the relationship between yield and its contributing

traits is important for making informed selections and developing effective selection criteria. The correlation coefficient helps measure the relationships between different traits, highlighting which characteristics should be targeted for genetic improvement. Additionally, path coefficient analysis is useful for distinguishing between the direct and indirect effects of various traits on yield. This study aims to explore the relationship between traits and yield, as well as the direct and indirect effects of yield-related attributes, to identify and select the best genotypes for improving brinjal.

2. MATERIALS AND METHODS

The experiment was conducted with 42 genotypes of brinjal during two consecutive *Kharif* season of 2022 and 2023 at Horticulture Research Centre (HRC), Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.) India. Meerut is located in the semi-arid region and agro-climatic plain zone of Uttar Pradesh, India. It is situated in the North West Plain Zone, with coordinates of 28.99° N and 77.7° E, at an elevation of 220 meters above mean sea level.

Seedlings were grown in trays using a mix of coco peat and vermicompost (2:1) under careful management, achieving a high survival rate, at the College of Horticulture's shade net house in June. They were then transplanted in the third week of July. Each genotype's seedlings were planted on 15 cm raised ridges with a spacing of 60×45 cm and evaluated using a Randomized Complete Block Design with three replications. To support optimal crop growth and development, the recommended intercultural practices and doses of fertilizers (RDF) were applied.

To analyse the relationships between the examined traits and fruit yield, phenotypic and genotypic correlation coefficients were first calculated using the formulae of Johnson et al. [7] based on the mean values of the traits. Subsequently, path coefficient analysis, as described by Dewey and Lu [8] was conducted to determine the direct and indirect effects of the traits on fruit yield per plant.

3. RESULTS AND DISCUSSION

“Character association study was conducted in order to know how various traits are correlated with yield and inter-correlated among each other, on which selection can be used for genetic improvement in the fruit yield. The genotypic and phenotypic correlation coefficient for fruit yield and its component traits in brinjal are presented in Tables 1 and 2. The present study indicated a strong inherent relationship between the traits, because the magnitude of genotypic correlation coefficient was generally higher than their corresponding phenotypic” [9].

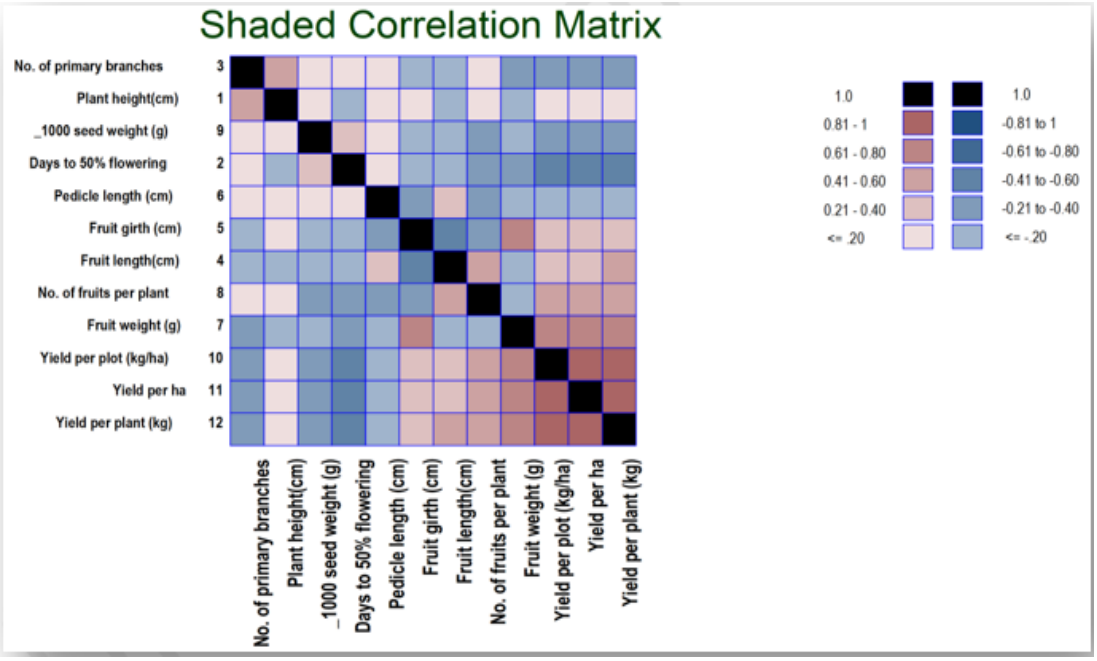

Fig. 1. Phenotypic shaded correlation matrix

During pooled season of 2022 and 2023, fruit yield per plant (kg) has showed positive and significant correlation with fruit yield per hectare (0.984), fruit yield per plot (0.983), fruit weight (0.713), number of fruits per plant (0.495), fruit length (0.404) and fruit girth (0.285). It exhibited a significant negative correlation with no. of primary branches (-0.276), 1000 seed weight (-0.315) and days to 50% flowering (-0.481).

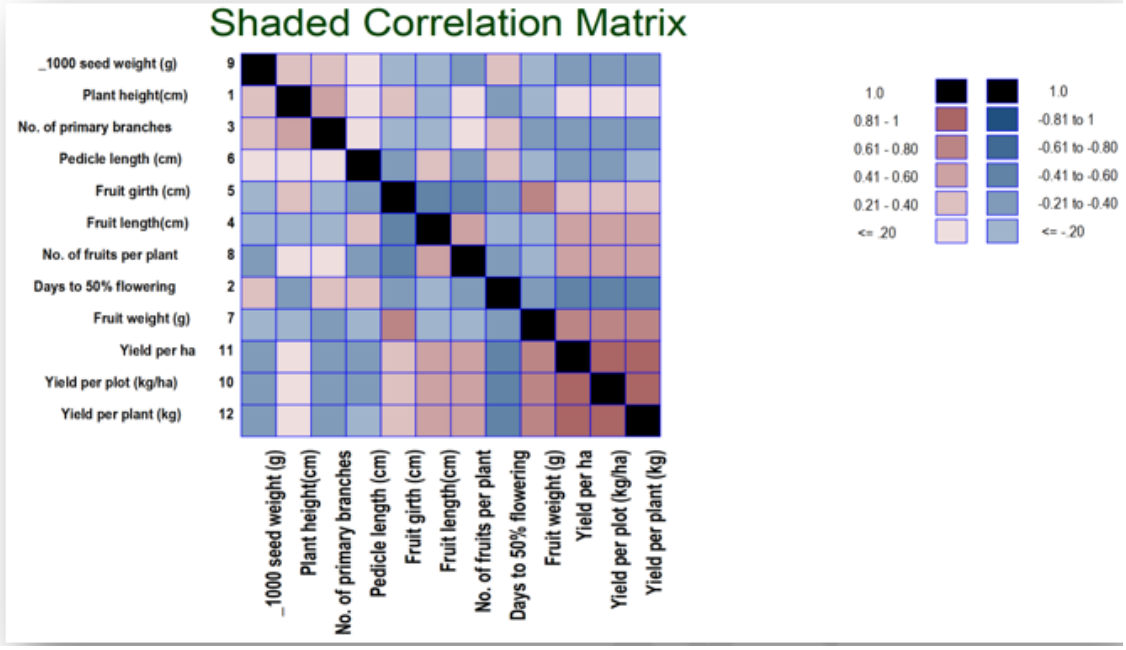

Fig. 2. Genotypic shaded correlation matrix

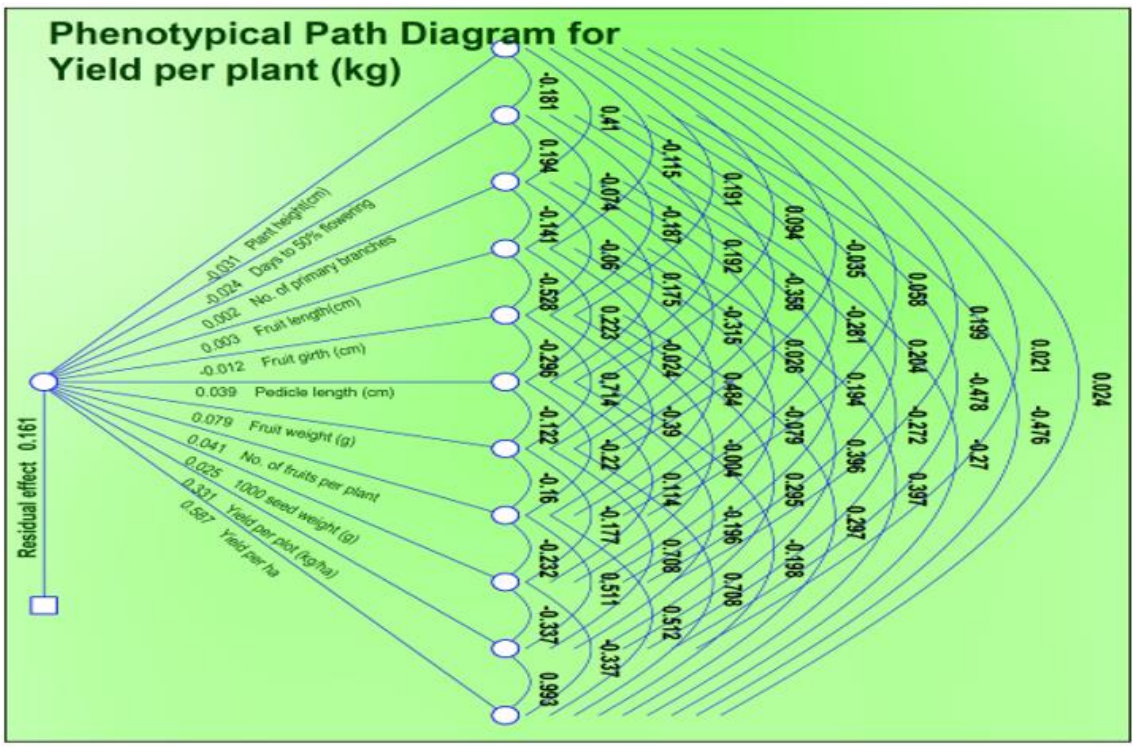

Fig. 3. Phenotypical path diagram

Table 1. Pooled estimates of genotypic correlation co-efficient between yield and yield contributing traits of brinjal

Traits	Plant height(cm)	Days to 50% flowering	No. of primary branches	Fruit length(cm)	Fruit girth (cm)	Pedicle length (cm)	Fruit weight (g)	No. of fruits per plant	1000 seed weight (g)	Yield per plot (kg/ha)	Yield per ha	Yield per plant (kg)
Plant height(cm)	1	-0.218*	0.435**	-0.1227	0.202*	0.0975	-0.0472	0.0637	0.217*	0.0216	0.0196	0.0041
Days to 50% flowering		1	0.202*	-0.0816	-0.209*	0.222*	-0.397**	-0.320**	0.232*	-0.533**	-0.535**	-0.535**
No. of primary branches			1	-0.1493	-0.062	0.180*	-0.324**	0.0264	0.206*	-0.281*	-0.282*	-0.284*
Fruit length(cm)				1	-0.545**	0.231*	-0.0222	0.494**	-0.0707	0.405**	0.405**	0.417**
Fruit girth (cm)					1	-0.300**	0.733**	-0.407**	-0.0094	0.305**	0.304**	0.289*
Pedicle length (cm)						1	-0.128	-0.220*	0.12	-0.204*	-0.203*	-0.1672
Fruit weight (g)							1	-0.1611	-0.178*	0.720**	0.720**	0.727**
No. of fruits per plant								1	-0.249*	0.520**	0.520**	0.510**
1000 seed weight (g)									1	-0.355**	-0.355**	-0.327**
Yield per plot (kg/ha)										1	0.732**	0.812**
Yield per ha											1	0.781**
Yield per plant (kg)												1

Table 2. Pooled estimates of phenotypic correlation co-efficient between yield and yield contributing traits of brinjal

Traits	Plant height(cm)	Days to 50% flowering	No. of primary branches	Fruit length(cm)	Fruit girth (cm)	Pedicle length (cm)	Fruit weight (g)	No. of fruits per plant	1000 seed weight (g)	Yield per plot (kg/ha)	Yield per ha	Yield per plant (kg)
Plant height(cm)	1	-0.181*	0.410**	-0.115	0.191*	0.0942	-0.0351	0.0585	0.199*	0.0206	0.0243	0.0005
Days to 50% flowering		1	0.194*	-0.074	-0.187*	0.192*	-0.358**	-0.282*	0.204*	-0.478**	-0.476**	-0.481**
No. of primary branches			1	-0.1406	-0.0599	0.1748	-0.315**	0.0264	0.194*	-0.272*	-0.270*	-0.276*
Fruit length(cm)				1	-0.528**	0.223*	-0.0243	0.484**	-0.0794	0.396**	0.397**	0.404**
Fruit girth (cm)					1	-0.296**	0.714**	-0.390**	-0.0044	0.295**	0.297**	0.285*
Pedicle length (cm)						1	-0.1217	-0.220*	0.1138	-0.196*	-0.198*	-0.1602
Fruit weight (g)							1	-0.16	-0.177*	0.708**	0.708**	0.713**
No. of fruits per plant								1	-0.232*	0.512**	0.512**	0.495**
1000 seed weight (g)									1	-0.337**	-0.337**	-0.315**
Yield per plot (kg/ha)										1	0.993**	0.983**
Yield per ha											1	0.984**
Yield per plant (kg)												1

Table 3. Pooled direct and indirect effects (genotypic) of yield components in brinjal

Traits	Plant height(cm)	Days to 50% flowering	No. of primary branches	Fruit length(cm)	Fruit girth (cm)	Pedicle length (cm)	Fruit weight (g)	No. of fruits per plant	1000 seed weight (g)	Yield per plot (kg/ha)	Yield per ha
Plant height(cm)	-0.0241	0.0053	-0.0105	0.003	-0.0049	-0.0024	0.0011	-0.0015	-0.0052	-0.0005	-0.0005
Days to 50% flowering	0.0035	-0.0163	-0.0033	0.0013	0.0034	-0.0036	0.0064	0.0052	-0.0038	0.0087	0.0087
No. of primary branches	0.0031	0.0015	0.0072	-0.0011	-0.0004	0.0013	-0.0023	0.0002	0.0015	-0.002	-0.002
Fruit length(cm)	0.0031	0.0021	0.0038	-0.0256	0.014	-0.0059	0.0006	-0.0126	0.0018	-0.0104	-0.0104
Fruit girth (cm)	-0.0111	0.0115	0.0034	0.0299	-0.0549	0.0164	-0.0402	0.0223	0.0005	-0.0167	-0.0167
Pedicle length (cm)	0.0032	0.0072	0.0059	0.0075	-0.0097	0.0325	-0.0042	-0.0072	0.0039	-0.0066	-0.0066
Fruit weight (g)	-0.0025	-0.0213	-0.0174	-0.0012	0.0393	-0.0069	0.0536	-0.0086	-0.0095	0.0386	0.0386
No. of fruits per plant	0.0002	-0.0008	0.0001	0.0013	-0.001	-0.0006	-0.0004	0.0025	-0.0006	0.0013	0.0013
1000 seed weight (g)	0.0084	0.009	0.008	-0.0027	-0.0004	0.0047	-0.0069	-0.0097	0.0388	-0.0138	-0.0138
Yield per plot (kg/ha)	0.0079	-0.1939	-0.1021	0.1474	0.1109	-0.074	0.2618	0.1892	-0.1291	0.3636	0.3649
Yield per ha	0.0124	-0.3397	-0.179	0.2571	0.193	-0.1288	0.4575	0.3305	-0.2254	0.6377	0.6354
Yield per plant (kg)	0.0041	-0.535**	-0.284*	0.417**	0.289*	-0.1672	0.727**	0.510**	-0.327**	0.812**	0.781**

Table 4. Pooled direct and indirect effects (phenotypic) of yield components in brinjal

TRAITS	Plant height(cm)	Days to 50% flowering	No. of primary branches	Fruit length(cm)	Fruit girth (cm)	Pedicle length (cm)	Fruit weight (g)	No. of fruits per plant	1000 seed weight (g)	Yield per plot (kg/ha)	Yield per ha
Plant height(cm)	-0.0314	0.0057	-0.0129	0.0036	-0.006	-0.003	0.0011	-0.0018	-0.0063	-0.0006	-0.0008
Days to 50% flowering	0.0044	-0.0242	-0.0047	0.0018	0.0045	-0.0046	0.0087	0.0068	-0.0049	0.0116	0.0115
No. of primary branches	0.001	0.0005	0.0024	-0.0003	-0.0001	0.0004	-0.0008	0.0001	0.0005	-0.0007	-0.0007
Fruit length(cm)	-0.0004	-0.0003	-0.0005	0.0034	-0.0018	0.0008	-0.0001	0.0016	-0.0003	0.0013	0.0013
Fruit girth (cm)	-0.0023	0.0023	0.0007	0.0065	-0.0123	0.0036	-0.0088	0.0048	0.0001	-0.0036	-0.0037
Pedicle length (cm)	0.0037	0.0075	0.0068	0.0087	-0.0116	0.0392	-0.0048	-0.0086	0.0045	-0.0077	-0.0077
Fruit weight (g)	-0.0028	-0.0283	-0.0249	-0.0019	0.0564	-0.0096	0.079	-0.0126	-0.014	0.0559	0.0559
No. of fruits per plant	0.0024	-0.0115	0.0011	0.0198	-0.0159	-0.009	-0.0065	0.0409	-0.0095	0.0209	0.021
1000 seed weight (g)	0.0049	0.005	0.0048	-0.0019	-0.0001	0.0028	-0.0043	-0.0057	0.0246	-0.0083	-0.0083
Yield per plot (kg/ha)	0.0068	-0.1581	-0.0899	0.1309	0.0974	-0.0647	0.234	0.1691	-0.1113	0.3306	0.3282
Yield per ha	0.0143	-0.2793	-0.1587	0.2331	0.1744	-0.1161	0.4156	0.3006	-0.1979	0.583	0.5872
Yield per plant (kg)	0.0005	-0.481**	-0.276*	0.404**	0.285*	-0.1602	0.713**	0.495**	-0.315**	0.983**	0.984**

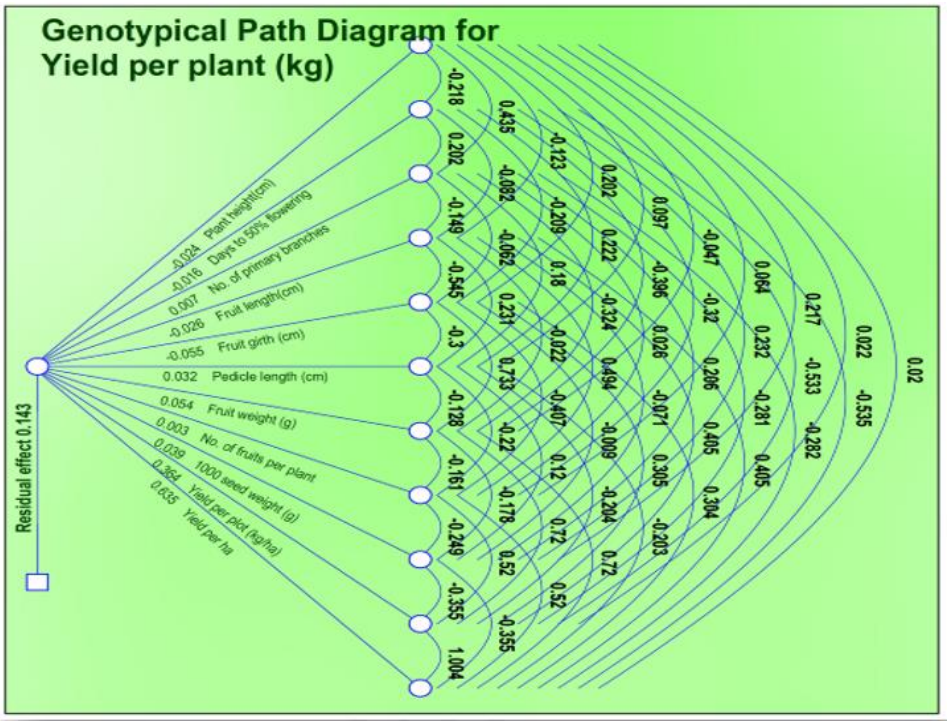

Fig. 4. Genotypic path diagram

Days to 50% flowering has showed positive and significant correlation with 1000 seed weight (0.204), no. of primary branches (0.194) and pedicle length (0.192) It has also showed the negative correlation but significant with plant height (-0.181), fruit girth (-0.187), no. of fruits per plant (-0.282), fruit weight (-0.358), fruit yield per hectare (-0.476), fruit yield per plot (-0.478) and fruit yield per plant (-0.481). Plant height has showed positive and significant association with no. of primary branches (0.410), 1000 seed weight (0.199) and fruit girth (0.191). It has also showed the negative correlation but significant with days to 50 % flowering (-0.181). The trait, number of primary branches has showed positive and significant correlation with plant height (0.410), days to 50% flowering (0.194) and 1000 seed weight (0.194). It has also showed the negative correlation but significant with fruit yield per hectare (-0.270), fruit yield per plot (-0.272), fruit yield per plant (-0.276) and fruit weight (-0.315). Fruit length has showed positive and significant correlation with number of fruits per plant (0.484), fruit yield per plant (0.404), fruit yield per hectare (0.397), fruit yield per plot (0.396) and pedicle length (0.223). It has also showed the negative correlation but significant with fruit girth (-0.528). Fruit girth has showed positive and significant correlation with fruit weight (0.714), fruit yield per hectare (0.297), fruit yield per plot (0.295), fruit yield per plant (0.285) and plant height (0.191). It has also showed the negative correlation but significant with days to 50 % flowering (-0.187), pedicle length (-0.296), no. of fruits per plant (-0.390) and fruit length (-0.528). Pedicle length has showed positive and significant correlation with fruit length (0.223) and days to 50% flowering (0.192). It has also showed the negative correlation but significant with fruit yield per hectare (-0.198), fruit yield per plot (-0.196), number of fruits per plant (-0.220) and fruit girth (-0.296). Fruit weight has showed positive and significant correlation with fruit girth (0.714), fruit yield per plant (0.713), fruit yield per hectare (0.708) and fruit yield per plot (0.708). It has also showed the negative correlation but significant with 1000 seed weight (-0.177), number of primary branches (-0.315) and days to 50 % flowering (-0.358). Number of fruits per plant has showed positive and significant correlation with fruit yield per hectare (0.512), fruit yield per plot (0.512), fruit yield per plant (0.495) and fruit length (0.484). It has also showed the negative correlation but significant with pedicle length (-0.220), 1000 seed weight (-0.232), days to 50 % flowering (-0.282) and fruit girth (-0.390). 1000 seed weight has showed positive and significant correlation with days to 50% flowering (0.204), plant height (0.199) and number of primary branches (0.194). It has also showed the negative correlation but significant with fruit

weight (-0.177), number of fruits per plant (-0.232), fruit yield per plant (-0.315), fruit yield per hectare (-0.337), and fruit yield per plot (-0.337). Fruit yield per plot has showed positive and significant correlation with fruit yield per plant (0.983), fruit yield per hectare (0.993), fruit weight (0.708), number of fruits per plant (0.512), fruit length (0.396) and fruit girth (0.295). It has also showed the negative correlation but significant with pedicle length (-0.196), no. of primary branches (-0.272), 1000 seed weight (-0.337) and days to 50% flowering (-0.478). Fruit yield per hectare has showed positive and significant correlation with fruit yield per plot (0.993), fruit yield per plant (0.984), fruit weight (0.708), number of fruits per plant (0.512), fruit length (0.397) and fruit girth (0.297). It has also showed the negative correlation but significant with pedicle length (-0.198), number of primary branches (-0.270), 1000 seed weight (-0.337) and days to 50% flowering (-0.476).

Similar trends of positive and significant correlation were reported by Gupta et al. [10] Saha et al. [11] Singh et al. [9] Gangadhara et al. [12] and Kumar et al. [13]. This suggested that fruit yield per plant can be enhanced by the selecting genotypes with a greater value of no. of fruits per plant, fruit length and fruit weight. The number of fruits per plant exhibited a significant positive phenotypic correlation with fruit yield. Thus, the number of fruits per plant seems to have predominated effect on fruit yield per plant. There is ample scope in the enhancement of yield by selecting a genotype having a higher number of fruits since they are highly correlated.

3.1 Path Coefficient Analysis

The components of a complex trait like yield can be found using correlation coefficients, but the relative importance of each component trait's direct and indirect effect cannot be determined from these results. Due to the fact that these assessments only give the kind and amount of the association rather than the cause, such studies do not provide each component characteristic. For dividing the correlation coefficient into the direct and indirect effects of a single causative factor in such circumstances, path coefficient analysis is essential (Wright,1921 and Dewey and Lu, 1959). The direct and indirect effects of different characters on fruit yield per plant were presented in Table 3. In phenotypic correlation (Table 4)**,** the higher magnitude of a positive direct effect on fruit yield per plant was exerted by the fruit yield per hectare (0.5872), followed by fruit yield per plot (0.3306), fruit weight (0.079), number of fruits per plant (0.0409), pedicle length (0.0392), 1000 seed weight (0.0246), fruit length (0.0034) and no. of primary branches (0.0024). The negative direct effect on yield was shown by the fruit girth (-0.0123), days to 50% flowering (-0.0242) and plant height (-0.0314).

Days to 50% flowering has indirect positive effect on pedicle length (0.0075) followed by plant height (0.0057), number of primary branches (0.0005), fruit girth (0.0023) and 1000 seed weight (0.005); while negative indirect effect on fruit length (-0.0003), fruit weight (-0.0283), number of fruits per plant (-0.0115), yield per plot (-0.1581) and yield per hectare (-0.2793). The character, plant height has indirect positive effect on days to 50% flowering (0.0044) followed by number of primary branches (0.001), pedicle length (0.0037), number of fruits per plant (0.0024), 1000 seed weight (0.0049), yield per plot (0.0068) and yield per hectare (0.0143). However, this trait has indirect negative effect on fruit length (-0.0004), fruit girth (-0.0023) and fruit weight (-0.0028). Number of primary branches has indirect positive effect on pedicle length (0.0068), number of fruits per plant (0.0011),1000 seed weight (0.0048) and fruit girth (0.0007), while indirect negative effect on plant height (-0.0129), days to 50% flowering (-0.0047), fruit length (-0.0005), fruit weight (-0.0249), yield per plot (-0.0899) and yield per hectare (-0.1587). Fruit length has indirect positive effect on fruit girth (0.0176), plant height (0.0036), days to 50% flowering (0.0018), fruit girth (0.0065), pedicle length (0.0087), number of fruits per plant (0.0198), yield per plot (0.1309) and yield per hectare (0.2331), whereas it has negative indirect effect on number of primary branches (-0.0003), fruit weight (-0.00190) and 1000 seed weight (-0.0019). Fruit girth has indirect positive effect on days to 50% flowering (0.0045), fruit weight (0.0564), yield per plot (0.0974), and yield per hectare (0.1744), while negative indirect effect on plant height (-0.003), number of primary branches (-0.0001), fruit length (-0.0018), pedicle length (-0.0116), number of fruits per plant (-0.0159) and 1000 seed weight (-0.0001). Pedicle length has indirect positive effect on number of primary branches (0.0004), fruit length (0.0008), fruit girth (0.0036) and 1000 seed weight (0.0028), whereas the trait exhibited negative effect on fruit weight (-0.0096), number of fruits per plant (-0.009), fruit yield per hectare (-0.1161) and fruit yield per plot (-0.0647). Fruit weight has indirect

positive effect on fruit girth (0.0775) followed by fruit yield per hectare (0.4156), and fruit yield per plot (0.234), plant height (0.0011) and days to 50% flowering (0.0087), while this trait has negative effect on fruit length (-0.0001), pedicle length (-0.0048), no. of fruits per plant (-0.0065), 1000 seed weight (-0.0043) and number of primary branches (-0.0008). Number of fruits per plant has indirect positive effect on fruit yield per hectare (0.3006) followed by fruit yield per plot (0.1691), fruit length (0.0016), days to 50% flowering (0.0068), fruit girth (0.0048) and number of primary branches (0.0001), while it has negative effect on fruit weight (-0.0126), plant height (-0.0018),1000 seed weight (-0.0057) and pedicle length (-0.0086). Thousand seed weight has indirect positive effect on number of primary branches (0.0005), pedicle length (0.0045) and fruit girth (0.0001), while it has negative effect on plant height (-0.0063), days to 50% flowering (-0.0049), fruit length (-0.0003), fruit weight (-0.014), number of fruits per plant (-0.0095), yield per hectare (-0.1979) and yield per plot (-0.1113). The trait, yield per plot has indirect positive effect on yield per hectare (0.583) followed by fruit weight (0.0559), days to 50% flowering (0.0116), number of fruits per plant (0.0209) and fruit length (0.0013), while yield per plot has negative effect on plant height (-0.0006), pedicle length (-0.0077)**,** 1000 seed weight (-0.0083), number of primary branches (-0.0007) and fruit girth (-0.0036). Yield per hectare has indirect positive effect on yield per plot (0.3282) followed by fruit weight (0.0559), days to 50% flowering (0.0116), number of fruits per plant (0.021) and fruit length (0.0013), while it has negative effect on plant height (-0.0008), pedicle length (-0.0077)**,** 1000 seed weight (-0.0083), number of primary branches (-0.0007) and fruit girth (-0.0037).

The results are in confirmation with the findings of Angadi et al. [14] Yadav et al. [15] Chithra et al*.,* [16] Taru et al*.,* [17] Saha et al. [11] Singh et al. [9] and Gangadhara et al. (2023). In genotypic path, fruit yield per plant has indirect positive effect on fruit yield per plot (0.812), yield per hectare (0.781), fruit weight (0.727), number of fruits per plant (0.510), fruit length (0.417), fruit girth (0.289) and plant height (0.0041). The negative indirect effect on fruit yield per plant was shown by the days to 50% flowering (-0.535), number of primary branches (-0.284), pedicle length (-.0.1672) and 1000 seed weight (-0.327). Similarly, in phenotypic path, fruit yield per plant has indirect positive effect on yield per hectare (0.984), fruit yield per plot (0.983), fruit weight (0.713), number of fruits per plant (0.495), fruit length (0.404), fruit girth (0.285) and plant height (0.0005). The negative indirect effect on fruit yield per plant was shown by the days to 50% flowering (-0.481), number of primary branches (-0.276), pedicle length (-.0.1602) and 1000 seed weight (-0.315). These results are in agreement with the findings of Bansal and Mehta [18] Singh et al. [19] and Singh et al. [20] Singh et al. [9] Kumar et al. [13] Sakariya et al*.,* [21] and Rathod et al*.,* [22]. The path analysis revealed that traits such as the number of fruits per plant, fruit weight, fruit length, and fruit girth are the most crucial for yield, due to their significant direct effects and their indirect effects through other traits. Traits that show a strong positive association with fruit yield and a high direct impact at the genotypic level are valuable for selection. Therefore, these traits should be prioritized, as direct selection based on them will be effective in developing high-yielding brinjal varieties. This indicates that plant breeders should focus on traits with high significant correlations and both direct and indirect effects on fruit yield when selecting elite genotypes for further improvement.

4. CONCLUSION

The comprehensive analysis of correlation coefficients, along with path coefficient analysis, provides valuable insights into the yield dynamics among the investigated brinjal genotypes. Fruit yield per plant depicted a significant positive association with fruit yield per plot, fruit yield per hectare, fruit weight, number of fruits per plant, fruit length and fruit girth at both genotypic and phenotypic levels. This indicates that fruit yield can be improved by selecting genotypes with high performance for the above characters. Furthermore, the path coefficient analysis revealed that number of fruits per plant, fruit weight, fruit girth, and fruit length had the highest direct effects on the trait fruit yield. These traits also influenced other yield-attributing traits, suggesting their crucial role in the yield improvement of brinjal in future breeding programs.

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 this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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