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Path coefficient analysis in brinjal (*Solanum melongena* L.)

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Abstract
A field experiment was conducted to evaluate sixty brinjal genotypes at Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj Ayodhya (U.P.), India during August-2019 to March -2020. The experiment was laid out in Randomized Block Design with three replications. The observations were recorded on ten quantitative and three qualitative traits. High magnitude of positive direct effect on total fruit yield was exerted by marketable fruit yield per plant (0.973) followed by number of primary branches (0.0694), average fruit (0.0632) weight, days to first fruit harvest (0.0533), and number of fruit per plant (0.0495). The negative direct effect on total fruit yield was showed by days to 50% flowering (-0.055) and plant height (-0.0371). Likewise substantial positive indirect effect was also exerted by marketable fruit yield per plant via average fruit weight (0.0504), days to first fruit harvest (0.0088), number of fruit per plant (0.0038), fruit circumference (0.0033), and fruit length (0.002). While substantial negative indirect effect via number of primary branches (-0.03), days to 50% flowering (-0.013) and plant height (-0.008) were exerted by marketable fruit yield per plant towards total fruit yield per plant.

Keywords: Brinjal, path coefficient

Introduction
Brinjal (*Solanum melongena* L.), 2n=2x=24 belongs to sub genus *Leptostemonum* section Melongena of the family *Solanaceae*, sub family Solanoideae and Tribe Solaneae. It is worldwide known as aubergine or guinea squash which is one of the most popular and major vegetable crop in India and other parts of the world. It is probably originated in India and showed secondary diversity in South East Asia. It is being grown extensively in India, Bangladesh, Pakistan, China, Japan, Philippines, France, Italy and U.S.A. In Southern Europe, brinjal is a staple vegetable and it is a favorite dish in South East of France. Brinjal has got much potential as raw material in pickle making and dehydration industries. It is highly productive and usually finds its place as the poor man's vegetable.
In India it is cultivated over an area of 7.36 million ha with an average annual production of 127.77 million tonnes. It is distributed in Orissa, Bihar, Karnataka, West Bangal, Andhra Pradesh, Maharashtra and Utter Pradesh. In Uttar Pradesh, brinjal is being cultivated on an area of 4.10 lakh ha with annual production of 136.16 lakh tonnes. (Anony., 2018-2019) [1].
Collection of germplasm and its genetic studies can help to get a suitable genotype for higher yield or any other desirable character. To meet the demand of ever increasing population, there is need to enhance the productivity levels of brinjal crop. It is one of very few self-pollinated crops where exploitation of hybrid vigour has been commercially successful because of high number of seeds obtained from a cross. Keeping in view the above fact the present study was under taken to study the path coefficient analysis in brinjal.

Materials and Methods
Materials for the study comprised of sixty genotypes of brinjal laid out in a Randomized Block Design with three replications at Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology Kumarganj Ayodhya (U.P.), India (U.P.) during Aug-2019 to Mar-2020. The experimental site had sandy loam soil, low in organic carbon and slightly alkaline having pH=7.4. Twelve plants were raised separately for each accession in 1.2x3.0m² size plot at spacing of 60 cm×50 cm under three replications. Path-coefficient analysis was carried out according to Dewey and Lu (1959).

Results and Discussion

In the present investigation, significant differences were observed among all the characters providing scope of improvement in brinjal for yield traits (Table 1). The path coefficient analysis was carried out from phenotypic and genotypic correlation coefficients to resolve direct and indirect effects of nine characters on total fruit yield per plant. The direct and indirect effects of different characters on total fruit yield at phenotypic and genotypic level has been presented in table-2 and 3.

The genotypic direct and indirect effects of most of the traits were similar in nature and higher in magnitude than the phenotypic direct and indirect effect. The higher magnitude of positive direct effect on total fruit yield was exerted by marketable fruit yield per plant (0.9733) followed by number of primary branches (0.0694), average fruit weight (0.0632), days to first fruit harvest (0.0533), number of fruit per plant

(0.0495) and fruit circumference (0.0047). While negative direct effect on total fruit yield per plant was exerted by days to 50% flowering (-0.055) followed by plant height (-0.037) and fruit length (-0.006). The marketable fruit yield was not only found to have maximum direct effect on total fruit yield per plant but it also contributed substantial positive indirect effect on total fruit yield via average fruit weight (0.050), days to first fruit harvest (0.008), number of fruit per plant (0.0038), fruit circumference (0.0033) and fruit length (0.002). While it showed negative indirect effect via number of primary branches per plant (-0.03), days to 50% flowering (-0.013) and plant height (-0.008) towards total fruit yield per plant. Therefore during selection these characters should also be taken into consideration. Similar results had also been reported by many workers viz. Neha et al. (2017) [3], Patel et al. (2017) [4], Sujin et al. (2017) [6] and Rameshkumar et al. (2021) [5].

Table 1: Analysis of variance (Mean squares) for ten quantitative characters in brinjal germplasm.

Traits	Source of variation		
	Replicate	Treatments	Error
df	2	59	118
Days to 50% Flowering	1.69	33.08**	13.58
Days to first harvesting	7.51	21.15**	12.55
Plant height	1.82	392.54**	57.82
Number of primary branches	0.06	1.01**	0.14
Fruit length	10.49	57.37**	4.15
Fruit Circumference	0.78	87.13**	2.48
Average fruit weight	3.18	5821.12**	77.22
Number of fruit per plant	0.99	14.28**	1.11
Marketable fruit yield per plant	3391.72	594474.12**	11406.37
Total fruit yield per plant	5987.64	709671.92**	13822.75

Table 2: Direct and indirect effect of ten characters on total fruit yield per plant (g) at phenotypic level in

Traits	Days to 50% Flowering	Days to first fruit harvest	Plant height	Number of primary Branches	Fruit length	Fruit Circumference	Average fruit weight	Number of fruit per plant	Marketable fruit yield per plant	Correlation with total fruit yield per plant
Days to 50% Flowering	-0.055	0.0493	0.0033	-0.025	0.0005	-0.0003	-0.002	0.0209	0.226	0.218*
Days to first fruit harvest	-0.0512	0.0533	0.0035	-0.0177	0.0004	-0.0003	-0.0032	0.0144	0.158	0.158
Plant height	0.0049	-0.005	-0.0371	-0.0066	-0.0012	0.0008	0.0184	0.002	0.219	0.195
Number of primary branches	0.0197	-0.014	0.0036	0.0694	-0.002	0.0009	-0.014	-0.028	-0.414	-0.379**
Fruit length	0.0047	-0.004	-0.007	0.0194	-0.006	-0.003	-0.018	-0.002	-0.302	-0.318**
Fruit Circumference	0.0039	-0.004	-0.006	-0.014	0.0043	0.0047	0.05	-0.012	0.694	0.722**
Average fruit weight	0.0017	-0.003	-0.011	-0.015	0.0018	0.0037	0.0632	-0.016	0.777	0.803**
Number of fruit per plant	-0.023	0.0155	-0.002	-0.039	0.0002	-0.001	-0.02	0.0495	0.075	0.055
Marketable fruit yield per plant	-0.013	0.0087	-0.008	-0.03	0.002	0.0033	0.0504	0.0038	0.973	0.991**

R square = 0.9860, Residual effect = 0.1183

Table 3: Direct and indirect effect of ten characters on total fruit yield per plant (g) at genotypic level in brinjal

Traits	Days to 50% Flowering	Days to first fruit harvest	Plant height	Number of primary branches	Fruit length	Fruit Circumference	Average fruit weight	Number of fruit per plant	Marketable fruit yield per plant	Correlation with total fruit yield per plant
Days to 50% Flowering	-0.261	0.251	0.004	-0.053	0.002	0.001	-0.003	0.063	0.303	0.306**
Days to first fruit harvest	-0.255	0.257	0.006	-0.046	0.001	0.001	-0.007	0.057	0.264	0.276*
Plant height	0.031	-0.042	-0.035	-0.012	-0.003	-0.001	0.035	0.005	0.24	0.216*
Number of primary branches	0.131	-0.113	0.004	0.105	-0.005	0.002	-0.026	-0.063	-0.445	-0.410**

Fruit length	0.025	-0.018	-0.007	0.032	-0.017	0.005	-0.034	-0.006	-0.323	-0.344**
Fruit Circumference	0.024	-0.03	-0.006	-0.024	0.012	-0.007	0.089	-0.026	0.701	0.733**
Average fruit weight	0.007	-0.017	-0.011	-0.024	0.005	-0.005	0.111	-0.034	0.78	0.812**
Number of fruit per plant	-0.164	0.144	-0.002	-0.066	0.001	0.002	-0.037	0.1	0.057	0.035
Marketable fruit yield per plant	-0.082	0.07	-0.009	-0.049	0.006	-0.005	0.089	0.006	0.966	0.993**

R square = 0.9940, Residual effect = 0.0772

Conclusion

High magnitude of positive direct effect on total fruit yield was exerted by marketable fruit yield per plant followed by number of primary branches, average fruit weight, days to first fruit harvest, and number of fruit per plant. Likewise substantial positive indirect effect was also exerted by marketable fruit yield per plant via average fruit weight, days to first fruit harvest, number of fruit per plant, fruit circumference, fruit length. Therefore, during selection in brinjal for yield improvement marketable fruit yield per plant, primary branches average fruit weight, days to first fruit harvest and number of fruit per plant should give due consideration.

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