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CHARACTER ASSOCIATION AND PATH ANALYSIS STUDIES IN SOME GENOTYPES OF SPINACH BEET (*BETA VULGARIS* L. VAR. *BENGALENSIS ROXB.*)

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ABSTRACT

Present investigation included character association among fifteen spinach beet (*Beta vulgaris L. var. bengalensis Roxb.*) genotypes for the fourteen quantitative traits *viz.* days to 50% germination, leaf length, leaf width, petiole length, leaf area, fresh weight of leaves, dry weight of leaves, ascorbic acid content, plant spread at first cutting, plant height at first cutting, days to first cutting, number of cuttings, harvest duration, total yield per plant. The results revealed that the traits leaf length, leaf width, leaf area, fresh weight of leaves, dry weight of leaves, plant height at first cutting, number of cuttings and harvest duration had positive and significant correlation for total yield per plant. The path analysis suggested that the character leaf area exerted maximum direct effect over the economic character total yield per plant. Hence these traits were found to be important for the selection of desirable and superior genotypes of spinach beet with high total yield per plant.

***Key words*:** Genotypes, Path analysis, Correlation, Yield

Introduction

Spinach Beet scientifically known *as Beta vulgaris L. var. bengalensis Roxb.* belongs to the family Chenopodiaceae with chromosome number 2n=18. Spinach beet is also known as Indian Spinach, Beet leaf or Palak and is a very common winter season leafy vegetable. Spinach beet is probably the native of Indo-Chinese region. In terms of nutrients, it is a rich source of various vitamins (A and C), proteins, carbohydrates and minerals like calcium, magnesium, iron, manganese etc. The correlation studies help in measuring the mutual relationship between the various horticultural characters of the crop and help in determining the component characters on which selection can be based for genetic improvement of important character like yield. The knowledge of correlation between yield and its contributing characters measures only mutual association between two traits and it does not imply the cause and effect of relationship. Under such conditions, the use of path analysis would be more beneficial as it clearly forms the direct and indirect associations and identifies the most reliable yield contributing character. Path analysis is a standardized partial regression analysis, which further permits the partitioning of correlation coefficient into components of direct and indirect effects, of independent variables on the dependent variable like yield (Wright 1921).

Materials and Methods

The present investigation comprised of 15 genotypes (11 local genotypes and 4 commercial varieties) of spinach beet (*Beta vulgaris L. var. bengalensis Roxb.*) grown in completely randomized block design with three replications at experimental research farm of the Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh carried out in 2020-2021. The seeds were sown with a spacing

Table 1: List of genotypes of Spinach beet (*Beta vulgaris* L. var. *bengalensis Roxb.*).

S. No.	Name of Cultivars	Source
1	P-COHFNERI-1	Department of Vegetable Science, COH&F Neri, Hamirpur
2	P-COHFNERI-2	Department of Vegetable Science, COH&F Neri, Hamirpur
3	P-COHFNERI-3	Department of Vegetable Science, COH&F Neri, Hamirpur
4	P-COHFNERI-4	Department of Vegetable Science, COH&F Neri, Hamirpur
5	P-COHFNERI-5	Department of Vegetable Science, COH&F Neri, Hamirpur
6	P-COHFNERI-6	Department of Vegetable Science, COH&F Neri, Hamirpur
7	P-COHFNERI-7	Department of Vegetable Science, COH&F Neri, Hamirpur
8	P-COHFNERI-8	Department of Vegetable Science, COH&F Neri, Hamirpur
9	P-COHFNERI-9	Department of Vegetable Science, COH&F Neri, Hamirpur
10	P-COHFNERI-10	Department of Vegetable Science, COH&F Neri, Hamirpur
11	P-COHFNERI-11	Department of Vegetable Science, COH&F Neri, Hamirpur
12	Arka Anupama	IIHR, Bengaluru.
13	All Green	IARI, New Delhi
14	HS-23	HAU, Hissar
15	Pusa Harit (Check)	IARI, Regional Station Katrain

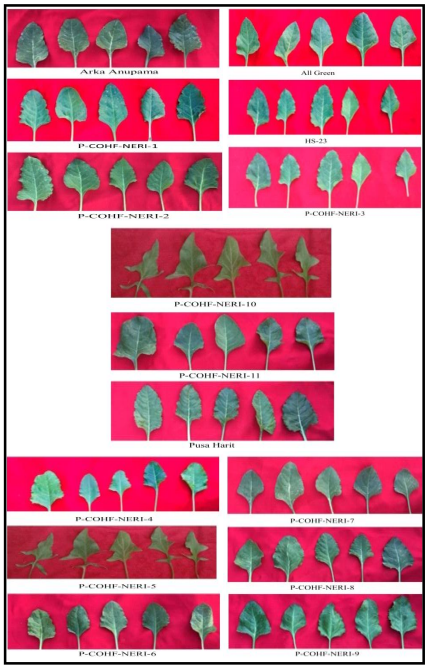

Fig. 1: Leaf Characters of Spinach beet

Table 2: Genotypic path coefficient analysis for direct and indirect effects of component characters on dependent trait total yield per plant in Spinach Beet (*Beta vulgaris* L. var. *bengalensis Roxb.*) genotyoes.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	correlation
X1	**0.44323**	-1.13706	0.05634	0.20743	1.28968	-0.68007	0.59378	-0.08961	0.05136	-0.20458	0.03683	0.41997	-0.53902	0.448
X2	0.20938	**-2.40704**	0.16739	0.20727	2.85499	-1.11401	1.30090	0.10625	0.05872	-1.05029	0.65824	1.00159	-0.99419	0.999
X3	0.11037	-1.78064	**0.22628**	0.06520	2.69500	-0.54962	0.69704	0.13930	-0.01870	-1.41324	1.01482	0.20027	-0.44764	0.938
X4	-0.33527	1.81928	-0.05380	**-0.27423**	-1.83648	1.23712	-0.92026	0.05420	-0.15369	-0.08432	0.16569	-0.96574	0.96987	-0.378
X5	0.19294	-2.31947	0.20583	0.16998	**2.96277**	-0.96160	1.13314	0.13696	0.02821	-1.29654	0.87589	0.72004	-0.84816	0.999
X6	0.23044	-2.04997	0.09508	0.25936	2.17806	**-1.30805**	1.34861	0.00327	0.04397	-0.29161	0.21943	0.92909	-0.90931	0.748
X7	0.17943	-2.13481	0.10753	0.17205	2.28882	-1.20266	**1.46679**	0.02664	-0.00085	-0.38881	0.30838	0.91059	-0.79735	0.936
X8	-0.13668	-0.88003	0.10846	-0.05115	1.39631	-0.01471	0.13444	**0.29060**	-0.02811	-0.91519	0.53255	0.09111	-0.20546	0.322
X9	-0.09384	0.58262	0.01744	-0.17373	-0.34447	0.23707	0.00516	0.03368	**-0.24260**	0.11862	-0.00595	-0.31042	0.36719	0.191
X10	0.05441	-1.51691	0.19188	-0.01388	2.30490	-0.22887	0.34219	0.15958	0.01727	**-1.66660**	1.05845	0.19584	-0.39823	0.500
X11	-0.01705	1.65467	-0.23982	0.04745	-2.78838	0.29975	-0.47239	-0.16162	-0.00151	1.84223	**-0.95754**	-0.22792	0.37738	-0.645
X12	0.14350	-1.85859	0.03494	0.20417	1.64461	-0.93690	1.02967	0.02041	0.05806	-0.25162	0.16825	**1.29715**	-1.00314	0.551
X13	0.21810	-2.18454	0.09247	0.24280	2.29396	-1.08579	1.06764	0.05451	0.08132	-0.60587	0.32987	1.18786	**-1.09544**	0.597

X1- Days to 50% germination; X2- Leaf Length; X3- Leaf Width; X4- Petiole Length; X5- Leaf Area; X6- Fresh weight of leaves; X7- Dry weight of leaves; X8- Ascorbic acid content; X9- Plant spread at 1st cutting; X10- Plant height at 1st cutting; X11- Days to 1st cutting; X12- No. of cutting; X13- Harvest duration **(Residual effect = -0.43235)**

Table 3: Genotypic and phenotypic correlation coefficients between total yield per plant and its component characters in Spinach Beet (*Beta vulgaris* L. var. *bengalensis Roxb*.) genotypes.

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14
X1	G	1													
	P	1													
X2	G	0.472**	1												
	P	0.282	1												
X3	G	0.249	0.740**	1											
	P	-0.019	0.690**	1											
X4	G	-0.756**	-0.756**	-0.238	1										
	P	-0.361*	-0.147	0.269	1										
X5	G	0.435**	0.964**	0.910**	-0.620**	1									
	P	0.144	0.884**	0.925**	0.091	1									
X6	G	0.520**	0.852**	0.420**	-0.946**	0.735**	1								
	P	0.460**	0.671**	0.247	-0.519**	0.471**	1								
X7	G	0.405**	0.887**	0.475**	-0.627**	0.773**	0.919**	1							
	P	0.356*	0.654**	0.293	-0.295*	0.488**	0.886**	1							
X8	G	-0.308*	0.366*	0.479**	0.187	0.471**	0.011	0.092	1						
	P	-0.277	0.284	0.273	0.102	0.298*	0.011	0.090	1						
X9	G	-0.212	-0.242	0.077	0.634**	-0.116	-0.181	0.004	0.116	1					
	P	-0.213	-0.020	0.115	0.148	0.060	-0.137	-0.027	0.079	1					
X10	G	0.123	0.630**	0.848**	0.051	0.778**	0.175	0.233	0.549**	-0.071	1				
	P	-0.002	0.532**	0.775**	0.287	0.713**	0.129	0.196	0.390**	0.002	1				
X11	G	-0.038	-0.687**	-1.060**	-0.173	-0.941**	-0.229	-0.322*	-0.556**	0.006	-1.105**	1			
	P	-0.038	-0.539**	-0.585**	-0.098	-0.587**	-0.228	-0.309*	-0.553**	0.011	-0.771**	1			
X12	G	0.324	0.772**	0.154	-0.745	0.555**	0.716**	0.702**	0.070	-0.239	0.151	-0.176	1		
	P	0.281	0.611**	0.104	-0.340	0.362*	0.675**	0.633**	0.069	-0.246	0.114	-0.164	1		
X13	G	0.492	0.908**	0.409**	-0.885**	0.774**	0.830**	0.728**	0.188	-0.335*	0.364*	-0.344*	0.916**	1	
	P	0.448	0.706**	0.209	-0.485**	0.480**	0.817**	0.702**	0.186	-0.230	0.226	-0.342*	0.869**	1	
X14	G	0.448	0.999**	0.938**	-0.378*	0.999**	0.748**	0.936**	0.322*	0.191	0.500**	-0.645**	0.551**	0.597**	1
	P	0.161	0.635**	0.593**	-0.087	0.670**	0.400**	0.517**	0.174	0.293	0.394**	-0.310*	0.283	0.334*	1

*Significant at 5% level; **Significant at 1% level; X1- Days to 50% germination; X2- Leaf Length; X3- Leaf Width; X4- Petiole Length; X5- Leaf Area; X6- Fresh weight of leaves; X7- Dry weight of leaves; X8- Ascorbic acid content; X9- Plant spread at 1st cutting; X10- Plant height at 1st cutting; X11- Days to 1st cutting; X12- No. of cutting; X13- Harvest duration; X14- Total yield per plant

of 30cm × 10cm. The observations were recorded on five randomly taken plants in each replication for fourteen quantitative traits *viz*. days to 50% germination, leaf length, leaf width, petiole length, leaf area, fresh weight of leaves, dry weight of leaves, ascorbic acid content, plant spread at first cutting, plant height at first cutting, days to first cutting, number of cuttings, harvest duration, total yield per plant. The correlation coefficients among all character combinations at phenotypic and genotypic level were estimated as per the formula given by Al-Jibouri *et al*., (1958). Path coefficient analysis suggested by Wright (1921) and Dewey and Lu (1959) was carried out to know the direct and indirect effect of morphological traits on the total yield per plant.

Result and Discussion

Correlation

The data in Table 1 revel that total yield per plant had positive and significant correlation with leaf length, leaf width, leaf area, fresh weight of leaves, dry weight of leaves, plant height at first cutting, number of cuttings and harvest duration. These findings are similar to those obtained by Vishnuvardhana (1993). Total yield per plant had negative and significant association with the trait petiole length (-0.378) at genotypic level and the trait days to first cutting (-0.310) at phenotypic level. The correlation coefficients were higher in magnitude at genotypic level in comparison to phenotypic level for most of the characters studied indicating strong association between these characters genetically. However, for these traits the phenotypic value was lessened mainly due to the significant interaction of the environment.

Path analysis

Path coefficient analysis (Table 3) suggested that the highest positive direct effect on the dependent trait total yield per plant was exhibited by leaf area (2.96277) followed by dry weight of leaves (1.13314), days to first cutting (0.87589), number of cuttings (0.72004), leaf width (0.20583), days to 50% germination (0.19294), petiole length (0.16998), ascorbic acid content (0.13696) and plant

spread at first cutting (0.02821). These findings are similar to those reported by Dolma (2007).

Conclusion

The present investigations indicated that the character leaf area (2.96277) exerted maximum direct effect over the economic character total yield per plant suggesting that the direct selection for the genotypes with larger leaf area can help in the maximum improvement of total yield in spinach beet.

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