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Original Research Article

Genetic Variability, Correlation and Path Analysis for Phomopsis Blight and Yield Components in Brinjal (*Solanum melongena* L.)

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Keywords

Variability, correlation, path analysis, brinjal and phomopsis blight

ABSTRACT

In the present study, variability, correlation and path coefficients analysis was carried out in twenty brinjal genotypes for phomopsis blight, fruit yield and its attributing traits. The study indicated that the genotypes evaluated differed significantly for all the seventeen traits in field condition whereas for five traits in pot experiment. The genotypes BRBL-11, followed by BRBL-4 and BRBL-1 showed significantly higher fruit yield per plant than the resistant check Pant Samrat. The phenotypic correlation coefficients between different characters were generally similar in magnitude and nature to the corresponding genotypic correlation coefficient except for few traits due to environmental influence. The significant and positive correlation with phomopsis incidence on fruit was observed at phenotypic level with phomopsis incidence on shoot, leaf breadth and days to first harvest. The analysis of path coefficient revealed appreciable amount of direct positive effect of fruit yield per plant followed by phomopsis incidence on shoot, leaf breadth, days to 50 % flowering and plant height on phomopsis incidence on fruit.

Introduction

Brinjal (*Solanum melongena* L., 2n=2x=24) is commonly known as eggplant comes under *solanaceae* family. Phomopsis blight and fruit rot caused by *Phomopsis vexans* (Sacc. and Syd Harter.) is very devastating and widespread disease in eggplant (Chen *et al.*, 2002). The fungus is asexual morph of *Diaporthe vexans* on brinjal, causing severe damage to the brinjal crop in different regions of the world. *Diaporthe* species are responsible for some important crop diseases worldwide including root rots, fruit rots, dieback, cankers, leaf spots, blights, decay and wilt (Mostert *et al.*, 2001, Santos *et al.*, 2011, Thompson *et al.*, 2011) Phomopsis blight ranks second only to bacterial wilt in destructiveness of eggplant and varies in severity depending on area, soil type and weather (Meah *et al.*, 2002). *Phomopsis vexans* is both externally and internally seed borne (Singh, 1992) and remains viable for about 14 months in soil with plant debris and in the seed from infected fruits (Kalda *et al.*, 1977). Brinjal is the only economic host of *Phomopsis vexans* and the disease is variously known as tip over, stem blight, canker, leaf blight or spot and fruit rot, even damping off may also occur. Leaf spots (up to 3 cm diameter) are conspicuous, irregular in outline and may coalesce; lower leaves may be affected first. In stem lesions, the cortex dries and cracks, plants become stunted and girdling cankers cause death of the plant. Fruit spots are pale sunken, conspicuous and may affect the whole fruit, fruit may drop or remain attached, becoming mummified after a soft decay and pycnidia are abundant. *Phomopsis vexans* has both α and β conidia, pycnidia with short or no pycnidial beaks. It is the sole causal agent of *Phomopsis* fruit rot of eggplant. The disease was first reported from Gujrat in 1914 and since then from many parts of India.

Occurrence of the disease in Bangladesh has been reported by Fakir (1983) and Ahmad (1987). Crop losses range from 15-20 % in general but 30-50 % in severe case (Das, 1998). Genetic variability and its parameters are prerequisite criteria for indirect selection of genotypes. For screening and selection of elite genotype in brinjal, information on correlation coefficient always has been helpful as a basis for selection in a breeding programme. Path coefficient analysis partitions into direct and indirect matrix presenting correlation in a more meaningful way (Mohsin *et al.,* 2009).

The present research study was conducted to find out the genetic variability among different plant traits, direct and indirect contribution of these parameters towards phomopsis blight and yield of brinjal to identify better genotype considering through better combination of traits for developing selection criteria against phomosis blight tolerant genotypes having good yield as well.

Materials and Methods

Twenty genotypes of brinjal were evaluated to identify the tolerant one against Phomopsis blight along with high yield. List of genotypes under study is given in Table no. 1. The experiment was plotted in field as well as in pot in randomized block design and completely randomized design respectively with three replications. Experiment was carried out during 1st week of September 2015 at the Department of Horticulture (Vegetable and Floriculture) at BAU, Sabour, Bhagalpur. The spacing of plant to plant within row kept 75cm x 60 cm and plot size was 3m x 2.4 m in the field experiment. To see the disease reactions of different genotypes, substrate for fungal growth of Phomopsis was prepared first, using maize in the ratio of 9:1.After sometime inoculum was fully grown on substrate and vermicompost mixed with flour in 6:1 ratio. Then composite mixture of inoculum, maize substrate, vermicompost and flour was made followed by sprinkling of water. This prepared composite mixture was turned into earthen pots each having equal quantity of 1.5 kg. In each pot single seedling was transplanted after 45 days of sowing. Inoculums of Phomopsis were mixed with vermicompost 1:9 ratios, and the mixture was moistened with slight application of water spray. Mixture was filled in pots and the seedlings up to 2-6 leaf stage were planted and watered. Pots were kept under protected condition and mortality of seedlings was monitored up to 45 days. The pot experiment using plug tray was inoculated with prepared media. After emergence of seedlings inoculums were sprayed uniformly in each replication in pot as well as field having normal basal soil condition. Sixteen plants of each genotype were maintained in each plot and prepared inoculums sprayed at evening hours, the spray were attempted at flowering and fruiting stage. Three fruits of each genotype were kept in glass plate. Surface was sterilized by sodium hypochloride to avoid contamination. Inoculums of phomopsis were mixed in water and sprayed on fruits of each genotype. After inoculation of plants, plots were monitored upon symptom expression. The incidence of disease on whole plants and fruits were noted using Disease severity index (Islam *et al.,* 1993) and Per-cent disease index (PDI) given by Mc-Kinney, 1923. Genotype Pant Samrat was used as resistant check whereas Arka Nidhi was used as susceptible check repectively.Traits under observation were, Plant height (cm), Plant spread (cm^2), Number of primary branches/plant, Stem Diameter, Length of leaves, Breadth of leaf, Days to first flowering, Days to 50 % flowering, Days to first fruit harvest, Number of fruits per plant, Fruit weight (g), Fruit yield per plant (g).The experimental data for various characters, recorded in course of this investigation were subjected to statistical analysis using suitable technique for different characters. The technique of analysis of variance for Randomised Block Design was adopted, as suggested by Fisher (1948) and Panse and Sukhatme (1967). The mean value of the characters from each genotype in each replication was used for statistical analysis. Phenotypic variance was calculated by adding genotypic variance to error mean sum of square as suggested by Comstock and Robinson (1952).Genotypic variance was calculated by subtracting the error mean sum of square from the treatment mean sum of square and dividing it by the number of replications as suggested by Comstock and Robinson (1952).Phenotypic and Genotypic coefficients of variation were calculated by the method suggested by Burton and de Vane (1953).PCV and GCV were classified as low, moderate or high by Sivasubramanian and Menon (1973).Correlation coefficient is the mutual association between variables without implying any cause and effect relationship. Single correlation coefficients were computed at genotypic and phenotypic levels between pair of characters adopting following formula given by Johnson *et al.,* (1955) and Al-Jibouri*et al.,* (1958). The path coefficient analysis is simply the standardized partial regression coefficient, which splits the correlation coefficient into the measures of direct and indirect effects of independent variables on the dependent variables. The concept of path analysis was originally developed by Wright (1921), but this technique was firstly used for plant selection by Dewey and Lu (1959).

Results and Discussion

In the present investigation, significant differences were observed among the test entries for all the characters providing scope of improvement in brinjal for phomopsis blight along with yield traits. The variation among the genotypes might have occurred due to differences in genes carried by different lines, differences in the environmental factors to which these lines were exposed to and by interaction between genotypes and environment. The genotypes BRBL-11, followed by BRBL-4 and BRBL-1 showed significantly higher fruit yield per plant than the resistant check Pant Samrat

High PCV and GCV were recorded for percent disease index, phomopsis incidence on fruit, fruit length, fruit girth, average fruit weight, number of fruits per plant, leaf breadth fruit yield per plant and phomopsis incidence on fruit (Table 2). The result reflects that these traits have diverse influence on phomopsis blight incidence. These findings are in conformity with the results of Balaji *et al.,* (2013) and Munniapan *et al.,* (2010). While, low estimate of genotypic and phenotypic coefficient of variation was observed for days to 50% flowering and days to 1st harvest indicating their low variability. Similar type of findings was reported by Kumar *et al.,* (2012), Gavade and Ghadage (2015). PCV was slightly higher than GCV for all the characters which indicates the lesser role of environment on the expression of these traits. This result was in agreement to the findings of Swarup (2000) and Mohanty and Prusuti (2002) in brinjal. This also indicated that these characters were comparatively stable and highly heritable and suggests selection for such characters could be made effectively on the basis of phenotypic performance. This is in agreement with the findings of Dhaka and Soni (2012).

Moderate estimates of phenotypic coefficient of variation and genotypic coefficient of variation were observed for plant height and number of days to first flowering. This is in agreement with the findings of Sharma and Swaroop (2000). It is not possible to determine the amount of variation which is heritable with the help of phenotypic coefficient of variation and genotypic coefficient of variation alone. In order to have a clear predictability of the breeding value, heritability in conjunction with genetic advance (GA) was found to be more effective and reliable in predicting the result and effect of selection. Heritability and genetic advance when estimated together are more useful for predicting the genetic progress in selection as high heritability coupled with high genetic advance reflect preponderance of additive gene action (Rai *et al.,* 1999).High heritability and high genetic advance were reported for percent disease index, phomopsis incidence on fruit, phomopsis incidence on shoot and average fruit weight. Therefore, selection will be effective for these characters due to additive gene effect. These findings are corroborative with the findings of Kumar *et al.,* (2013). Days to 1st flowering, fruit girth, fruit yield per plant, leaf breadth, leaf length, stem diameter and no. of primary branches showed High heritability and low genetic advance indicating predominant role of non-additive gene action for these traits. This was supported by Mili *et al.,* (2014). High heritability and moderate genetic advance were recorded for fruit length, Days to 1st harvest and no. of fruit per plant. Hence simple mass selection for these characters would be effective. Heritability values were higher than GA values for all characters which indicated that they were least influenced by environmental changes and showed that the phenotypes were the true representative of their genotypes and selection based on phenotypic performance would be reliable. This was in confirmation with Arya and Saini (1977).

Degree of association of various quantitative characters was also calculated for yield and attributing traits as well as screening for disease resistance in brinjal (Table 3 & 4). Present study revealed that in general; genotypic correlation coefficients were higher than their phenotypic ones. This could be attributed to the masking effect of environment which modifies the expression of a character thereby reducing the phenotypic expression Baswana *et al.,* (2002), Bhukya Ravi Nayak and Nagre (2013).

At genotypic and phenotypic level, the correlation coefficient studies revealed that phomopsis incidence on fruit showed significant and positive association with phomopsis incidence on shoot, days to first harvest and leaf breadth whereas, fruit girth was positively correlated with phomopsis incidence on fruit at genotypic level only.

Table.1 Genotypes of Brinjal used under investigation

S.N.	Genotypes	Source	S.N.	Genotypes	Source	S.N.	Genotypes	Source	S.N.
1	Pant samrat	Pantnagar	**11**	PPC	IARI	**1**	Pant samrat	Pantnagar	**11**
2	Pant rituraj	Pantnagar	**12**	PPL	IARI	**2**	Pant rituraj	Pantnagar	**12**
3	Pusa uttam	IARI	**13**	Swarna mani	ICAR, Ranchi	**3**	Pusa uttam	IARI	**13**
4	Muktakeshi	BAU, Sabour	**14**	Brinjal 71-19	BAU, Sabour	**4**	Muktakeshi	BAU, Sabour	**14**
5	Rajendra Baigan-2	BAU, Sabour	**15**	IIHR-563	IIHR	**5**	Rajendra Baigan-2	BAU, Sabour	**15**
6	BRBL-01	Local collection	**16**	Arka neelkanth	IIHR,	**6**	BRBL-01	Local collection	**16**
7	BRBL-04	BAU, Sabour	**17**	*Solanum aethiopicum*	BCKV	**7**	BRBL-04	BAU, Sabour	**17**
8	BRBL-07	West Bengal (local)	**18**	S.gilo	BCKV	**8**	BRBL-07	West Bengal (local)	**18**
9	BRBL-02	BAU, Sabour	**19**	IIHR-562	IIHR	**9**	BRBL-02	BAU, Sabour	**19**
10	BRBL-11	BAU, Sabour	20	Arka nidhi	IIHR	**10**	BRBL-11	BAU, Sabour	20

Table.2 Genetic parameters of fifteen characters of twenty brinjal genotype

Characters	PH (cm)	PS (cm)	NPB	SD	LL	LB	DFF	D50%F	DFH	FL (cm)	FG (cm)	AFW (g)	F/P	Fy/p (kg)	PIS (%)
Var Environmental	20.13	29.03	0.16	0.17	0.13	0.51	1.80	2.50	1.70	1.48	2.39	23.53	2.56	0.01	2.71
ECV	5.97	6.23	12.64	2.81	3.08	9.58	2.77	2.63	1.48	8.60	9.77	5.64	8.25	5.83	10.90
Var.Genotypical	111.44	205.49	0.16	2.72	4.14	2.23	23.62	34.31	27.26	29.97	11.29	1358.13	57.89	0.21	102.24
GCV	14.04	16.57	12.39	11.30	17.50	20.05	10.04	9.73	5.93	38.66	21.23	42.83	39.27	29.67	66.88
Var Phenotypical	131.57	234.51	0.32	2.88	4.27	2.73	25.42	36.81	28.96	31.45	13.69	1381.66	60.45	0.22	104.96
PCV	15.25	17.71	17.70	11.64	17.77	22.22	10.41	10.08	6.11	39.60	23.37	43.20	40.13	30.24	67.76
h^2 (Broad Sense)	0.85	0.88	0.49	0.94	0.97	0.81	0.93	0.93	0.94	0.95	0.83	0.98	0.96	0.96	0.97
GA	20.01	27.64	0.57	3.30	4.13	2.77	9.65	11.65	10.44	11.01	6.29	75.27	15.34	0.93	20.56
GA % mean	26.61	31.96	17.86	22.59	35.51	37.26	19.93	19.35	11.85	77.73	39.72	87.47	79.16	59.97	135.98
General Mean	75.20	86.49	3.21	14.59	11.62	7.44	48.43	60.20	88.05	14.16	15.83	86.05	19.38	1.54	15.12
Exp. Mean next Generation	95.21	114.14	3.78	17.88	15.75	10.21	58.09	71.85	98.49	25.17	22.12	161.32	34.71	2.47	35.68

PH- Plant height, PS- Plant spread, NPB- Number of primary branches, SD- Stem diameter, LL- Leaf length, LB- Leaf breadth, DFF- Days to first flowering, D 50 %F- Days to fifty percent flowering, DFH- Days to first harvest, FL- Fruit length, FG- Fruit girth, AFW- Average fruit weight, F/P- Number of fruit per plant, Fy/P- Fruit yield per plant, PIS- Phomopsis incidence on shoot

Table.3 Estimation of genotypic correlation coefficient among Percent disease index and other characters in brinjal

Character	PH (cm)	PS (cm)	NPB	SD	LL	LB	DFF	D50%F	DFH	FL (cm)	FG (cm)	AFW (g)	F/P	Fy/p (kg)	PIS(%)	PIF (%)
PS (cm)	0.705**															
NPB	0.03	0.469**														
SD	-0.159	-0.071	0.132													
LL	0.153	0.067	0.057	-.265*												
LB	0.115	0.119	-0.031	0.287*	-0.147											
DFF	0.218	0.167	-.391**	-0.14	0.065	-0.184										
D50%F	0.483**	0.439**	-0.267*	-0.219	-0.287*	0.004	0.709**									
DFH	-0.148	0.209	-0.087	0.166	-0.330*	-0.266*	-0.02	0.218								
FL (cm)	-0.13	-0.032	-.577**	0.24	-.447**	-0.164	0.294*	0.151	0.468**							
FG (cm)	0.012	0.337**	-0.212	0.095	-0.06	-0.064	0.042	0.351**	0.793**	0.228						
AFW (g)	-0.005	0.320*	-0.138	0.209	-0.216	-0.282*	0.076	0.24	0.867**	0.545**	0.809**					
Fruits/plant	-0.065	-0.224	-0.15	-.291*	-0.299*	0.238	0.219	0.134	-.564**	-0.038	-.622**	-.639**				
Fy/p (kg)	-0.269*	-0.018	-.372**	-0.077	-.513**	-0.016	0.305*	0.303*	0.327*	0.636**	0.205	0.310*	0.458**			
pIS(%)	-0.317*	-.368**	-0.112	0.263*	-.360**	0.495**	-0.168	-0.097	0.176	0.099	0.108	0.022	0.001	0.09		
PIF (%)	-0.054	0.043	0.135	0.161	-.593**	0.447**	-.360**	0.122	0.412**	0.048	0.259*	0.244	-0.121	0.114	0.704**	
PDI	-.341**	-.384**	-0.125	0.275*	-.348**	0.484**	-0.169	-0.121	0.174	0.123	0.097	0.018	-0.006	0.081	0.998**	0.673**

Table.4 Estimation of phenotypic correlation coefficient among Percent disease index and other characters in brinjal

Character	PH (cm)	PS (cm)	NPB	SD	LL	LB	DFF	D50%F	DFH	FL (cm)	FG (cm)	AFW (g)	F/P	Fy/p (kg)	PIS(%)	PIF (%)
PS (cm)	0.653**															
NPB	0.057	0.266*														
SD	-0.119	-0.059	0.104													
LL	0.142	0.053	0.047	-0.254												
LB	0.085	0.091	0.056	0.268*	-0.147											
DFF	0.21	0.138	-0.313*	-0.141	0.058	-0.16										
D50%F	0.422**	0.431**	-0.18	-0.214	-0.274*	0.003	0.641**									
DFH	-0.135	0.19	-0.074	0.148	-0.324*	-0.225	-0.021	0.209								
FL (cm)	-0.112	-0.021	-0.374**	0.225	-0.429**	-0.141	0.281*	0.166	0.455**							
FG (cm)	0.034	0.278*	-0.106	0.106	-0.038	-0.072	0.034	0.331**	0.699**	0.236						
AFW (g)	0.003	0.308*	-0.094	0.204	-0.215	-0.257*	0.072	0.227	0.842**	0.532**	0.735**					
Fruits/plant	-0.057	-0.232	-0.073	-0.280*	-0.286*	0.227	0.203	0.126	-0.546**	-0.036	-0.550**	-0.639**				
Fy/p (kg)	-0.234	-0.021	-0.245	-0.069	-0.492**	-0.013	0.276*	0.287*	0.312*	0.613**	0.205	0.298*	0.460**			
pIS(%)	-0.301*	-0.351**	-0.079	0.257*	-0.348**	0.460**	-0.159	-0.098	0.169	0.096	0.112	0.02	0.005	0.089		
PIF (%)	-0.054	0.026	0.095	0.149	-0.566**	0.394**	-0.334**	0.102	0.375**	0.035	0.198	0.232	-0.114	0.094	0.669**	
PDI	-0.314*	-0.365**	-0.079	0.271*	-0.333**	0.444**	-0.163	-0.121	0.163	0.116	0.095	0.017	-0.003	0.076	0.994**	0.648**

Table.5 Direct and indirect effects of component traits attributing to phomopsis incidence on brinjal fruit at phenotypic level

CHARACTER	PH (cm)	PS (cm)	NPB	SD	LL	LB	DFF	D50%F	DFH	FL (cm)	FG (cm)	AFW (g)	F/P	Fy/p (kg)	PIS(%)	PIF (%)
PH (cm)	0.400	-0.268	0.003	0.070	-0.125	0.073	0.018	0.001	-0.046	0.083	-0.009	0.001	0.103	-0.273	0.099	-0.185
PS (cm)	0.282	-0.381	0.052	0.031	-0.054	0.075	0.014	0.001	0.064	0.020	-0.239	-0.067	0.357	-0.019	0.115	-0.208
NPB	0.012	-0.179	0.110	-0.058	-0.046	-0.019	-0.033	0.000	-0.027	0.367	0.151	0.029	0.238	-0.378	0.035	-0.068
SD	-0.064	0.027	0.015	-0.439	0.216	0.182	-0.012	0.000	0.051	-0.153	-0.068	-0.044	0.463	-0.079	-0.082	0.149
LL	0.061	-0.025	0.006	0.116	-0.814	-0.093	0.005	-0.001	-0.101	0.285	0.042	0.045	0.476	-0.521	0.113	-0.189
LB	0.046	-0.045	-0.003	-0.126	0.120	0.632	-0.015	0.000	-0.082	0.105	0.046	0.059	-0.380	-0.016	-0.155	0.262
DFF	0.087	-0.064	-0.043	0.061	-0.053	-0.116	0.084	0.001	-0.006	-0.187	-0.030	-0.016	-0.349	0.310	0.053	-0.092
D50%F	0.193	-0.167	-0.029	0.096	0.234	0.003	0.059	0.002	0.067	-0.096	-0.249	-0.050	-0.213	0.308	0.030	-0.065
DFH	-0.059	-0.080	-0.010	-0.073	0.268	-0.168	-0.002	0.000	0.307	-0.298	-0.563	-0.182	0.899	0.332	-0.055	0.094
FL (cm)	-0.052	0.012	-0.064	-0.106	0.364	-0.104	0.025	0.000	0.144	-0.637	-0.162	-0.115	0.060	0.646	-0.031	0.067
FG (cm)	0.005	-0.128	-0.023	-0.042	0.048	-0.041	0.004	0.001	0.244	-0.145	-0.710	-0.170	0.991	0.208	-0.034	0.052
AFW (g)	-0.002	-0.122	-0.015	-0.092	0.176	-0.178	0.006	0.000	0.267	-0.347	-0.574	-0.210	1.017	0.314	-0.007	0.010
Fruits/plant	-0.026	0.085	-0.017	0.128	0.243	0.151	0.018	0.000	-0.173	0.024	0.442	0.134	-1.593	0.465	0.000	-0.003
Fy/p (kg)	-0.108	0.007	-0.041	0.034	0.418	-0.010	0.026	0.001	0.101	-0.405	-0.145	-0.065	-0.729	1.015	-0.028	0.044
pIS(%)	-0.127	0.140	-0.012	-0.115	0.293	0.313	-0.014	0.000	0.054	-0.063	-0.076	-0.005	-0.002	0.092	-0.314	0.541
PIF (%)	-0.136	0.146	-0.014	-0.121	0.284	0.306	-0.014	0.000	0.053	-0.078	-0.069	-0.004	0.009	0.082	-0.313	0.542
PDI	0.400	-0.381	0.110	-0.439	-0.814	0.632	0.084	0.002	0.307	-0.637	-0.710	-0.210	-1.593	1.015	-0.314	0.542

Residual effect 0.04513; PH- Plant height, PS- Plant spread, NPB- Number of primary branches, SD- Stem diameter, LL- Leaf length, LB- Leaf breadth, DFF- Days to first flowering, D 50 %F- Days to fifty percent flowering, DFH- Days to first harvest, FL- Fruit length, FG- Fruit girth, AFW- Average fruit weight, F/P- Number of fruit per plant, Fy/P- Fruit yield per plant, PIS- Phomopsis incidence on shoot, PIF- Phomopsis incidence on fruit, PDI- Percent disease index

Therefor the genotype having low incidence of *phomopsis vexans* on shoot, less fruit girth and small leaf breadth will be favoured for selection of tolerant genotype against *phomopsis vexans.* Significant and negative correlation of phomopsis incidence on fruit was observed by leaf length at both genotypic and phenotypic level while Days to 1st harvest showed negative correlation at genotypic level only. Days to first flower reflected negative association at phenotypic level due to influence of environment. Therefore, emphasis for indirect selection for phomopsis tolerant should be given on those genotypes having longer leaves. Now considering both positive and negative interrelationship of independent variables on the dependent variable phomopsis incidence on fruit under study we can say that phomopsis tolerant genotype should have low incidence of *phomopsis vexans* on shoot, less fruit girth, small leaf breadth and longer leaves. Thus, in the present study the wild species *solanum aethiopicum* have longer leaf having small breadth, *Solanum gilo* have lowest fruit girth and Pant Samrat, *solanum aethiopicum* and *Solanum gilo* showed lowest phomopsis incidence on shoot.

Average fruit weight and number of fruits per plant had significant positive correlation with yield per plant at genotypic level while, at phenotypic level; the positive correlation was recorded for fruit weight and number of fruits per plant. Days to 1st harvest had significant positive correlation with number of primary branches, plant height, days to 1st flowering, days to 50% flowering, days to 1st fruit set, plant height and number of primary branches per plant. These results get support with the findings of Singh and Singh (1974) in chilli and Shinde *et al.,* (2012) for days to 1st harvest and number of primary branches. Fruit weight showed significant and negative association with number of fruits per plant and positive correlation with fruit girth, while, fruit length had significant positive correlation with number of fruits per plant indicating that the limited number of fruits per plant more efficiently obtain larger share of the metabolites and thereby increase the fruit girth. These results were also confirmed by the findings of Devi and Sankar (1990), Thangamani and Jansirani (2012). Among the yield components the average weight of fruit, fruit girth and number of primary branches per plant were positively and significantly inter related among themselves indicating that simultaneous selection for these characters might bring an improvement in yield per plant. This was also reported by Shinde *et al.,* (2012).

Path coefficient analysis facilitates the partitioning of correlation coefficients into direct and indirect effects of various characters on phomopsis incidence on fruit (Table 5). Therefore, information on the cause and effect of various yields attributes and the relative importance of their direct and indirect effects on phomopsis incidence on fruit are essential in crop improvement programmes. Correlation studies in conjunction with path coefficient analysis revealed a better picture of the cause and effect relationship of different attributes.

The path coefficient analysis revealed that direct and indirect effects obtained at genotypic level were markedly different from those at phenotypic level which might be due to varying degree of influence of environment on various traits studied and these were also observed in component variance analysis and correlation studies.

Yield per plant is the product of interaction of components traits. Path analysis is important to obtain information about different ways in which component characters' influence phomopsis incidence on fruit. Direct effects of any character on phomopsis incidence on fruit gives idea about how reliable selection can be made for particular character to bring improvement in phomopsis incidence on fruit, if a correlation between a causal factor and direct effect is more or less of equal magnitude, it explain true relationship between character and direct selection through this trait will be effective. In the present study, the path coefficients analysis indicated that number of fruit yield per plant expressed high positive direct influences on phomopsis incidence on fruit at both genotypic and phenotypic levels. Highest direct positive effect of fruit yield per plant on phomopsis incidence on fruit followed by phomopsis incidence on shoot, percent disease index, leaf breadth, days to 50% flowering and plant. Leaf length gave high negative indirect effect *via* fruit length and number of fruit per plant. This result is in agreement with the findings of Karak *et al.*, (2012). Based on direct and indirect effects of different yield components on phomopsis incidence on fruit, it appears that weight of fruit had high GCV, PCV, high heritability with genetic advance and high direct contribution towards yield at both genotypic and phenotypic levels. But on genotypic level, path coefficient analysis revealed that number of fruits per plant, days to 1st harvest, number of primary branches per plant and fruit weight expressed direct positive influences on yield but days to 1st harvest and fruit length, had direct negative effect on phomopsis incidence on fruit. The results are in conformity with the earlier findings of Karak *et al.*, (2012). From this study, number of fruits per plant and fruit weight emerged as the most important fruit yield contributing characters of eggplant and these characters may be used as important selection parameters because of their probable conditioning by additive gene action. The residual effect i.e. unexplained variations in genotypic path were 0.04513.

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