



Study of Correlation and Path Analyses over Environments in Sesamum (*Sesamum indicum* L.)

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ABSTRACT

Ten Sesame genotypes were evaluated during *kharif*, 2010 and *rabi*, 2010-11 over 6 environments in respect of 9 quantitative characters. Analysis of variance revealed significant differences among genotypes for all the nine characters studied. Number of capsules per plant and 1000 seed weight were positively associated with seed yield per plant in all the six environments while number of seeds per capsule was positively associated with seed yield per plant in all the environments except environment VI. The character plant height exhibited significant positive association with seed yield per plant in all environments except II and III. Path coefficient analysis showed direct positive contribution of plant height, days to 50% flowering, number of capsules per plant, number of seeds per capsule, 1000 seed weight and oil content on seed yield. These traits deserve special emphasis in selection while improvement of seed yield in sesame.

Key words : Correlation, Path Analysis, Sesamum.

Sesame is one of the important oil seed crops cultivated in India and called “ Queen of oilseed crops” by virtue of its excellent quality. It is having the highest oil content (46-64%) and dietary energy (6355 Kcal/kg). It is grown through out the tropical, sub-tropical and warm region of the world. In India it is cultivated over an area of 18.57 lakh ha with an average productivity of 382.87 Kg/ha, which is far below the average productivity of China (1127 Kg/ha) and Egypt (1211 Kg/ha).

There is an ample scope for improving the productivity of this important oil seed crop through varietal improvement. A knowledge of the association of various quantitative characters and the direct and indirect effects of yield components on grain yield would be of immense help to the breeders (Sarvaiya *et al.*, 1982). Therefore, present investigation was undertaken to study character association and path analysis in sesame over 6 environments.

MATERIAL AND METHODS

Ten genotypes of sesame were sown on 6 sowing dates *i.e.*, 3 sowing dates in *kharif* (17.07.2010, 2.08.2010 and 17.08.2010) and 3 sowing dates in *rabi* (2.12.2010, 17.12.2010 and 3.01.2011), thus providing 6 environments for study

in Agricultural College Farm, Bapatla. The experimental material was grown in randomized block design with 3 replications of 2 m long plots of 3 rows was used with 30 ´ 10 cm spacing. Data were recorded on nine characters *viz.*, plant height (cm), days to 50% flowering, number of primaries, number of secondaries, number of capsules per plant, number of seeds per capsule, 1000- seed weight(g), oil content(%) and seed yield per plant(g). The means of the data were utilized for statistical analysis of correlations (Falconer, 1964) and path analysis (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

The genotypic and phenotypic correlation coefficients between seed yield per plant and its components and the component characters among themselves for environments I, II and III are given in Table 1 and for environments IV, V and VI are given in Table 2. The trait, Seed yield per plant exhibited significant positive correlation with plant height, number of capsules per plant, number of seeds per capsule, 1000 seed weight and oil content in environment I; number of secondaries, number of capsules per plant, number of seeds per capsule and 1000-seed weight in environment II; number of primaries, number of capsules per

Table 1. Phenotypic and genotypic correlation coefficients among nine characters in sesamum (*Sesamum indicum* L.) for environments I, II and III.

Character	envi- ron- ments		Days to 50% flowering	No of primaries	No of second aries	No of capsules/ plant	No of seeds/ capsule	1000 seed weight	Oil content	Seed yield/ plant
Plant height	E1	P	-0.3562	0.2849	0.4318*	0.3159	0.4630**	0.1045	0.2842	0.5132**
		G	-0.3544	0.2400	0.4065*	0.3389	0.3664*	0.1119	0.3112	0.5964**
	E2	P	-0.2602	0.1560	0.1289	-0.4668**	0.1029	0.2427	-0.2475	-0.1209
		G	-0.2489	0.1380	0.1070	-0.5349**	0.1177	0.2771	-0.2495	-0.1350
	E3	P	-0.8066**	0.4278**	0.8155**	-0.7178**	0.8694**	0.0230	0.3278	0.0446
		G	-0.9633**	0.5560**	0.8913**	-0.7597**	0.9125**	0.0168	0.3722*	0.0541
Days to 50% flowering	E1	P		-0.0389	-0.2599	0.3312	-0.0784	-0.0137	-0.5002**	0.2730
		G		-0.0264	-0.2522	0.3512	-0.0493	-0.0134	-0.5080**	0.2838
	E2	P		0.4386**	-0.4823**	-0.0759	-0.5916**	0.2287	-0.1906	-0.1462
		G		0.5128**	-0.4682**	-0.0765	-0.6337**	0.2125	-0.2027	-0.1492
	E3	P		-0.6785**	-0.6986**	0.4807**	-0.8241**	-0.2036	-0.4036*	-0.3790*
		G		-0.8493**	-0.8883**	0.4980**	-0.9074**	-0.2337	-0.5156**	-0.4164*
No of primaries	E1	P			0.8717**	-0.0874	0.2458	-0.1267	-0.3747*	-0.0495
		G			0.8834**	-0.0865	0.1926	-0.1301	-0.3895*	-0.0501
	E2	P			0.2707	0.0046	0.0195	0.5022**	0.4718**	0.1220
		G			0.2513	-0.0433	-0.0102	0.5632**	0.5415**	0.1515
	E3	P			0.3907*	0.0517	0.5825**	0.4766**	0.2090	0.7535**
		G			0.4602*	0.0399	0.6311**	0.5652**	0.2231	0.8887**
No of secondaries	E1	P				-0.2603	0.0121	-0.0400	-0.3566	-0.1374-
		G				-0.2735	-0.0651	-0.0422	-0.3649*	0.1433
	E2	P				0.6632**	0.7038**	0.5105**	0.2351	0.7334**
		G				0.6844**	0.7448**	0.5426**	0.2488	0.7614**
	E3	P				-0.4513*	0.8631**	-0.2075	0.1382	0.2066
		G				-0.5140**	0.9397**	-0.2246	0.0697	0.2506
No of capsules/ plant	E1	P				0.4859**	0.0183	0.4964**	0.8418**	
		G				0.5399**	0.0190	0.5389**	0.9079**	
	E2	P				0.5335**	0.4941**	0.0582	0.8911**	
		G				0.5428**	0.5125**	0.0676	0.9357**	
	E3	P				-0.4110*	-0.0960	-0.0417	0.5047**	
		G				-0.4311*	-0.1012	-0.0764	0.5454**	
No of seeds/ capsule	E1	P					0.2955	0.4817**	0.6909**	
		G					0.3258	0.5399**	0.8214	
	E2	P					0.3249	0.4176*	0.7589**	
		G					0.3302	0.4543*	0.8183**	
	E3	P					-0.0653	0.2430	0.3919*	
		G					-0.0648	0.2817	0.4093*	
1000 seed weight	E1	P						0.2228	0.4418*	
		G						0.2241	0.4595*	
	E2	P						-0.0212	0.6739**	
		G						-0.0229	0.6992**	
	E3	P						0.2594	0.4039*	
		G						0.3028	0.4238*	
Oil content	E1	P							0.4627*	
		G							0.4962**	
	E2	P							0.1163	
		G							0.0797	
	E3	P							0.2764	
		G							0.3438	

*significant at 0.05 level ** significant at 0.01 level

Table 2. Phenotypic and genotypic correlation coefficients among nine characters in sesamum (*Sesamum indicum* L.) for environments IV, V and VI.

Character	envi- ron- ments		Days to 50% flowering	No of primaries	No of second aries	No of capsules/ plant	No of seeds/ capsule	1000 seed weight	Oil content	Seed yield/ plant
Plant height	E4	P	-0.5344**	-0.6248**	0.2550	0.2677	0.6463**	0.4696**	0.2120	0.5517**
		G	-0.7575**	-0.6388**	0.2570	0.3515	0.7606**	0.4888**	0.2134	0.5958**
	E5	P	-0.5512**	0.8571**	0.3530	0.0303	0.6029**	0.1351	0.0455	0.3937**
		G	-0.6891**	1.0028**	0.4746**	0.0917	0.8121**	0.1719	0.1485	0.4546**
	E6	P	-0.0235	-0.3510	-0.3240	0.5235**	-0.0443	0.8191**	-0.3239	0.6369**
		G	-0.0949	-0.3866*	-0.3283	0.5644**	-0.0903	0.8465**	0.3390	0.6624**
Days to 50% flowering	E4	P		0.3728*	-0.5001**	-0.0585	-0.4822**	0.1421	-0.4879**	-0.4879**
		G		0.4946**	-0.5627**	-0.0606	-0.5313**	0.0978	-0.5243**	-0.5243**
	E5	P		-0.6534**	-0.5188**	0.3264	-0.6534**	0.3197	-0.5698**	0.1063
		G		0.8295*	-0.5625**	0.3639*	-0.7887**	0.3510	-0.7109**	0.1173
	E6	P		-0.6375**	-0.5588**	-0.3487*	-0.0331	-0.0903	-0.4586*	-0.2799
		G		0.7283**	-0.6625**	-0.4064*	-0.0594	-0.1384	-0.6525**	-0.3248
No of primaries	E4	P		0.1339	-0.4798**	-0.4225*	-0.3552	-0.5536**	-0.6353**	
		G		0.2510	-0.5653**	-0.4086*	-0.3148	-0.5792**	-0.6391**	
	E5	P		0.6370**	0.2482	0.6359**	-0.1652	0.1349	0.3897**	
		G		0.8296**	0.2649	0.8938**	-0.1823	0.1588	0.4226**	
	E6	P		0.6967**	0.0898	0.2567	-0.1416	0.6328**	0.2472	
		G		0.7536**	0.0919	0.2962	-0.1489	-0.7233**	0.2451	
No of secondaries	E4	P			0.3364	0.6878**	0.0920	0.3019	0.3403	
		G			0.3814*	0.7225**	0.0898	0.3239	0.3681*	
	E5	P				-0.0533	0.6291**	-0.5352**	0.2020	-0.0496
		G				-0.0409	0.7640**	-0.6280**	0.3032	-0.0605
	E6	P				-0.0663	0.3870*	-0.3638*	0.1485	0.1456
		G				-0.0657	0.4414*	-0.3922*	0.1879	0.1636
No of capsules/ plant	E4	P				0.4905**	0.5488**	0.3151	0.8331**	
		G				0.5234**	0.5949**	0.3309	0.8995**	
	E5	P				-0.3089	0.1106	-0.2180	0.7133**	
		G				-0.3628*	0.1067	-0.2555	0.7571**	
	E6	P				-0.4279*	0.2627	-0.0820	0.5025**	
		G					0.2904	-0.1202	0.5154**	
No of seeds/ capsule	E4	P					0.3960*	0.3406	0.7343**	
		G					0.3808*	0.3336	0.7378**	
	E5	P					-0.2479	0.3891*	0.7133	
		G					-0.2775	0.5295**	0.7571	
	E6	P					-0.0553	0.0160	0.5069**	
		G					-0.0662	0.0413	0.5226**	
1000 seed weight	E4	P						0.2927	0.8068**	
		G						0.2733	0.7937**	
	E5	P							0.1519	0.6020**
		G							0.1570	0.6113**
	E6	P							0.0735	0.4813**
		G							0.0979	0.4950**
Oil content	E4	P							0.4806**	
		G							0.4690**	
	E5	P								0.1859
		G								0.1895
	E6	P								-0.0237
		G								-0.0188

*significant at 0.05 level ** significant at 0.01 level

Table 3. Path coefficients of yield and yield components of sesamum (*Sesamum indicum* L.) in environment -I.

		Plant height	Days to 50% flowering	No of primaries	No of secondaries	No of capsules/plant	No of seeds/capsule	1000 seed weight	Oil content
Plant height	P	0.1513	-0.0539	0.0431	0.0653	0.0478	0.0701	0.0158	0.0430
	G	0.5594	-0.1982	0.1342	0.2274	0.1896	0.2049	0.0626	0.1741
Days to 50% flowering	P	-0.0675	0.1894	-0.0074	-0.0492	0.0627	-0.0149	-0.0026	-0.0947
	G	-0.5109	1.4418	-0.0381	-0.3636	0.5063	-0.0710	-0.0193	-0.7324
No of primaries	P	-0.1388	0.0190	-0.4872	-0.4247	0.0426	-0.1198	0.0617	0.1825
	G	-0.1264	0.0139	-0.5268	-0.4653	0.0455	-0.1014	0.0686	0.2052
No of secondaries	P	0.1770	-0.1065	0.3574	0.4099	-0.1067	0.0050	-0.0164	-0.1462
	G	0.3106	-0.1927	0.6750	0.7641	-0.2090	-0.0497	-0.0323	-0.2788
No of capsules/plant	P	0.2027	0.2125	-0.0561	-0.1670	0.6416	0.3117	0.0118	0.3185
	G	-0.1737	-0.1800	0.0443	0.1402	-0.5125	-0.2767	-0.0097	-0.2762
No of seeds/capsule	P	0.1871	-0.0317	0.0994	0.0049	0.1964	0.4042	0.1194	0.1947
	G	0.1881	-0.0253	0.0989	-0.0334	0.2772	0.5134	0.1672	0.2772
1000 seed weight	P	0.0286	-0.0037	-0.0346	-0.0109	0.0050	0.0808	0.2734	0.0609
	G	-0.0036	0.0004	0.0041	0.0013	-0.0006	-0.0104	-0.0319	-0.0071
Oil content	P	-0.0273	0.0480	0.0360	0.0342	-0.0477	-0.0462	-0.0214	-0.0960
	G	0.3530	-0.5762	-0.4418	-0.4139	0.6113	0.6124	0.2542	1.1343
Correlation with seed yield/plant	P	0.5132**	0.2730	-0.0495	-0.1374	0.8418**	0.6909**	0.4418*	0.4627*
	G	0.5964**	0.2838	-0.0501	-0.1433	0.9079**	0.8214**	0.4595*	0.4962**

P = Residual effect = 0.0849

P = Phenotypic coefficients

G = Residual effect = SQRT(1 - 1.1642)

G = Genotypic coefficients

Bold values are direct effects and all other values except correlation coefficients with seed yield are indirect effects

* Significant at 0.05 level

** Significant at 0.01 level

plant , number of seeds per capsules and 1000-seed weight in environment III; plant height , number of secondaries , number of capsules per plant , number of seeds per capsule , 1000-seed weight and oil content in environment IV; plant height , number of primaries , number of capsules per plant and 1000 seed weight in environment V; plant height , number of capsules per plant , number of seeds per capsule and 1000 seed weight in environment VI.

Number of capsules per plant and 1000 seed weight were positively associated with seed

yield per plant in all the six environments and number of seeds per capsule positively associated with seed yield per plant in all the environments except environment VI. The character plant height exhibited significant positive association with seed yield per plant in all environments except II and III.

Positive association between seed yield per plant and number of capsules per plant, seed yield per plant and number of seeds per capsule were earlier reported by Ratnababu *et al.* (2004) and Thiyagu *et al.* (2007). Positive association of seed

Table 4. Path coefficients of yield and yield components of sesamum (*Sesamum indicum* L.) in environment -II.

		Plant height	Days to 50% flowering	No of primaries	No of secondaries	No of capsules/plant	No of seeds/capsule	1000 seed weight	Oil content
Plant height	P	0.6043	-0.1572	0.0943	0.0779	-0.2821	0.0622	0.1467	-0.1496
	G	0.2267	-0.0564	0.0313	0.0242	-0.1213	0.0267	0.0628	-0.0566
Days to 50% flowering	P	-0.1950	0.7492	0.3286	-0.3614	-0.0569	-0.4433	0.1714	-0.1428
	G	-0.2148	0.8628	0.4425	-0.4040	-0.0660	-0.5467	0.1833	-0.1749
No of primaries	P	-0.0937	-0.2632	-0.6002	-0.1624	-0.0028	-0.0117	-0.3014	-0.2832
	G	-0.0759	-0.2823	-0.5504	-0.1383	0.0239	0.0056	-0.3100	-0.2980
No of secondaries	P	0.0389	-0.1456	0.0817	0.3019	0.2003	0.2125	0.1541	0.0710
	G	0.0377	-0.1652	0.0886	0.3527	0.2414	0.2627	0.1914	0.0877
No of capsules/plant	P	-0.3955	-0.0643	0.0039	0.5620	0.8473	0.4520	0.4186	0.0493
	G	-0.1964	-0.0281	-0.0159	0.2513	0.3672	0.1993	0.1882	0.0248
No of seeds/capsule	P	0.0312	-0.1792	0.0059	0.2131	0.1616	0.3028	0.0984	0.1265
	G	0.0887	-0.4775	-0.0077	0.5612	0.4090	0.7535	0.2488	0.3423
1000 seed weight	P	-0.0011	-0.0010	-0.0022	-0.0023	-0.0022	-0.0014	-0.0044	0.0001
	G	0.0383	0.0294	0.0779	0.0750	0.0708	0.0456	0.1382	-0.0032
Oil content	P	-0.1101	-0.0848	0.2099	0.1046	0.0259	0.1858	-0.0094	0.4449
	G	-0.0393	-0.0319	0.0853	0.0392	0.0107	0.0715	-0.0036	0.1575
Correlation with seed yield/plant	P	-0.1209	-0.1462	0.1220	0.7334**	0.8911**	0.7589**	0.6739**	0.1163
	G	-0.1350	-0.1492	0.1515	0.7614**	0.9357**	0.8183**	0.6992**	0.0797

P = Residual effect = 0.027

P = Phenotypic coefficients

G = Residual effect = SQRT(1 - 1.0952)

G = Genotypic coefficients

Bold values are direct effects and all other values except correlation coefficients with seed yield are indirect effects

* Significant at 0.05 level

** Significant at 0.01 level

yield per plant with 1000-seed weight was noted by Kumaresan and Nadarajan (2002) and with plant height was reported by Gawali *et al.* (2007).

In the present investigation, the overall results on correlation studies revealed that the important yield attributes i.e., number of capsules per plant, number of seeds per capsule and 1000 seed weight may be included in the selection criteria in any hybridization programme aimed at improvement of seed yield.

Seed yield per plant showed significant negative association with days to 50% flowering

in environment III; days to 50% flowering and number of primaries ($r_g = -0.6391$, $r_p = -0.6353$) in environment IV.

Path coefficient analysis was carried out for partitioning the correlation coefficients of yield and yield contributing characters into direct and indirect effects. The results of path coefficient analysis of yield and yield components are presented in Tables 3 to 8 environment-wise. Path analysis revealed that the following characters exhibited predominant positive direct effect on yield per plant both at phenotypic and genotypic levels in

Table 5. Path coefficients of yield and yield components of sesamum (*Sesamum indicum* L.) in environment -III.

		Plant height	Days to 50% flowering	No of primaries	No of secondaries	No of capsules/plant	No of seeds/capsule	1000 seed weight	Oil content
Plant height	P	-0.2004	0.1616	-0.0857	-0.1634	0.1438	-0.1742	-0.0046	-0.0657
	G	-0.7509	0.7233	-0.4175	-0.6692	0.5704	-0.6851	-0.0126	-0.2795
Days to 50% flowering	P	0.2662	-0.3301	0.2240	0.2306	-0.1587	0.2720	0.0672	0.1332
	G	0.4276	-0.4438	0.3770	0.3943	-0.2211	0.4027	0.1037	0.2288
No of primaries	P	-0.0908	0.1440	-0.2122	-0.0829	-0.0110	-0.1236	-0.1012	-0.0444
	G	-0.1914	0.2923	-0.3442	-0.1584	-0.0137	-0.2172	-0.1945	-0.0768
No of secondaries	P	0.1481	-0.1268	0.0709	0.1816	-0.0819	0.1567	-0.0377	0.0251
	G	0.5361	-0.5343	0.2768	0.6015	-0.3091	0.5652	-0.1351	0.0419
No of capsules/plant	P	-0.6929	0.4640	0.0499	-0.4356	0.9653	-0.3968	-0.0926	-0.0402
	G	-0.7170	0.4701	0.0377	-0.4851	0.9438	-0.4069	-0.0955	-0.0721
No of seeds/capsule	P	0.6231	-0.5907	0.4175	0.6187	-0.2946	0.7168	-0.0468	0.1742
	G	0.7226	-0.7186	0.4998	0.7442	-0.3414	0.7919	-0.0513	0.2231
1000 seed weight	P	0.0147	-0.1299	0.3041	-0.1324	-0.0612	-0.0417	0.6381	0.1656
	G	0.0134	-0.1865	0.4509	-0.1792	-0.0807	-0.0517	0.7979	0.2416
Oil content	P	-0.0234	0.0288	-0.0149	-0.0099	0.0030	-0.0173	-0.0185	-0.0714
	G	0.0137	-0.0189	0.0082	0.0026	-0.0028	0.0103	0.0111	0.0367
Correlation with seed yield/plant	P	0.0446	-0.3790*	0.7535**	0.2066	0.5047**	0.3919*	0.4039*	0.2764
	G	0.0541	-0.4164*	0.8887**	0.2506	0.5454**	0.4093*	0.4238*	0.3438

P = Residual effect = 0.0122

P = Phenotypic coefficients

G = Residual effect = SQRT(1 - 1.1787)

G = Genotypic coefficients

Bold values are direct effects and all other values except correlation coefficients with seed yield are indirect effects

* Significant at 0.05 level

** Significant at 0.01 level

most of the environments *i.e.*, plant height in environments I ; II and V (Ratnababu *et al.*, 2004) ; days to 50% flowering in I ; II ; V and VI (Siddiqui *et al.*, 1998); number of secondaries in I ; II ; III ; IV ; V and VI (Rai *et al.*, 1997); number of capsules per plant in I ; II ; III ; IV ; V and VI (Karuppaiyan and Ramasamy (2000); number of seeds per capsule in I ; II ; III ; IV ; V and VI (Sumalatha *et al.*, 2008); 1000 seed weight I ; III ; IV ; V and VI (Sumalatha *et al.*, 2008); oil content in II ; V and VI (Swapna *et al.*, 2009) coupled with high positive correlation with yield indicating

suitability of these traits for selection in improving the yield. Hence greater emphasis may be placed on these traits during selection for yield improvement.

The other traits showed positive and negative direct effects even through the correlation was positive in all environments. Consequently care has to be taken in effecting selection by maintaining balance among these traits so that genotypes with more desirable attributes can be developed. The residual effects are minimum in all the environments

Table 6. Path coefficients of yield and yield components of sesamum (*Sesamum indicum* L.) in environment -IV.

		Plant height	Days to 50% flowering	No of primaries	No of secondaries	No of capsules/plant	No of seeds/capsule	1000 seed weight	Oil content
Plant height	P	-0.3338	0.1784	0.2086	-0.0851	-0.0894	-0.2157	-0.1568	-0.0708
	G	0.2803	-0.2124	-0.1791	0.0720	0.0985	0.2132	0.1370	0.0598
Days to 50% flowering	P	0.0807	-0.1511	-0.0563	0.0756	0.0088	0.0729	-0.0215	0.0737
	G	-0.2149	0.2836	0.1403	-0.1596	-0.0172	-0.1507	0.0277	-0.1487
No of primaries	P	0.2259	-0.1348	-0.3616	-0.0484	0.1735	0.1528	0.1284	0.2002
	G	0.0481	-0.0373	-0.0753	-0.0189	0.0426	0.0308	0.0237	0.0436
No of secondaries	P	0.0078	-0.0153	0.0041	0.0306	0.0103	0.0211	0.0028	0.0092
	G	0.0123	-0.0269	0.0120	0.0477	0.0182	0.0345	0.0043	0.0155
No of capsules/plant	P	0.0669	-0.0146	-0.1199	0.0840	0.2498	0.1225	0.1371	0.0787
	G	0.1604	-0.0277	-0.2580	0.1741	0.4564	0.2389	0.2715	0.1511
No of seeds/capsule	P	0.2477	-0.1848	-0.1619	0.2636	0.1880	0.3832	0.1518	0.1305
	G	0.1732	-0.1210	-0.0931	0.1645	0.1192	0.2277	0.0867	0.0760
1000 seed weight	P	0.2812	0.0851	-0.2128	0.0551	0.3287	0.2372	0.5989	0.1753
	G	0.0889	0.0178	-0.0573	0.0163	0.1083	0.0693	0.1820	0.0497
Oil content	P	-0.0247	0.0568	0.0644	-0.0351	-0.0367	-0.0396	-0.0341	-0.1163
	G	0.0474	-0.1164	-0.1286	0.0719	0.0735	0.0741	0.0607	0.2220
Correlation with seed yield/plant	P	0.5517**	-0.1803	-0.6353**	0.3403	0.8331**	0.7343**	0.8068**	0.4806**
	G	0.5958**	-0.2402	-0.6391**	0.3681*	0.8995**	0.7378**	0.7937**	0.4690**

P = Residual effect = 0.0014

P = Phenotypic coefficients

G = Residual effect = 0.0905

G = Genotypic coefficients

Bold values are direct effects and all other values except correlation coefficients with seed yield are indirect effects

* Significant at 0.05 level

** Significant at 0.01 level

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Table 7. Path coefficients of yield and yield components of sesamum (*Sesamum indicum* L.) in environment -V.

		Plant height	Days to 50% flowering	No of primaries	No of secondaries	No of capsules/plant	No of seeds/capsule	1000 seed weight	Oil content
Plant height	P	0.3710	-0.2045	0.3180	0.1310	0.0112	0.2236	0.0501	0.0169
	G	0.4664	-0.3214	0.4677	0.2213	0.0428	0.3787	0.0802	0.0692
Days to 50% flowering	P	-0.0054	0.0098	-0.0064	-0.0051	0.0032	-0.0068	0.0031	-0.0056
	G	-0.4647	0.6743	-0.5593	-0.3793	0.2454	-0.5318	0.2367	-0.4794
No of primaries	P	-0.3538	0.2697	-0.4128	-0.2629	-0.1025	-0.2625	0.0682	-0.0557
	G	-0.3625	0.2999	-0.3615	-0.3227	-0.0958	-0.3231	0.0659	-0.0574
No of secondaries	P	0.0528	-0.0776	0.0953	0.1496	-0.0080	0.0941	-0.0800	0.0302
	G	-0.2394	0.2838	-0.4503	-0.5045	0.0206	-0.3854	0.3168	-0.1529
No of capsules/plant	P	0.0273	0.2948	0.2242	-0.0482	0.9031	-0.2789	0.0999	-0.1969
	G	0.0976	0.3872	0.2819	-0.0435	1.0639	-0.3860	0.1135	-0.2719
No of seeds/capsule	P	0.2228	-0.2553	0.2350	0.2325	-0.1142	0.3696	-0.0916	0.1438
	G	0.8788	-0.8535	0.9673	0.8268	-0.3926	1.0822	-0.3003	0.5730
1000 seed weight	P	0.0711	0.1682	-0.0869	-0.2815	0.0582	-0.1304	0.5260	0.0799
	G	0.0033	0.0067	-0.0035	-0.0120	0.0020	-0.0053	0.0192	0.0030
Oil content	P	0.0079	-0.0987	0.0234	0.0350	-0.0378	0.0674	0.0263	0.1733
	G	0.0751	-0.3596	0.0804	0.1534	-0.1293	0.2679	0.0794	0.5059
Correlation with seed yield/plant	P	0.3937*	0.1063	0.3897*	-0.0496	0.7133**	0.0762	0.6020**	0.1859
	G	0.4546*	0.1173	0.4226*	-0.0605	0.7571**	0.0971	0.6113**	0.1895

P = Residual effect = 0.0071

P = Phenotypic coefficients

G = Residual effect = SQRT(1 - 1.1871)

G = Genotypic coefficients

Bold values are direct effects and all other values except correlation coefficients with seed yield are indirect effects

* Significant at 0.05 level

** Significant at 0.01 level

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Table 8. Path coefficients of yield and yield components of sesamum (*Sesamum indicum* L.) in environment -VI.

		Plant height	Days to 50% flowering	No of primaries	No of secondaries	No of capsules/plant	No of seeds/capsule	1000 seed weight	Oil content
Plant height	P	-0.0071	0.0002	0.0025	0.0023	-0.0037	0.0003	-0.0058	0.0023
	G	-0.5657	0.0537	0.2187	0.1857	-0.3193	0.0511	-0.4789	0.1918
Days to 50% flowering	P	-0.0029	0.1223	-0.0780	-0.0684	-0.0427	-0.0040	-0.0111	-0.0561
	G	0.0408	-0.4297	0.3129	0.2846	0.1746	0.0255	0.0595	0.2804
No of primaries	P	0.0032	0.0059	-0.0092	-0.0064	-0.0008	-0.0024	0.0013	-0.0058
	G	-0.0521	-0.0982	0.1349	0.1016	0.0124	0.0400	-0.0201	0.0975
No of secondaries	P	-0.0166	-0.0285	0.0356	0.0511	-0.0034	0.0198	-0.0186	0.0076
	G	0.1649	0.3329	-0.3786	-0.5024	0.0330	-0.2218	0.1970	-0.0944
No of capsules/plant	P	0.4407	-0.2935	0.0756	-0.0558	0.8418	-0.3602	0.2211	-0.0690
	G	0.4955	-0.3567	0.0806	-0.0577	0.8778	-0.4010	0.2549	-0.1055
No of seeds/capsule	P	-0.0386	-0.0288	0.2315	0.3372	-0.3728	0.8712	-0.0482	0.0139
	G	-0.0983	-0.0647	0.3226	0.4807	-0.4974	1.0890	-0.0721	0.0449
1000 seed weight	P	0.2770	-0.0306	-0.0479	-0.1230	0.0888	-0.0187	0.3382	0.0249
	G	0.5103	-0.0834	-0.0898	-0.2364	0.1751	-0.0399	0.6029	0.0590
Oil content	P	-0.0190	-0.0268	0.0370	0.0087	-0.0048	0.0009	0.0043	0.0585
	G	0.1670	0.3214	-0.3562	-0.0925	0.0592	-0.0203	-0.0482	-0.4925
Correlation with seed yield/plant	P	0.6369**	-0.2799	0.2472	0.1456	0.5025**	0.5069**	0.4813**	-0.0237
	G	0.6624**	-0.3248	0.2451	0.1636	0.5154**	0.5226**	0.4950**	-0.0188

P = Residual effect = 0.0872

P = Phenotypic coefficients

G = Residual effect = SQRT(1 - 1.0448)

G = Genotypic coefficients

Bold values are direct effects and all other values except correlation coefficients with seed yield are indirect effects

* Significant at 0.05 level

** Significant at 0.01 level

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(Received on 24.11.2012 and revised on 04.03.2013)