Eco. Env. & Cons. 29 (May Suppl. Issue) : 2023; pp. (S242-S249)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i03s.046

Trait Association and path coefficient analysis for yield and yield attributing traits in Sesame (*Sesamum indicum* L.)

Preeti Kumari*[1] and Pankaj Shah[2]

Department of Genetics & Plant Breeding, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema 797106, Nagaland, India

(Received 21 December, 2022; Accepted 11 February, 2023)

ABSTRACT

Correlation and path analysis were carried out in 36 diverse genotypes of sesame collected from different parts of the country along with North-East region of India for local landraces. Analysis of variance indicated the presence of good amount of genetic variability among the genotypes under study. Correlation studies indicated that seed yield per plant was significantly and positively associated with traits, *i.e*. plant height, internodal length, number of capsules per plant, number of branches per plant, stover yield per plant and harvest index both at genotypic and phenotypic levels which indicate the importance of these traits in selection for enhancing the seed yield. Path analysis revealed that maximum positive direct effect on seed yield per plant was imposed by days to 80% physiological maturity, internodal length, capsule length, stem height from base to first branch, stover yield per plant, harvest index, relative water content, oil content and protein content both at genotypic and phenotypic levels. This indicate that these are the real independent characters and they have maximum contribution towards increase in the seed yield per plant.

Key words: *Sesame, Correlation, Path analysis, Seed yield*

Introduction

Sesame (*Sesamum indicum* L.) is an important oilseed crop with the longest history of cultivation in India. The name "Sesame" derives from the Arabic word "simsim" (Patidar *et al*., 2020) and commonly it is known by benniseed, gingelly, simsim, gergelim, til and tila in Sanskrit. It is an important source of edible oil (50-60%) and protein (25%) with antioxidants lignans such as sesamolin, sesamin (Sasipriya *et al*., 2018). This crop has high regard by consumers for superior oil quality and robust resistance to oxidation and rancidity, it has acquired the lyrical moniker "the queen of oilseed" (Goudappagoudra *et al*., 2011). Sesame is probably originated in Ethiopia (Africa) and from there it was introduced to India and China. Myanmar, India and China are the world's largest producers of sesame followed by Sudan, Uganda and Ethiopia. In India, Gujarat is the leading sesame producing state contributing 22.3% of total production. In Nagaland, sesame is known as "chutsi" in angami (Naga) and has been adopted well for its cultivation in almost in all the district. Sesame oil is highly resistant to oxidative rancidity as it consists of natural antioxidants *viz*. sasamin and sesamolin (Seiglar and Harlan, 1985). Inspite of the fact that sesame has superior economic potential in local consumption and export demand, its average productivity is low as compared to other oilseed crop. Due to its complex yield constraints *i.e*. indeterminate growth habit, non-uniform maturity of capsules, dehiscent of capsules, seed shattering, lack of high yielding and disease resistant varieties (Ali, K.A. 2020). The low yield in sesame is due to lack of attention in breeding program and lack of improved varieties used by the farmers. Seed yield is a complex character and is associated with numbers of component interrelated traits.

Direct selection for traits as such could be misleading because of complex association among the yield attributing traits. Correlation and path coefficient analysis between different yield attributes and yield is invaluable to the breeders who aim to identify key traits for exploitation in breeding for yield improvement (Gogoi and Sarma, 2019). Thus, keeping in view of the above, the present research work has been undertaken to assess the interrelationship and contribution of yield related component traits in sesame.

Materials and Methods

The present study was carried out at experimental research farm of Department of Genetics & Plant breeding, SASRD, Medziphema, Nagaland during *kharif* seasons of 2018 and 2019. It is situated at $25^0$45′43" N latitude and $93^0$53′04" E longitude at an elevation of 304 m above mean sea level. This area falls under sub-tropical climate with high humidity and moderate temperature. The preparation of the field was done by tractor drawn cultivator followed by two cross harrowing to pulverize the soil. The experiment was laid out in Randomised Block Design with three replications. 36 genotypes of sesame from different parts of the country has been collected to conduct the experiment. Seeds of each genotype were sown in hills on raised bed along with furrows with a spacing of 30 × 10 cm by dibbling at a depth of 2- 3 cm and thinning was done at 15 days after sowing. Five randomly selected and equally competitive plants from each treatment and replication from the central rows leaving corner plants to take care of boarder effects were tagged for recording the observations on sixteen characters *viz*., days to 50% flowering, days to 80% physiological maturity, plant height, internodal length, stem height from base to first branch, number of capsules per plant, capsule length, number of seeds per capsule, number of branches per plant, 1000-seeds weight, stover yield per plant, biological yield per plant, harvest index, relative water content, oil content, protein content and seed yield per plant. Pooled data from mean of two years collected data were subjected to simple correlation analysis. The genotypic and phenotypic correlation coefficient of yield and yield contributing traits were estimated as per described method by Al-Jibouri *et al*. (1958). The direct and indirect effect was estimated as per the method of Wright (1921) and elaborated by Dewey and Lu (1959) respectively. The estimates of correlation coefficient and path coefficient analysis were calculated by analysing data using INDOSTAT statistical package.

Results and Discussion

The genotypic and phenotypic correlation coefficients among different characters were worked out in all possible combinations with the objective to get information about the nature, extent and direction of selection pressure to achieve practical and usable results. In general, it was observed that genotypic correlation coefficient (r_g) values were higher in magnitude than the phenotypic correlation coefficient values (r_p). This indicated that although there is strong in herent association between the various pairs of characters studied, the low phenotypic correlation would result from the masking and modifying effects of environment on the association of characters at gene level. This study revealed that seed yield per plant showed positive significant association with plant height, internodal length, number of capsules per plant, number of branches per plant, stover yield per plant and harvest index both at genotypic and phenotypic levels, indicates that these are important characters and may be selected directly to increase the seed yield (Table 1 & 2 and in Figure 1(a) & 1(b). Inter-correlation among the traits showed that days to 50% flowering showed significant and positive association with days to 80% physiological maturity, stem height from base to first branch, capsule length, oil content and protein content and negative association with internodal length, 1000-seeds weight and stover yield per plant at genotypic level while at phenotypic level it showed significant association with days to 80% physiological maturity, oil content and protein content. These results were in agreement with Gupta *et al.* (2021) for days to 80% physiological maturity; Takele *et al.* (2021) for days to maturity and oil content. Significant and positive association of days to 80% physiological maturity was observed with only two traits *viz*. oil content and protein content while with traits plant height, internodal length, number

Table 1. Genotypic correlation for seventeen characters in sesame during *kharif* season of 2018 and 2019 (Pooled)

S. No.	Characters	DFF	DPM	PH	IL	SHBB	NCP	CL	NSC	NBP	TSW	SYP	HI (%)	RWC (%)	OC (%)	PC (%)	SYYP
1	DFF	1.00	0.767**	0.072	-0.280**	0.438**	-0.104	0.3509**	0.118	0.013	-0.437**	-0.237**	-0.104	-0.098	0.132*	0.317**	-0.214**
2	DPM		1.00	-0.425**	-0.516**	-0.021	-0.386**	0.129	-0.270**	-0.304**	-0.027	-0.445**	-0.167*	-0.471**	0.258**	0.321**	-0.443**
3	PH			1.00	0.354**	0.649**	0.621**	0.054	0.614**	0.597**	-0.646**	0.499**	0.172**	0.709**	-0.412**	-0.408**	0.519**
4	IL				1.00	0.305**	0.416**	-0.043	-0.158*	0.383**	0.004	0.445**	0.500**	0.261***	-0.102	-0.172**	0.605**
5	SHBB					1.00	0.269**	-0.041	0.343**	0.272**	-0.729**	0.107	-0.099	0.265**	-0.389**	-0.181**	0.058
6	NCP						1.00	-0.084	0.159*	0.562**	-0.28**	0.799**	0.219**	0.451**	-0.262**	-0.282**	0.821**
7	CL							1.00	0.204**	0.344**	0.087	-0.058	-0.004	0.038	0.277**	0.337**	-0.044
8	NSC								1.00	0.372**	-0.672**	0.065	-0.208**	0.474**	-0.364**	-0.229**	-0.032
9	NBP									1.00	-0.313**	0.425**	0.295**	0.655**	-0.147*	-0.089	0.506**
10	TSW										1.00	0.027	0.187**	-0.428**	0.296**	0.276**	0.061
11	SYP											1.00	0.109	0.096	-0.321**	-0.223**	0.919**
12	HI (%)												1.00	0.242**	0.173**	0.096	0.453**
13	RWC (%)													1.00	-0.367**	-0.431**	0.177**
14	OC (%)														1.00	0.275**	-0.195**
15	PC (%)															1.00	-0.172**
16	SYYP																1.00

Table 2. Phenotypic correlation for seventeen characters in sesame during *kharif* season of 2018 and 2019 (Pooled)

S. No.	Characters	DFF	DPM	PH	IL	SHBB	NCP	CL	NSC	NBP	TSW	SYP	HI (%)	RWC (%)	OC (%)	PC (%)	SYYP
1	DFF	1.00	0.603**	-0.048	-0.241**	0.087	-0.048	0.122	-0.054	0.058	-0.412**	-0.115	-0.161*	0.059	0.173*	0.252**	-0.126
2	DPM		1.00	-0.314**	-0.341**	-0.015	-0.233**	0.121	-0.155*	-0.062	-0.134	-0.279**	-0.231**	-0.019	0.191**	0.229**	-0.298**
3	PH			1.00	0.345**	0.550**	0.550**	-0.038	0.478**	0.519**	-0.498**	0.459**	0.172*	0.371**	-0.342**	-0.277**	0.469**
4	IL				1.00	0.267**	0.281**	0.047	-0.001	0.270**	-0.008	0.348**	0.229**	0.039	-0.053	-0.093	0.403**
5	SHBB					1.00	0.265**	0.038	0.374**	0.099	-0.577**	0.110	0.035	0.139*	-0.392**	-0.149*	0.114
6	NCP						1.00	-0.018	0.185**	0.510**	-0.193**	0.811**	0.335**	0.164*	-0.251**	-0.146*	0.844**
7	CL							1.00	0.335**	0.220**	0.079	0.037	0.099	0.013	0.182**	0.215**	0.089
8	NSC								1.00	0.234**	-0.405**	0.184**	0.031	0.185**	-0.311**	-0.124	0.176**
9	NBP									1.00	-0.242**	0.414**	0.196**	0.342**	-0.097	0.009	0.454**
10	TSW										1.00	0.045	0.232**	-0.275**	0.204**	0.224**	0.103
11	SYP											1.00	0.159*	0.0477	-0.243**	-0.114	0.906**
12	HI (%)												1.00	0.075	-0.041	0.068	0.522**
13	RWC (%)													1.00	-0.114	-0.165*	0.096
14	OC (%)														1.00	0.208**	-0.201**
15	PC (%)															1.00	-0.066
16	SYYP																1.00

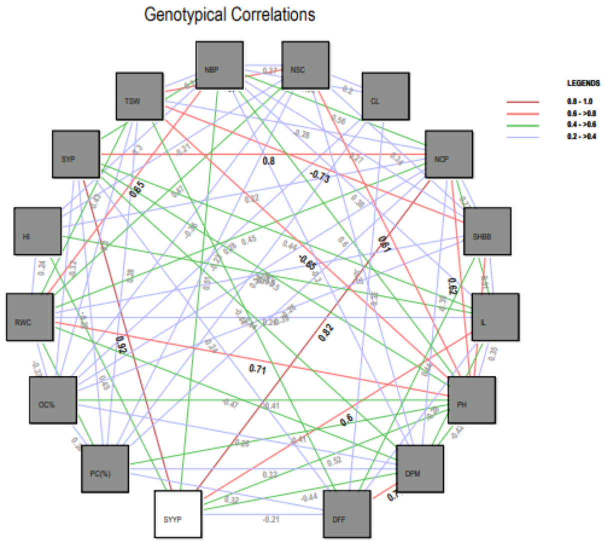

Fig. 1(a) Genotypic correlation coefficient among sixteen morpho-physiological and quality traits in sesame

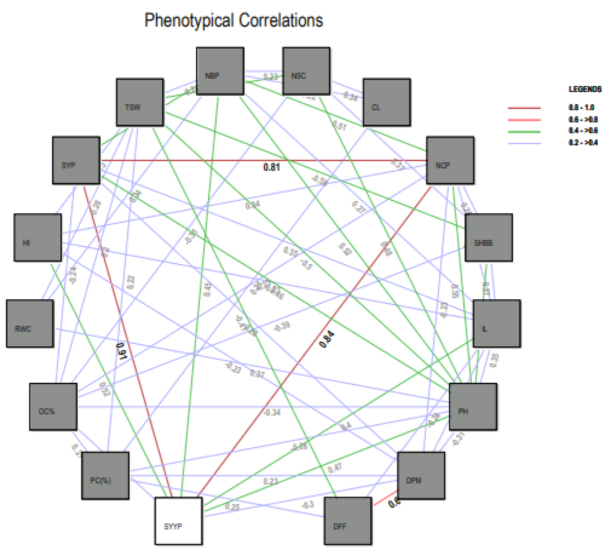

Fig. 1(b) Phenotypic correlation coefficient among sixteen morpho-physiological and quality traits in sesame

of capsules per plant, number of seeds per capsule, stover yield per plant and harvest index it showed negative association both at genotypic and phenotypic level. This result is in agreement with Goudappagoudra *et al*. (2011). Plant height exhibited highly significant and positive association with internodal length, stem height from base to first branch, number of capsules per plant, number of seeds per capsule, number of branches per plant, stover yield per plant, harvest index, relative water content while negatively associated with 1000-seeds weight, oil content, protein content both at genotypic and phenotypic level. Hence, seed yield can be increased to a substantial level through direct selection of plant height. Thus, indirect selection in favor of this trait can improve seed yield in sesame. Similar results were reported by Kant *et al*. (2021). Internodal length showed significant and positive association with stem height from base to first branch, number of capsules per plant, number of branches per plant, stover yield per plant, harvest index both at genotypic and phenotypic level while with relative water content at genotypic level only. Stem height from base to first branch exhibited significant and positive association with number of capsules per plant, number of seeds per capsule and relative water content both at genotypic and phenotypic level while with number of branches per plant at only genotypic level. 1000-seeds weight, oil content and protein content had shown significant but negative correlation with stem height from base to first branch both at genotypic and phenotypic level. Number of capsules per plant showed significant and positive association with number of branches/plant, number of seeds/capsule, stover yield/plant, harvest index and relative water content. These results are in consonance with the findings of Disowja *et al*. (2020). Capsule length showed significant and positive association with number of seeds per capsule, number of branches per plant, oil content and protein content both at genotypic and phenotypic level. Number of seeds per capsule were significant and positively associated with number of branches per plant and relative water content both at genotypic and phenotypic level while negatively associated with four traits *viz*. 1000-seeds weight, harvest index, oil content, protein content at genotypic level and highly correlate with 1000-seeds weight, oil content at phenotypic level. Number of branches per plant were highly significant and positively associated with stover yield per plant, harvest index, relative water content. The trait, *i.e.* 1000-seeds weight showed significant but negative association with number of branches per plant trait while positively associated with harvest index, oil content and protein content both at genotypic and phenotypic level. Stover yield was positively associated with harvest index at phenotypic and negatively correlated with oil content both at genotypic and phenotypic level. Harvest index showed significant and positive association with relative water content and oil contentat genotypic level. Relative water content showed significant but negative association with protein content both at genotypic and phenotypic level with oil contentat genotypic level.

These findings clearly indicated that genotypic correlation was of higher magnitude than the corresponding phenotypic ones, thereby establishing strong inherent relationship among the studied characters. The low phenotypic correlation value might be due to appreciable interaction of the genotypes with the environments. Hence, direct selection for these traits may lead to development of high yielding genotypes of sesame. These results are in confrontation with Singh and Bisen (2018), Lalpantluangi and Shah (2018) for number of capsules per plant at genotypic level and for plant height, number of branches per plant at phenotypic level; Singh *et al*. (2020) and Takele *et al*. (2021) for number of capsules per plant, the number of branches per plant, plant height and harvest index; Patil and Lokesha (2018), Navaneetha *et al*. (2019), Saravanan *et al*. (2020) for number of capsules per plant, plant height and number of branches per plant; Abate *et al*. (2018) for plant height, number of capsules per plant, stover yield/plant and harvest index; Haibru *et al*. (2018), Singh *et al*. (2018) and Disowja *et al*.(2020) for number ofcapsules per plant, plant height; Gupta *et al*. (2021) for harvest index; Singh *et al*. (2018) for number of capsules per plant; Abhijatha *et al*. (2017), Patil and Lokesha (2018), Jamir *et al*. (2020) and Kumar *et al*. (2022) for number of capsules per plant, number of branches per plant; Ravitej *et al*. (2019) and Sasipriya *et al*. (2022) for number of capsules per plant, number of branches per plant both at phenotypic and genotypic level; Abdou *et al*. (2015) for harvest index, number of branches per plant, this relation indicates that the best yield was obtained with highly branched plants because capsules number increases with the degree of branching and thus ultimately increase seed production.

Path coefficient analysis at genotypic and phenotypic level was worked out to study the effect of various traits on seed yield per plant. The results have been presented in Table 3 & 4 and in Figure 2. A pursual of phenotypic path coefficient analysis showed that maximum positive direct effect on seed yield per plant was imposed by stover yield per plant followed by harvest index, number of capsules per plant, internodal length, 1000-seed weight, days to 50% flowering, number of seeds per capsule, days to 80% physiological maturity, relative water content oil content and plant height. Therefore, these characters can be considered for direct selection for better seed yield. Similar results have been reported by Abhijatha *et al*. (2017), Sorathiya *et al*. (2021), Agrawal *et al*., 2017 and Sasipriya *et al*. (2022). Maximum negative direct effect on seed yield were recorded by stem height from base to first branch followed by number of branches per plant and protein content.

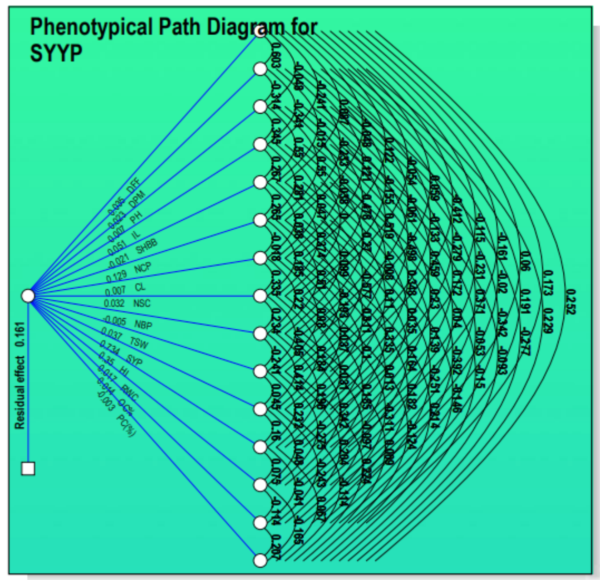

Fig. 2. Phenotypic path diagram among sixteen morpho-physiological and quality traits in sesame

On the other hand, the maximum positive indirect effect on seed yield per plant was imposed by number of capsules per plant followed by plant height, number of branches per plant, internodal length and harvest index through stover yield per plant. Character *viz*. days to 80% physiological maturity oil content, days to 50% flowering and protein content through stover yield per plant followed by stem height from base to first branch, plant height, number of seeds per capsule, relative water content, number of branches per plant, number of seeds per capsule through 1000-seed weight; capsule length and 1000-seed weight through number of capsules per plant; stover yield per plant through days to 80% physiological maturity; internodal length and harvest index through days to 50% flowering imposed maximum negative and indirect effect on seed yield per plant. So, indirectly selection of indirect effect all these traits will ultimately improves seed yield per plant (Hukumchand *et al*., 2019). Re-

Table 3. Genotypic Path coefficient analysis for seventeen characters in sesame during *kharif* season of 2018 and 2019 (Pooled)

Characters	DFF	DPM	PH	IL	SHBB	NCP	CL	NSC	NBP	TSW	SYP	HI (%)	RWC (%)	OC (%)	PC (%)
DFF	-0.1759	-0.1349	-0.0126	0.0493	-0.077	0.0183	-0.0617	-0.0208	-0.0023	0.0769	0.0417	0.0182	0.0172	-0.0232	-0.0557
DPM	0.1537	0.2004	-0.0852	-0.1034	-0.0042	-0.0774	0.0258	-0.0542	-0.061	-0.0053	-0.0892	-0.0334	-0.0944	0.0518	0.0643
PH	-0.0093	0.0548	-0.129	-0.0457	-0.0837	-0.0801	-0.007	-0.0792	-0.077	0.0833	-0.0644	-0.0221	-0.0914	0.0531	0.0526
IL	-0.0215	-0.0397	0.0272	0.0769	0.0234	0.032	-0.0033	-0.0121	0.0294	0.0003	0.0342	0.0384	0.0201	-0.0078	-0.0132
SHBB	0.0082	-0.0004	0.0122	0.0057	0.0188	0.0051	-0.0008	0.0065	0.0051	-0.0137	0.002	-0.0019	0.005	-0.0073	-0.0034
NCP	0.0065	0.024	-0.0386	-0.0259	-0.0167	-0.0621	0.0052	-0.0099	-0.0349	0.0174	-0.0496	-0.0136	-0.028	0.0163	0.0175
CL	0.0255	0.0094	0.004	-0.0031	-0.003	-0.0061	0.0727	0.0149	0.0251	0.0063	-0.0042	-0.0003	0.0028	0.0202	0.0245
NSC	-0.0031	0.0072	-0.0164	0.0042	-0.0091	-0.0042	-0.0054	-0.0266	-0.0099	0.0179	-0.0017	0.0055	-0.0126	0.0097	0.0061
NBP	-0.0017	0.0389	-0.0762	-0.0489	-0.0347	-0.0718	-0.044	-0.0475	-0.1277	0.0399	-0.0542	-0.0377	-0.0836	0.0188	0.0114
TSW	0.0884	0.0054	0.1306	-0.0008	0.1474	0.0566	-0.0176	0.1359	0.0632	-0.2022	-0.0055	-0.0378	0.0866	-0.0598	-0.0558
SYP	-0.2597	-0.4871	0.5464	0.4867	0.1169	0.8747	-0.063	0.0714	0.4648	0.0297	1.0947	0.1195	0.1048	-0.3512	-0.244
HI (%)	-0.0352	-0.0567	0.0584	0.17	-0.0339	0.0745	-0.0013	-0.0708	0.1004	0.0635	0.0371	0.34	0.0821	0.0588	0.0326
RWC (%)	-0.0226	-0.1083	0.163	0.0601	0.061	0.1038	0.0088	0.109	0.1506	-0.0985	0.022	0.0555	0.23	-0.0844	-0.0991
OC (%)	0.0122	0.0238	-0.0379	-0.0094	-0.0357	-0.0241	0.0255	-0.0335	-0.0135	0.0272	-0.0295	0.0159	-0.0337	0.092	0.0253
PC (%)	0.0204	0.0207	-0.0263	-0.0111	-0.0117	-0.0182	0.0217	-0.0148	-0.0058	0.0178	-0.0144	0.0062	-0.0278	0.0177	0.0645
SYYP	-0.2141	-0.4426	0.5197	0.6047	0.0577	0.821	-0.0444	-0.0317	0.5064	0.0606	0.919	0.4525	0.177	-0.1954	-0.1724

Table 4. Phenotypic Path coefficient for seventeen characters in sesame during *kharif* season of 2018 and 2019 (Pooled)

Characters	DFF	DPM	PH	IL	SHBB	NCP	CL	NSC	NBP	TSW	SYP	HI (%)	RWC (%)	OC (%)	PC (%)
DFF	0.035	0.0211	-0.0017	-0.0084	0.003	-0.0017	0.0043	-0.0019	0.0021	-0.0144	-0.004	-0.0056	0.0021	0.0061	0.0088
DPM	0.014	0.0233	-0.0073	-0.0079	-0.0003	-0.0054	0.0028	-0.0036	-0.0014	-0.0031	-0.0065	-0.0054	-0.0005	0.0045	0.0053
PH	-0.0003	-0.0023	0.0073	0.0025	0.004	0.004	-0.0003	0.0035	0.0038	-0.0036	0.0033	0.0012	0.0027	-0.0025	-0.002
IL	-0.0124	-0.0175	0.0177	0.0512	0.0137	0.0144	0.0024	0	0.0138	-0.0004	0.0178	0.0118	0.002	-0.0027	-0.0048
SHBB	-0.0018	0.0003	-0.0114	-0.0056	-0.0208	-0.0055	-0.0008	-0.0078	-0.0021	0.0120	-0.0023	-0.0007	-0.0029	0.0082	0.0031
NCP	-0.0062	-0.0301	0.0709	0.0363	0.0342	0.129	-0.0023	0.0239	0.0658	-0.0249	0.1046	0.0432	0.0212	-0.0324	-0.0189
CL	0.0008	0.0008	-0.0002	0.0003	0.0002	-0.0001	0.0065	0.0022	0.0014	0.0005	0.0002	0.0006	0.0001	0.0012	0.0014
NSC	-0.0017	-0.0049	0.0151	0.0000	0.0118	0.0059	0.0106	0.0316	0.0074	-0.0128	0.0058	0.001	0.0058	-0.0098	-0.0039
NBP	-0.0003	0.0003	-0.0024	-0.0012	-0.0005	-0.0023	-0.001	-0.0011	-0.0046	0.0011	-0.0019	-0.0009	-0.0016	0.0004	0.0000
TSW	-0.0152	-0.0049	-0.0183	-0.0003	-0.0212	-0.0071	0.0029	-0.0149	-0.0089	0.0368	0.0016	0.0085	-0.0101	0.0075	0.0082
SYP	-0.0845	-0.2051	0.3367	0.2554	0.0809	0.5954	0.0273	0.1347	0.304	0.0327	0.7339	0.1173	0.035	-0.1783	-0.0838
HI (%)	-0.0564	-0.0811	0.0602	0.0805	0.0123	0.1174	0.0349	0.0108	0.0687	0.0814	0.056	0.3503	0.0264	-0.0143	0.0236
RWC (%)	0.001	-0.0003	0.0062	0.0007	0.0023	0.0027	0.0002	0.0031	0.0057	-0.0046	0.0008	0.0013	0.0166	-0.0019	-0.0027
OC (%)	0.0025	0.0027	-0.0048	-0.0008	-0.0056	-0.0036	0.0026	-0.0044	-0.0014	0.0029	-0.0034	-0.0006	-0.0016	0.0142	0.0029
PC (%)	-0.0007	-0.0007	0.0008	0.0003	0.0004	0.0004	-0.0006	0.0004	0	-0.0007	0.0003	-0.0002	0.0005	-0.0006	-0.0029
SYYP	-0.1262	-0.2984	0.4687	0.4029	0.1145	0.8435	0.0896	0.1765	0.4544	0.1028	0.9064	0.5218	0.0958	-0.2006	-0.0657
Partial R^2	-0.0044	-0.007	0.0034	0.0206	-0.0024	0.1088	0.0006	0.0056	-0.0021	0.0038	0.6652	0.1828	0.0016	-0.0028	0.0002

sidual effect at phenotypic level was observed to be 0.1614 and at genotypic level it was 0.1711, indicates that traits which are included in the phenotypic and genotypic path analysis explained 83.86 and 82.89% respectively of the total variation in seed yield.

The present study suggest that more emphasis should be given to selective genotypes having early flowering as it results in to early maturity in genotypes, also possessing less internodal length, more number of seeds per capsule with long capsule length. Additionally, positive direct effect of harvest index (*i.e*. optimization of high seed yield with biological yield) and relative water content are important component traits towards seed yield per plant and could be successfully utilized for yield improvement in sesame.

References

Abate, M. 2018. Correlation and path coefficient analysis in mid-altitude sesame (*Sesamum indicum* L.) germplasm collection of Ethiopia. *African Journal of Agricultural Research*. 13 (46): 2651-2658.

Abdou, R. I. Y., Moutari, A., Ali, B., Basso, Y. and Djibo, M. 2015. Variability Study in Sesame (*Sesamum indicum* L.) Cultivars based on Agro-Morphological Characters. *International Journal of Agriculture, Forestry and Fisheries*. 3 (6): 237-242.

Abhijatha, A., Ayra, K., Madhukar, K. and Gogineni, S. 2017. Evaluation of sesame (*Sesamum indicum* L.) genotypes to the shaded uplands of southern region. *International Journal of Microbiolgy and Applied Science.* 6 (7): 332-339.

Agrawal, M.M., Wawge, S.S., M.N., Macwana, S. and Sasidharan, N. 2017. Correlation and path analysis for seed yield and yield attributing traits in Sesame germplasm (*Sesamum indicum* L.). *International Journal of Chemical Studies*. 5 (4): 1099-1102.

Ali, K.A. 2020. Performance and stability of yield and yield components in some sesame (*Sesamum indicum* L.) genotypes under northern Gedarif rainfed conditions of Sudan. *Journal of Global Biosciences*. 9(4): 7127-7148.

Al-jibouri, A., Miller, P.A. and Robinson, H.F. 1958. Genotype and environmental Variation and correlation in an upland cotton crop of the interspecific origin. *Journal of Agronomy*. 50(10): 633-636.

Dewey, O.R and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Journal of Agronomy*. 57: 515-518.

Disowja, A., Parameswari, C., Gnanamalar, R.P. and Vellaikumar, S. 2020. Evaluation of sesame (*Sesamum indicum* L.) based on correlation and path analysis. *Electronic Journal of Plant Breeding*. 11 (2): 511-514.

Gaudappagoudra, R., Lokesha, R. and Ranganatha, A.R.G. 2011. Trait association and path coefficient analysis for yield and yield attributing traits in Sesame (*Sesamum indicum* L.). *Electronic Journal of Plant Breeding*. 2 (3): 448-452.

Gogoi, L.R., Singh, S.K. and Sarma, R.N. 2018. Assessment of Genetic Diversity in Indigenous Sesame Genotypes.*International Journal of Current Microbiology and Applied Sciences*. 7 (6): 1509-1520.

Gupta, D., Muralia, S., Khandelwal, V. and Nehra, A. 2021. Assessing Diversity of Sesame Genotypes Using Cluster Analysis and Principal Component Analysis. *International Journal of Current Microbiology and Applied Sciences*. 10 (1): 304-312.

Haibru, G., Dash, M., Pradhan, B., Lenka, D. and Tripathy, S.K. 2018. Genetic parameters of variability and character association studies for yield and some capsule shattering traits in sesame germplasm. *Journal of Pharmacognosy and Phytochemistry*. 7 (5): 585-590.

Hukumchand and Parameshwarappa, S. G. 2019. Character Association and Path Analysis for Quantitative Traits in Advanced Breeding Lines of Sesame (*Sesamum indicum* L.) *International Journal of Current Microbiology and Applied Sciences*. 8 (12): 2980-2990.

Jamir, M., Changkija, S. and Chaturvedi, H.P. 2020. Genetic variation in sesame (*Sesamum indicum* L.) landraces of North East India. *Journal of Pharmacognosy and Phytochemistry*. 9 (4): 634-637.

Kant, C., Mishra, S.P., Mani, N. and Kumar, N. 2021. Assessment of genetic variability and some biochemical traits in Sesame (*Sesamum indicum* L.) genotypes. *Journal of Pharmacognosy and Phytochemistry*. 10 (5): 252-256.

Kumar, V., Sinha, S., Satyendra., Sinha, S., Singh, R.S. and Singh, S.N. 2022. Assessment of genetic variability, correlation and path analysis in sesame (*Sesamum indicum* L.). *Electronic Journal of Plant Breeding.* 13 (1): 208-215.

Lalpantluangi, P.C. and Shah, P. 2018. Character association and path coefficient analysis in sesame (*Sesamum indicum* L.) genotypes under foothill condition of Nagaland. *The Pharma Innovation*. 7(5): 82-87.

Navaneetha, J. S., Murugan E. and Parameswari, C. 2019. Correlation and path analysis for seed yield and its components in sesame (*Sesamum indicum* L.). *Electronic Journal of Plant Breeding.* 10 (3): 1262-1268.

Patidar, B., Tripathi, D., Patidar, S., Patidar, M., Singh, Y. and Kumari, G. 2020. The association and path coefficient analysis for yield and yield attributing traits in sesame (*Sesamum indicum* L.). *Journal of Pharmacognosy and Phytochemistry*. 9 (3): 1674-1678.

Patil, M.and Lokesha, R. 2018. Estimation of genetic variability, heritability, genetic advance, correlations and path analysis in advanced mutant breeding lines of sesame (*Sesamum indicum* L.). *Journal of Pharmacognosy and Natural Products*. 4(1): 1-5.

Ravitej, R.N., Kumar, P.R., Pandey, B.B., Reddy, S.N., Shankar, V.G. and Padmaja, D. 2019. Morpho-physiological and yield traits of sesame (*Sesame indicum* L.) varieties under rainfed conditions. *Journal of Oilseed Research*. 36 (3): 193-198.

Saravanan, M., Kalaiyarasi, R. and Viswanathan, P.L. 2020. Assessment of genetic variability, character association and path analysis in F_2 population of sesame (*Sesamum indicum* L.) *Electronic Journal of Plant Breeding*. 11 (2): 447-450.

Sasipriya, S., Parimala, K., Balram, M. and Eswari, K.B. 2022. Variability and character association in sesame (*Sesamum indicum* L.). *The Pharma Innovation Journal*. 11 (1): 299-302.

Sasipriya, S., Parimala, K., Eswari, K.B. and Balram, M. 2018. Correlation and path analysis for seed yield and its components in sesame (*Sesamum indicum* L.). *Electronic Journal of Plant Breeding*. 9(4): 1594-1599.

Seigler, B.D. and Harlan, J.R. 1985. Sesamin, sesamolin and the origin of the sesame. *Biochemical Systematics and Ecology*. 13: 133-139.

Singh, A., Bisen, R. and Tiwari, A. 2018. Genetic Variability and Character Association in Sesame (*Sesamum indicum* L.) Genotypes. *International Journal of Current Microbiology and Applied Sciences*. 7 (11): 2407-2415.

Singh, U.K., Kumar, N., Bharati, V., Singh, S.K. and Kumar, R. 2020. Trait association and path coefficient analysis for yield and yield attributing traits in sesame (*Sesamum indicum* L.). *Journal of Pharmacognosy and Phytochemistry*. 9 (6): 352-355.

Sorathiya, H. P. Babariya, C. A., Babiaya, A. V. and Rathod, V. T. 2021. Phenotypic and genotypic path coefficient analysis in black sesame (*sesamum indicum* L.). *Journal of Emerging Technologies and Innovative Research*. 8 (8): 379-383.

Takele, F., Lule, D. and Alemerew, S. 2021. Correlation and path coefficient analysis for yield and its related traits in sesame (*Sesamum indicum* L.) genotypes. *Agricultural and Veterinary Sciences*. 9 (1): 52-64.

Wright, S. 1921. Correlation and causation. *Journal of Agricultural Research*. 20: 557- 585.