Original Research Article

CORRELATION AND PATH ANALYSIS STUDIES IN LOCAL GERMPLASM OF SESAME (*Sesamum indicum* L.)

ABSTRACT

Sesame is the oilseed crop known as the 'Poor Man's Ghee' due to its higher nutritive value. In present investigation thirty-six local germplasm of sesame were evaluated for ten quantitative characters. The field trial was take on at Botany Section Farm, College of Agriculture, Dhule during 2023, summer. Trial was conducted using RBD design with two replications. Ten characters were recorded viz., days to 50 per cent flowering, days to maturity, plant height at maturity, number of primary branches, number of capsules per plant, number of seeds per capsule, 1000 seed weight, oil content, protein content and seed yield per plant. At both genotypic and phenotypic level 1000 seed weight, number of capsules per plant, number of branches per plant, plant height at maturity and number of seeds per capsule showed positive significant correlation with seed yield per plant. While protein content exhibited negative non-significant correlation with seed yield at both genotypic and phenotypic level. In path analysis number of capsules per plant, 1000 seed weight, number of seeds per capsule showed high positive direct effect on seed yield. Indirect effect of number of capsules on seed yield via, number of primary branches and 1000 seed weight is high and positive.

KEYWORDS: Correlation, Path analysis, direct effect, indirect effect, sesame

INTRODUCTION

Sesame is major oilseed crop originated in Africa (Bedigian 1981) and domesticated and cultivated in India (Bedigian 2003). Sesame belongs to the family Pedaliaceae. Sesame is self pollinated herbaceous annual plant with flower consisting four stamen and one bifid stigma. It is a erect, medium tall plant grows up to the height of 60 to 150 cm.

Sesame is widely distributed across the continents from Africa to Central Asia and South Asia through pan India. It is tropical and sub-tropical crop, response well to moisture stress condition, in low fertile soil. It can be cultivate under less inputs and with minimum agricultural practices.

Sesame seeds are the rich source of fat, proteins, minerals, Ca and Fe. High percentage of unsaturated fatty acids are found in sesame oil i.e. oleic acid and linoleic acid. Keeping quality of sesame oil is increases due to the high percentage of antioxidant present in it. Sesame oil is used in industrial purpose like insecticides, pharmaceutical and paints. Sesame is very famous food additive in Indian household to enhance food flavor.

Correlation coefficient and path coefficient are the useful measures for quantifying the effect of individual trait on seed yield. Correlation gives the information about mutual association between two variables on the basis of which breeders can select superior genotypes for seed yield. Path analysis is the partial regression analysis which partitioned correlation into direct and indirect effect. Path analysis specify the effect of independent variable via another independent variable on dependent variable. Combined study of correlation analysis with path analysis reveals the true picture of genetic association between component traits for seed yield.

MATERIALS AND METHODS

A total of thirty-six local germplasm of sesame were assessed for quantitative traits in the summer season of 2023. RBD design is adopted with two replications at Botany Section Farm, College of Agriculture, Dhule. The sources of local germplasms were the Oilseed Research Station, Jalgaon and the vicinity area of the College of Agriculture, Dhule. Recommended cultural practices were adopted to raise a healthy crop. Observations were recorded on ten characters viz., days to 50 per cent flowering, days to maturity, plant height (cm), number of branches per plant, number of capsules per plant, number of seeds per capsule, 1000 seed weight (g), oil content (%), protein content (%) and seed yield per plant (g). To know the mutual association between seed yield per plant and its component characters correlation coefficient were computed. For estimation of the direct and indirect effect of yield contributing characters path analysis were calculated. Statistical analysis for ANOVA is done by the method given by Panse and Sukhatme (1995). Analysis of covariance was worked out by Singh and Chaudhari (1977). Correlation coefficient by Johanson *et al.* (1955) and path analysis as suggested by Dewey and Lu (1959).

RESULT AND DISCUSSION

Analysis of variance revealed that all genotypes were highly significant for ten characters indicating that the presence of variability among the genotypes. Variability is the essential for the development of new breeding material. At both genotypic and phenotypic level 1000 seed weight showed highly positive significant correlation with seed yield, indicating that increased seed size results for higher yield. Followed by number of capsules per plant, number of branches per plant, plant height at maturity and number of seeds per capsule at both genotypic and phenotypic level. Oil content showed positive non-significant correlation with seed yield at both genotypic and phenotypic level. Protein content was negatively non-significant correlated with seed yield. Negative significant impact on seed yield was showed by days to 50 per cent flowering and days to maturity at both genotypic and phenotypic level. The genotypic path is showed in figure 1 and phenotypic path in figure2.

Days to 50 per cent flowering had a strong positive significant correlation with days to maturity and positive non-significant correlation with protein content at both genotypic and phenotypic level. At both genotypic and phenotypic level days to 50 per cent flowering exhibited strong negative significant correlation with number of capsules per plant, number of branches per plant, plant height at maturity and 1000 seed weight. Also show non-significant negative correlation with oil content and number of seed per capsule. Similar results for days to 50 per cent flowering were given by Raghuwanshi *et al*. (2003), Yol *et al*. (2010), Baraki *et al*. (2015), Sabiel *et al*. (2015), Patel *et al*. (2024).

At both genotypic and phenotypic level days to maturity showed positive non-significant correlations with protein content. While showed significant negative correlation with number of capsules per plant, number of branches per plant and oil content. And negative non-significant correlation with 1000 seed weight and number of seeds per capsule at both genotypic and phenotypic level. Similar results were revealed by Raghuwanshi *et al*. (2003), Yol *et al*. (2010), Baraki *et al*. (2015), Patel *et al*. (2024). Plant height at maturity showed strong positive and significant genotypic and phenotypic correlations with number of capsule per plant, 1000 seed weight and number of branches per plant. Also showed non-significant positive correlation with number of seed per capsule and oil content at both genotypic and phenotypic level.

At both genotypic and phenotypic level number of branches per plant showed positive significant correlation with number of capsules per plant and 1000 seed weight. While number of seeds per capsule at genotypic level showed non-significant positive correlation, at phenotypic level it showed significant positive correlation with number of primary branches per plant. Whereas number of branches showed positive non- significant correlation with oil content at both genotypic and phenotypic level. It showed negative non-significant correlation with protein content at both genotypic and phenotypic level. Similar findings were given by Krishnadoss and Kadambavanasundram (1986), Rao *et al*. (1991), Mukhekar *et al*. (2002), Raghuwanshi *et al*. (2003), Babu *et al*. (2004), Sumathi and Muralidharan (2010), Yol *et al*. (2010), Gangadhara *et al*. (2012), Chaudhari *et al*. (2022).

At both genotypic and phenotypic level number of capsules per plant showed positive significant correlation with 1000 seed weight and positive non-significant correlation with number of seed per capsule and oil content. While protein exhibited positive non-significant correlation at genotypic level, whereas it exhibited negative non-significant correlation at phenotypic level with number of capsules per plant. Similar findings were given by Krishnadoss and Kadambavanasundram (1986), Rong and Wu (1989), Li (1988), Deshmukh and Chavan (1990), Dharmalingam and Ramanathan (1993), Solanki and Gupta (2001), Mukhekar *et al*. (2002), Babu *et al*. (2004), Thiyagu *et al*. (2007), Kante and Ghodke (2022).

At both genotypic and phenotypic level number of seeds per capsule showed positive non-significant correlation with 1000 seed weight. While negative significant correlation with protein content and negative non-significant correlation with oil content at both genotypic and phenotypic level. At both genotypic and phenotypic level 1000 seed weight showed positive non-significant correlation with oil content. While negative non-significant correlation with protein content.

Significant correlation of 1000 seed weight to seed yield shows that boldness of seed had the major role in seed yield, so it might be the important character in selection for seed yield. Similar results were studied by Babu *et al.* (2004), Yol *et al.* (2010) and Sabiel *et al.* (2015) for 1000 seed weight. Higher number of capsules per plant ultimately increases the seed yield. Similar results for number of capsules per plant were given by Solanki and Gupta (2001), Mukhekar *et al.* (2002), Thiyagu *et al.* (2007) and Kante and Ghodke (2022). Plant with more number of primary branches will bears more capsules and ultimately increases the seed yield. Same findings was also given by Sumathi and Muralidharan (2010) and Gangadhara *et al.* (2012) for number of primary branches. With increase in plant height capsule bearing capacity of plant also increases ultimately increases the seed yield. Similar findings for plant height were given by Krishnadoss and Kadambavanasundram (1986), Raghuwanshi *et al.* (2003) and Sabiel (2015). Increase in number of seeds per capsule increases the seed yield. Same results were given by Babu *et al*. (2004), Gangadhara *et al.* (2012), Bamrotiya *et al*. (2016) and Saxena *et al*. (2016) for number of seeds per capsule. Oil content does not show significant variation with seed yield, similar results were given by Pawar et al. (2002), Baraka et al. (2015) and Kante and Ghodke (2022). With increased yield protein content decreases slightly.

Number of capsules per plant (0.6681, 0.3950), 1000 seed weight (0.3124, 0.2982), number of seeds per capsule (0.2931, 0.1640), oil content (0.2259, 0.0755), days to maturity (0.1522, 0.0570), plant height at maturity (0.1117, 0.1947) and days to 50 per cent flowering (0.0370, 0.0509) had direct positive effect on seed yield at both genotypic and phenotypic level. At both genotypic and phenotypic levels, protein content (-0.0381, -0.0111) showed a negative direct effect on seed yield per plant. Number of primary branches (-0.1398, 0.1175) showed negative direct effect at genotypic level while it shows positive direct effect at phenotypic level on seed yield per plant.

The indirect effect of days to 50 per cent flowering on days to maturity (0.1236, 0.0423) is low and positive at both genotypic and phenotypic level. Days to maturity showed low indirect effect *via*, oil content (0.1013) and negligible positive indirect effect via, number of branches per plant (0.0658) and dayss to 50 per cent flowering (0.03006) at genotypic level. Indirect effect of plant height at maturity via, number capsule per plant and 1000 seed weight on seed yield were positive and high at both genotypic and phenotypic level. Character number of capsules per plant showed high indirect positive effect via, number of capsules per plant (0.6119) and 1000 seed weight (0.2797) on seed yield at genotypic level. Number of capsules per plant showed moderate indirect effect via, 1000 seed weight (0.2853, 0.2564) at both genotypic and phenotypic level on seed yield. Low indirect effect of number of seeds per capsule on seed yield was found via, number of capsules per plant (0.1316) at phenotypic level. The indirect effect of 1000 seed weight via, number of capsules per plant (0.6103, 0.3399) was high on seed yield on both genotypic and phenotypic level. Protein content exhibited positive and low indirect effect on seed yield via, oil content (0.0654, 0.0184), days to maturity ((0.0290, 0.0540), days to 50 per cent flowering (0.0017, 0.0021) at both genotypic and phenotypic level.

Direct and indirect analysis of characters revealed that the number of capsules per plant followed by 1000 seed weight, number of seeds per capsule, oil content, days to maturity and plant height at maturity had a direct positive effect on seed yield at both genotypic and phenotypic levels. The indirect effect of the number of capsules per plant is high via characters number of primary branches and 1000 seed weight. Direct and indirect selection of genotypes on the basis of these characteristics may be useful for seed yield.

Similar results were reported by Kavitha and Ramalingam (2000), Kumar *et al.* (2008), Agrawal *et al.* (2017) and Kante and Ghodke (2022) revealed the greatest positive direct effect of the number of capsules per plant on seed yield. The higher direct effect of 1000 seed weight on seed yield was also reported by Kumar *et al.* (2008) and Agrawal *et al.* (2017).

SUMMARY AND CONCLUSION:- The characters showed a high positive correlation with seed yield at both genotypic and phenotypic levels *viz*., 1000 seed weight followed by the number of capsules per plant, number of branches per plant, plant height at maturity and number of seeds per capsules are desirable for selection to increase seed yield. High direct effect on seed yield exhibited by the character *viz*., number of capsules per plant (0.6681) followed by 1000 seed weight, number of seeds per capsule, oil content, days to maturity and days to 50% flowering. Protein content showed a negative direct effect on seed yield. Selection of genotypes on the basis of characters is effective in selecting yield potential genotypes. Therefore, these are important yield contributing characters for the development of sesame lines in breeding programmes.

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Table 1. Genotypic correlation coefficient for ten characters in sesame.

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Plant height at maturity	No. of branches/ plant	No. of capsules / plant	No. of seeds / capsule	1000 seed weight	Oil content	Protein content	Seed yield / plant
1	**Days to 50% flowering**	**1**	0.8119 **	-0.3999 *	-0.5472 **	-0.5575 **	-0.1313	-0.3354 *	-0.2988	0.0474	-0.3926 *
2	**Days to maturity**		**1**	-0.3137	-0.4713 **	-0.4860 **	-0.0848	-0.2778	-0.4426 **	0.1908	-0.3318 *
3	**Plant height at maturity**			**1**	0.7070 **	0.8473 **	0.1764	0.8226 **	0.0152	-0.2934	0.8398 **
4	**No. of branches/ Plant**				**1**	0.9159 **	0.3286	0.8953 **	0.2010	-0.0783	0.8836 **
5	**No. of capsules / plant**					**1**	0.1970	0.9135 **	0.1401	0.1093	0.9191 **
6	**No. of seeds / capsule**						**1**	0.2486	-0.2129	-0.4073 *	0.4258 **
7	**1000 seed weight**							**1**	0.1227	-0.0877	0.9387 **
8	**Oil content**								**1**	0.2895	0.1787
9	**Protein content**									**1**	-0.1836
10	**Seed yield / plant**										**1**

*, ** indicates the significance at 5% and 1% level, respectively.

Table 2. Phenotypic correlation coefficient for ten characters in sesame.

Sr. No.	Character	Days to 50% flowering	Days to maturity	Plant height at maturity	No. of branches/ Plant	No. of capsules / plant	No. of seeds / capsule	1000 seed weight	Oil content	Protein content	Seed yield / plant
1.	**Days to 50% flowering**	**1**	0.7417 **	-0.3668 **	-0.5101 **	-0.5151 **	-0.0796	-0.2933 *	-0.1831	0.0423	-0.3564 **
2.	**Days to maturity**		**1**	-0.2838 *	-0.4328**	-0.4369 **	-0.0376	-0.2263	-0.2908 *	0.0945	-0.2806
3.	**Plant height at maturity**			**1**	0.7085**	0.8287 **	0.1613	0.7856 **	0.0506	-0.208	0.8373 **
4.	**No. of branches/ plant**				**1**	0.9029 **	0.2774 *	0.8556 **	0.1273	-0.0715	0.8727 **
5.	**No. of capsules / plant**					**1**	0.1730	0.8605 **	0.1068	-0.0784	0.9052 **
6.	**No. of seeds / capsule**						**1**	0.2340 *	-0.1068	-0.2931 *	0.3552 **
7.	**1000 seed weight**							**1**	0.0883	-0.1169	0.9101 **
8.	**Oil content**								**1**	0.2425 *	0.123
9.	**Protein content**									**1**	-0.1479
10.	**Seed yield / plant**										**1**

*, ** indicates the significance at 5% and 1% level, respectively

Table 3. Genotypic path coefficient for ten characters in sesame

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Plant height	No. of Primary branches	No. of Capsules / plant	No. of seed per capsule	1000 seed weight	Oil content	Protein content	Correlation with seed yield/plant
1	**Days to 50% flowering**	**0.0370**	0.1236	-0.0446	0.0765	-0.3725	-0.0384	-0.1047	-0.0675	-0.0018	-0.3926
2	**Days to maturity**	0.0300	**0.1522**	-0.0350	0.0658	-0.3247	-0.0248	-0.0867	0.1013	-0.0072	-0.3318 *
3	**Plant height**	-0.0148	-0.0477	**0.1117**	-0.0988	0.5661	0.0517	0.2570	0.0034	0.0111	0.8398 **
4	**No. of Primary branches**	-0.0202	-0.0717	0.0790	**-0.1398**	0.6119	0.0963	0.2797	0.0454	0.0029	0.8836 **
5	**No. of Capsules / plant**	-0.0206	-0.0740	0.0946	-0.1280	**0.6681**	0.0577	0.2853	0.0316	0.0041	0.9191 **
6	**No. of seeds per capsule**	-0.0048	-0.0129	0.0197	-0.0459	0.1316	**0.2931**	0.0776	-0.0481	0.0155	0.4258 **
7	**1000 seed weight**	-0.0124	-0.0423	0.0919	-0.1251	0.6103	0.0728	**0.3124**	0.0277	0.0033	0.9387 **
8	**Oil content**	-0.0111	-0.0683	0.0017	-0.0281	0.0936	-0.0624	0.0383	**0.2259**	-0.0110	0.1787
9	**Protein content**	0.0017	0.0290	-0.0327	0.0109	-0.0730	-0.1194	-0.0274	0.0654	**-0.0381**	-0.1836

Residual effect = 0.0152 (Bold value indicated direct effect)

Table 4. Phenotypic path coefficient for ten characters in sesame

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Plant height	No. of Primary branches	No. of capsule / plant	No. of seed per capsule	1000 seed weight	Oil content	Protein content	Correlation with seed yield/plant
1	**Days to 50% flowering**	**0.0509**	0.0423	-0.0714	-0.0599	-0.2035	-0.0130	-0.0873	-0.0138	-0.0004	-0.3564 **
2	**Days to maturity**	0.0377	**0.0570**	-0.0552	-0.0508	-0.1726	-0.0061	-0.0674	-0.0219	-0.0010	-0.2806
3	**Plant height**	-0.0186	-0.0161	**0.1947**	0.0833	0.3274	0.0264	0.2341	0.0038	0.0023	0.8373 **
4	**No. of primary branches**	-0.0259	-0.0246	0.1380	**0.1175**	0.3567	0.0455	0.2551	0.0096	0.0007	0.8727 **
5	**No. of Capsules/plant**	-0.0262	-0.0249	0.1614	0.1061	**0.3950**	0.0283	0.2564	0.0080	0.0008	0.9052 **
6	**No. of seeds per capsule**	-0.0040	-0.0021	0.0314	0.0326	0.0683	**0.1640**	0.0697	-0.0080	0.0032	0.3552 **
7	**1000 seed weight**	-0.0149	-0.0129	0.1530	0.1006	0.3399	0.0384	**0.2982**	0.0067	0.0013	0.9101 **
8	**Oil content**	-0.0093	-0.0165	0.0098	0.0149	0.0421	-0.0175	0.0264	**0.0755**	-0.0027	0.1230
9	**Protein content**	0.0021	0.0054	-0.0405	-0.0083	-0.0309	-0.0480	-0.0350	0.0184	**-0.0111**	-0.1479

Residual effect = 0.0704 (Bold value indicated direct effect)

Figure 1: Genotypical path diagram for yield per plant

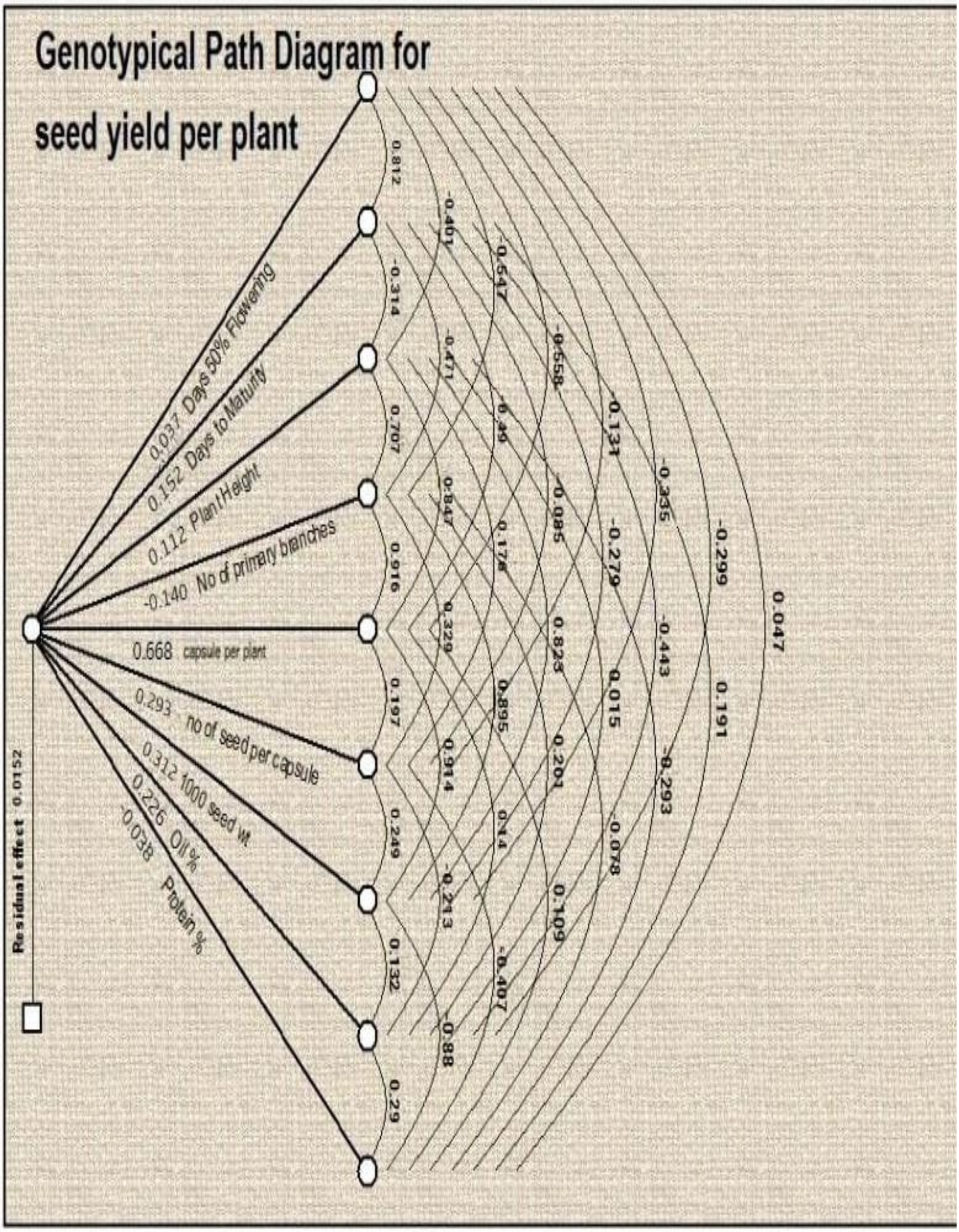

Figure 2: Phenotypical path diagram for yield per plant