Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 1234-1241

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7692 **Special Issue-6 pp. 1234-1241**
Journal homepage: http://www.ijcmas.com

Original Research Article

Correlation Coefficient and Path Analysis in Safflower (*Carthamus tincorius* L.)

S. A. Jadhav*, M. V. Dhuppe and P. M. Salunke

Department of Agricultural Botany, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431 402 (M.S), India
**Corresponding author*

A B S T R A C T

The experimental material comprising a set of 30 genotypes accessions and 2 checks were evaluated to estimate the correlation coefficient and pathanalysis. The genotypic correlation coefficients were slightly higher than their respective phenotypic correlation coefficient for most of the characters. Seed yield per plant was highly significant and positively correlated with days to maturity, number of effective capitula per plant, 100 seedweight and low in magnitude with plant height and harvest index. Whereas seed yield per plant showed negative correlation with hull content. The path analysis indicated that the character days to maturity exerted the highest direct positive effect on seedyield per plant followed by harvest index and number of seeds per capitulum. The direct negative influence were observed for oil content, plant height, 100 seed weight and days to 50 per cent flowering.

Keywords

Correlation, path analysis

Introduction

Safflower, a multipurpose crop, has been grown for centuries in India for the orange-red dye (carthamin) extracted from its brilliantly coloured flowers. Oil rich in polyunsaturated fatty acids (linoleic acid 78%). Traditionally, this crop was grown for its flowers, fabric dyes, food colouring and for medicinal purposes (Harlan 1992; Weiss 2000). However, it is currently grown as an oilseed crop worldwide. Safflower has some agronomic advantages such as drought resistance and adaptation to arid and semiarid climatic conditions (Weiss, 2000).

Safflower possesses considerable diversity across different regions of the world (Knowles, 1989). In order to design an appropriate breeding program, it is important to know how much the phenotypic variation of a trait is heritable (Kearsey and Pooni, 1996), since the efficiency of a selection program is mainly dependent on the magnitude of genetic variation and heritability of a trait (Falconer and Mackay, 1996).

Safflower is mainly grown as a rainfed crop in rabi season on residual soil moisture both, sole crop as well as inter crop with other rabi crops like sorghum, bengal gram etc. Spiny nature of the crop is another problem for area expansion in non- traditional areas. Therefore, it is necessary to boost up the productivity per unit area by genetic manipulation. This can be achieved by exploiting heterosis or by developing

varieties through systematic breeding programme suitable for rainfed as well as irrigated condition.

Materials and Methods

The material for the study consist of 30 genotypes viz.GMU-15-3590, GMU-15-224, GMU-15-3730, GMU-15-3293, GMU-15-2720, GMU-15-1339, GMU-15-3778, GMU-15-3640, GMU-15-3384, GMU-15-2465, GMU-15-3325, GMU-15-3431, GMU-15-3395, GMU-15-3266, GMU-15-3968, GMU-15-3423, GMU-15-2822, GMU-15-2550, GMU-15-2757, GMU-15-1551, GMU-15-2687, GMU-15-2380, GMU-15-3494, GMU-15-3477, GMU-15-3477, GMU-15-4101, GMU-15-3716, GMU-15-3739, NARI-6, SHARDA, PBNS-40 of safflower along with 2 checks i.e. A-1(NC), PBNS-12 lines selected from AICRP on safflower, VNMKV Parbhani.

All genotypes were raised in randomized block design (RBD) with two replications with spacing of 45 x 20 cm. The present field study was undertaken at during rabi season 2016-17 under irrigated conditions, at College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.). The campus is being geographically situated in Deccan plateau, not semi-arid eco-region in Maharashtra state with an altitude of 409 meter above mean sea level.

Recommended cultural practices were adopted to raise good crop. Five plants in genotypes were randomly selected in each replication and observations were recorded for days to 50 per cent flowering, days to maturity, plant height (cm), number of seeds per capitulum, number of effective capitulum per plant, hull content, harvest index, 100-seed weight (g), seed yield per plant (g),oil content etc. The mean values of 5 plants were utilized for correlation coefficient and pathanalysis.

Correlation co-efficient (r)

Variances were calculated for all the characters and analysis of covariance was carried out by taking two characters at a time to find out the simple correlations among the characters. The interrelationship of different yield contributing characters at genotypic level was worked out according to Johnson *et al.,* (1955).

Path analysis

Path analysis was carried out by using both phenotypic and genotypic correlation coefficients to know the direct and indirect effects of the components on yield as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

Results and Discussion

Correlation analysis for seed yield per plant

In the present study the genotypic correlation coefficients were slightly higher than their respective phenotypic correlation coefficient for most of the character. These results are also in conformity with those of Omidi Tabrezi (2001). (Table No. 1)

The present studies revealed that plant height, days to maturity, number of effective capitulum per plant, test weight and harvest index is the characters which showed strong positive correlation with seed yield. Nair *et al.,* (2006) reported significant positive correlation of seed yield with number of effective capitula per plant. These results are also in conformity with those of Lakha *et al.,* (1992), Diwakar *et al.,* (2006), Shivani *et al.,* (2010) and Mohtasham *et al.,* (2012).

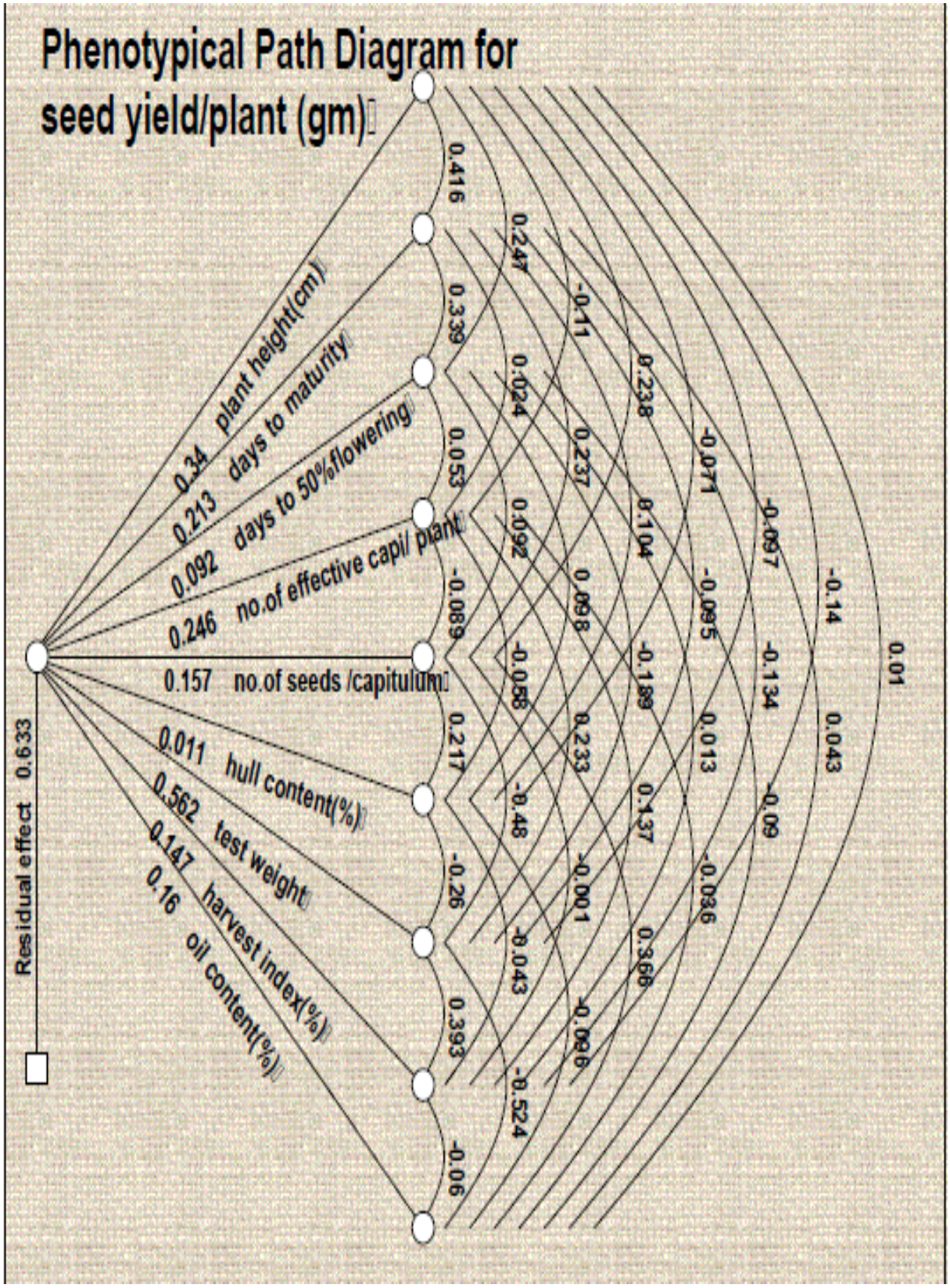
Table.1 Correlation coefficients of yield and yield components in safflower

Characters		Plant height	Days to maturity	Days to 50% flowering	No of effective capitulum	No of Seeds/capitulum	Hull content	100 seed weight	Harvest index	Oil content	Seed yield/plant
Plant height	P	1.0000	0.4158**	0.2466*	-0.1104	0.2383	-0.0707	-0.0974	-0.1401	0.0104	0.3871**
	G	1.0000	0.5792**	0.5936**	-0.3793**	0.2960*	-0.1600	-0.2973*	-0.3460**	0.1960	0.3415**
Days to maturity	P		1.0000	0.3391**	0.0236	0.2366	0.1037	-0.0955	-0.1337	0.0429	0.3629**
	G		1.0000	0.1950	0.0208	0.2481*	-0.3554**	-0.4408**	-0.7991**	0.5263**	0.4937**
Days to 50%flowering	P			1.0000	0.0532	0.0916	0.0981	-0.1890	0.0135	-0.0901	0.1576
	G			1.0000	0.0863	0.0800	-0.3314**	-0.5094**	0.0283	0.2599*	0.1479
No of effective capitulum	P				1.0000	-0.0888	-0.0577	0.2327	0.1375	-0.0364	0.3488**
	G				1.0000	-0.2669*	-0.0716	0.4041**	-0.0943	-0.0974	0.4575**
No of Seeds/capi	P					1.0000	0.2172	-0.4804**	-0.0009	0.3659**	0.0660
	G					1.0000	0.3670**	-0.8717**	-0.3693**	0.6608**	0.0530
Hull content	P						1.0000	-0.2605*	-0.0432	-0.0958	-0.1297
	G						1.0000	-0.7385**	0.0458	0.0073	-0.3422**
100 seed weight	P							1.0000	0.3933**	-0.5243**	0.4441**
	G							1.0000	0.5921**	-0.6923**	0.4065**
Harvest index	P								1.0000	-0.0596	0.3170*
	G								1.0000	-0.3697**	0.3662**
Oil content	P									1.0000	-0.0916
	G									1.0000	0.0550
Seed yield/plant	P										1.0000
	G										1.0000

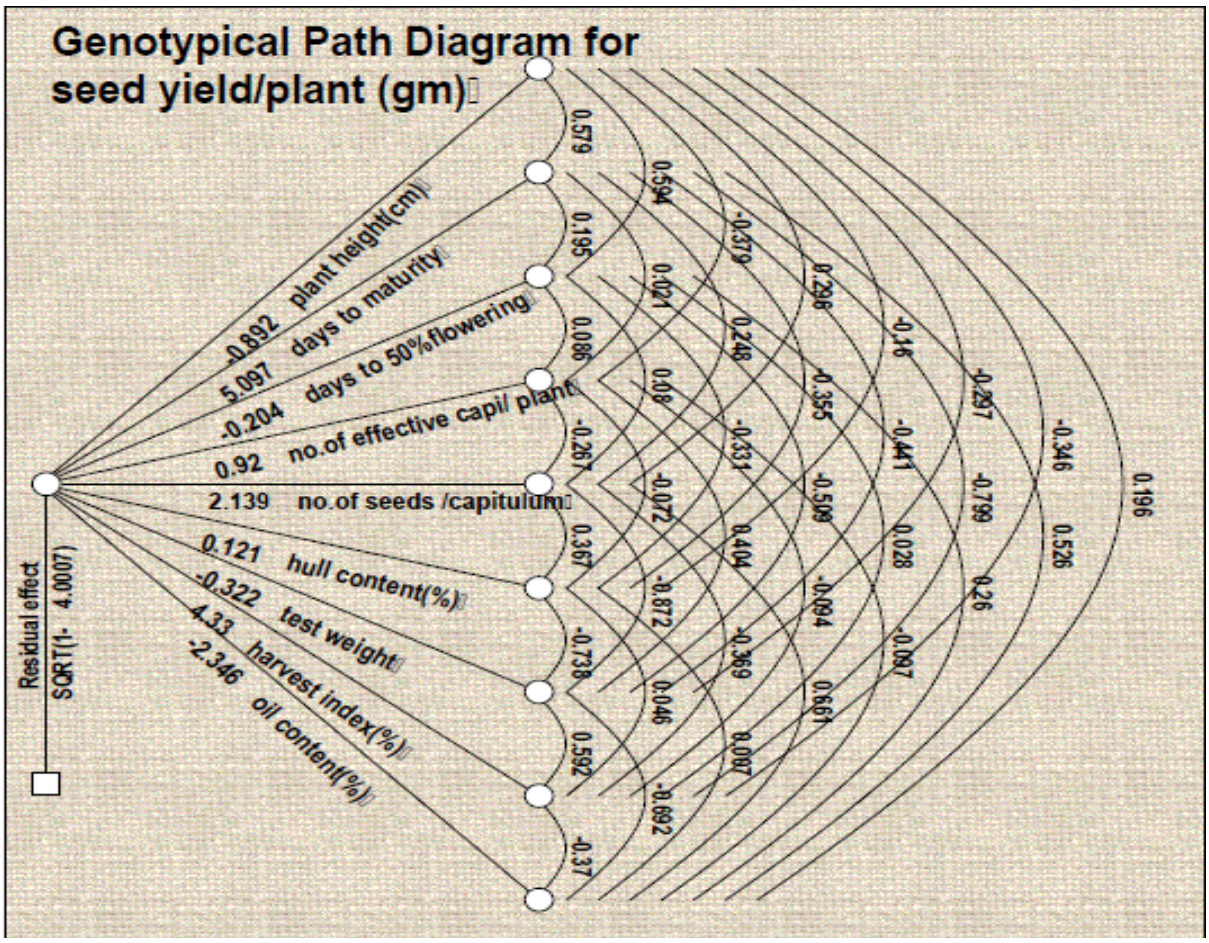
Table.2 Estimates of genotypic (G) and phenotypic (P) Path analysis Direct (diagonal) and indirect (off diagonal) effect of different characters on seed yield

Characters		Plant height	Days to maturity	Days to 50% flowering	No of effective capitulum	No of Seeds/capi	Hull content	100 seed weight	Harvest index	Oil content	Seed yield/plant
Plant height	P	**0.3403**	0.1415	0.0839	-0.0376	0.0811	-0.0240	-0.0331	-0.0477	0.0035	0.3871
	G	**-0.8919**	-0.5166	-0.5294	0.3383	-0.2641	0.1427	0.2651	0.3086	-0.1748	0.3415
Days to maturity	P	0.0884	**0.2126**	0.0721	0.0050	0.0503	0.0221	-0.0203	-0.0284	0.0091	0.3629
	G	2.9521	**5.0966**	0.9938	0.1060	1.2646	-1.8116	-2.2468	-4.0726	2.6825	0.4937
Days to 50% flowering	P	0.0226	0.0311	**0.0917**	0.0049	0.0084	0.0090	-0.0173	0.0012	-0.0083	0.1576
	G	-0.1209	-0.0397	**-0.2038**	-0.0176	-0.0163	0.0675	0.1038	-0.0058	-0.0530	0.1479
No of effective capitulum	P	-0.0271	0.0058	0.0311	**0.2459**	-0.0218	-0.0142	0.0572	0.0338	-0.0090	0.3488
	G	-0.3490	0.0191	0.0794	**0.9201**	-0.2456	-0.0659	0.3718	-0.0867	-0.0896	0.4575
No of Seeds/capi	P	0.0375	0.0372	0.0144	-0.0140	**0.1552**	0.0341	-0.0755	-0.0001	0.0575	0.0660
	G	0.6333	0.5308	0.1710	-0.5709	**2.1392**	0.7851	-1.8646	-0.7901	1.4135	0.0530
Hull content	P	-0.0008	0.0012	0.0011	-0.0007	0.0025	**0.0114**	-0.0030	-0.0005	-0.0011	-0.1297
	G	-0.0193	-0.0430	-0.0401	-0.0087	0.0444	**0.1209**	-0.0893	0.0055	0.0009	-0.3422
100 seed weight	P	-0.0547	-0.0537	-0.1063	0.1308	-0.2701	-0.1464	**0.5622**	0.2211	-0.2948	0.4441
	G	0.0957	0.1420	0.1640	-0.1301	0.2807	0.2378	**-0.3220**	-0.1907	0.2229	0.4065
Harvest index	P	-0.0206	-0.0197	0.0020	0.0202	-0.0001	-0.0063	0.0578	**0.1471**	-0.0088	0.3170
	G	-1.4985	-3.4604	0.1226	-0.4082	-1.5994	0.1984	2.5640	**4.3304**	-1.6010	0.3662
Oil content	P	0.0017	0.0069	-0.0144	-0.0058	0.0585	-0.0153	-0.0839	-0.0095	**0.1600**	-0.0916
	G	-0.4599	-1.2350	-0.6098	0.2285	-1.5505	-0.0171	1.6245	0.8675	**-2.3465**	0.0550

Phenotypic path diagram for seed yield per gram Residual effect (0.633)



Genotypic path diagram for seed yield per gram Residual effect SQRT (1-4.0007)



The days to maturity exhibited positive significant correlation with seed yield per plant indicating that they had certain inherent relationship with each other. Similar findings were quoted by Amir *et al.*, (2009), Kamran and Ali (2006) and Diwakar *et al.*, (2006).

It was important to note that the characters, days to maturity and seed yield per plant were positively and strongly associated with eachother (p=0.3629, g=0.4937). Hence, these traits couldbeconsidered as important traits for improvingseedyield in safflower. These results are in conformity with those of Kamran and Ali (2006) and Seyed *et al.*, (2012). The character Number of seeds per capitulum are positive and significant with oil content. 100-seed weight exhibited strongly positive and significant relation with seed yield per plant in safflower.

Path coefficient analysis for seed yield per plant

Path coefficient analysis is a standardized partial regression analysis which permits the separation of correlation coefficient intomeasures of direct and indirect effect. Seed yield is the product of interaction of component traits. Apart from correlation studies, path coefficient analysisis important characters influence seed yield. This helps in giving the weightage to a particular character during the selection. The path analysis (Table No. 2) indicated that the

character days to maturity exerted the highest direct positive effect (5.0966) on seed yield per plant followed by harvest index (4.3304) and Number of seeds per capitulum (2.1392). Jawanjal *et al.,* (2006) reported that the maximum direct effect on seed yield was shown by number of effective capitula per plant, plant height and 100 seed weight. Present findings were also in conformity with those of Diwakar *et al.*, (2006), Ali *et al.,* (2006), Shivani *et al.,* (2010), Golkar *et al., (2011)* and Sreenivasa *et al.,* (2011).

The direct negative influence wereobserved for oil content (-2.3465) and plant height (-0.8919). These findings are in conformity with Jawanjal *et al.,* (2006) and Diwakar *et al., (2006).*

The present investigation clearly revealed that the character days to maturity, number of effective capitula per plant, number of seed per capitulum, hull content and harvest index showed that higher direct positive effects and indirect effects via other components traits. These findings are in conformity with Diwakar *et al., (2006).* These indicated that direct selection for these characters will enhance the breeding efficiency for seed yield in safflower. Hence, for a plant breeder engaged in the improvement of safflower yield, it would be necessary to lay the maximum emphasis on above mentioned characters.

The residual factor SQRT (1- 4.0007) explains that some other factors which have not been considered needs to be included in this analysis to account fully for variation in yield.

Correlation studies indicated the importance of the character which is plant height, days to maturity, number of effective capitulum per plant, test weight and harvest index. This characters showed significant and positive correlation with seed yield. Hence, these traits could be considered as important traits for improving seed yield in safflower.

The path coefficient analysis revealed that, the days to maturity exerted the highest positive direct effect on seed yield followed by harvest index, Number of seeds per capitulum, number of effective capitulum per plant. Hence, importance must be given to these characters because they are directly proportional to seed yield.

References

Ali, M., Gholam, A., Mohammad, J., Eskandar, Z. and Saeid, S. 2006. Path analysis of the relationships between seed yield and some morphological and phonological traits in safflower. *Euphytica* 148: 261-268.

Amir, H., Hamid, K. and Shao, H. 2009.Variation for some important agronomic traits in 100 spring safflower genotypes. *American - Eurasian J. Agri and Environ. Sci.* 5(6): 791-795.

Bahmankar, M., Mohammad, R., Ali, R. and Shirkool, K. 2014. Correlation, multiple regression and path analysis for some Yield-related traits in safflower *J. Bio. & env. Sci.*4 (2):111-118.

Dewey, D. and Lu.K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron.* J., 51:515-518.

Golkar, P., Arzani, A. and Rezaei, A. 2011. Determining relationship among seed yield, yield components and morpho-phenological traits using multivariate analyses in safflower. *Annals of Biological Research*, 2(3): 162-169.

Harlan, J., 1992. Crops and man, *2nd edn.*

ASA, CSSA, Inc. WI, ASA-CSSA Publishers: 117-133, Madison, WI, USA.

Jawanjal, S., Choulwar, S. and Patil, S. 2006. Character association and path analysis for yield in safflower. *J. Maharashtra agric, univ.* 31(1):030-032.

Kamran, A. and Ali, A. 2006. Relationship among traits using correlation, principal components and path analysis in safflower mutants sown in irrigated and drought stress condition.*Asian Journal of Plant Sciences* 5(6):977-983.

Kearsey, M. J. and Pooni, H.S., 1996. The genetical analysis of quantitative traits. London: Chapman & Hall.

Knowles, P. F., 1989. *Carthamus* species relationships. A lecture in Beijing Botanical Garden, Institute of Botany, *Chinese Acad. Sci*., Beijing, China.

Lakha, N., Patil, V., Nerkar, Y. and Mahajan, A. 1992. Genetic variability and correlation studies in safflower. *J. Maharashtra agric. Univ.* 17(2):318-320

Mohtasham, M., Peyman, S., Rahmatollah, K. and Mohammad, K. 2012. Sequential Path analysis for determination of relationships between yield and oil content and yield components of safflower. *International Journal of Agriculture: Research and Review*, (4): 410-415.

Nair, B., Kalamkar, V., Bansode, S., and Lakshmi M. 2006. Genetic association, path analysis and heritability studies in safflower. *J.soils and crops* 16(1):194-198.

Omidi Tabrizi, 2001. Correlation between traits and path analysis for grain and oil yield in spring safflower. *Vth Internatioal safflower conference, Williston, N.D. U.S.A.*

Panse, V. and Sukhatme, P. 1985. Stastical methods for agricultural research workers Second edition ICAR.

Patil, F. 1985. Correlation of some yield components in safflower. J. *Maharashtra agric, Univ.*, 10(1):82-83.

Pavithra, K., Patil, R., Harijan, Y. and Nishanth, G. 2016. Correlation and Path Analysis Studies in Safflower (*Carthamus tinctorius* L.) Germplasm *Res. J. of Agri. Sci.* 7(2): 428-432.

Pushpa Valli, Sudhakar, C., Jyothi Rani and Rajeswari, R. 2016. Correlation and path coefficient analysis for the yield components of Safflower germplasm *(Carthamus tinctorius)* L. Elec. J. of Plant Bree.7 (2): 10.5958/0975-928.

Seyed, M., Seyyed, P. and Seyed, A. 2012. Assesment of genetic diversity in safflower genotypes using Agro-morphological traits. *Annals of Biological Res.* 3(5):2428-2432.

Shivani, D., Sreelakshmi, C. and Sameerkumar, C.V. 2010. Genetic Studies for Yield and Component Characters in Germplasm Lines of Safflower, *Carthamus tinctorius* L. *Madras Agric. J*., 97 (10-12): 337-339.
‘

Singh, R. and Choudary, B. 1977. Biometrical methods in quantitative genetic analysis. Kalyani pub., Ludhiana, 54:224-252.

Sreenivasa, V., Sreedhar, N. and Mukta, N. 2011. Character association and path analysis in safflower. *J. Oilseed Res.* 28(1): 87-88.

Wright, S. 1921. Correlation and causation.*J. agric. Res.,* 20: 257-287.

Zhang, L.P., 1997. Safflower: a versatile plant, *IV Internl. Safflower Conf.*, Bari 2-7 June, pp.311-329.