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Research Article

CORRELATION AND PATH COEFFICIENT ANALYSIS RELATIONSHIPS IN SAFFLOWER (*CARTHAMUS TINCTORIUS* L.)

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ABSTRACT

An experiment was conducted on 40 genotypes of safflower (*Carthamus tinctorius* L.) at the Experimental Farm of College of Agriculture, Latur, to examine genetic diversity and connections among characteristics. In Rabi 2020–2021, the experimental design was a complete randomized block design with two replications. The presence of considerable genetic diversity in the experimental materials was confirmed by analysis of variance results for 10 quantitative characters, which showed significant differences for all traits. The phenotypic and genotypic correlation among the traits and their path analysis were calculated. Plant height, number of branches per plant, number of effective capitulum per plant, number of seed per capitulum, and test weight were found to have a strong positive significant relationship with seed yield. This character had a strong and positive relationship toward seed yield. As a result, these characteristics could be considered important for improving safflower seed yield. The character number of branches per plant, plant height, number of effective capsules per plant, number of seed per capitulum, and test weight showed higher direct positive effects and indirect effects through other components traits. Number of seeds per capitulum had the greatest direct positive effect on seed yield per plant, followed by number of branches per plant and number of capsules per plant. As a result, these characteristics must be considered because they are directly relevant to seed yield. Characters like as days to maturity and oil content showed negative direct effects.

Keywords: Correlation, Path analysis and safflower (*Carthamus tinctorius* L.).

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INTRODUCTION

One of the oldest oilseed crops is safflower (*Carthamus tinctorius* L.). It was first grown in Mesopotamia, according to archaeological evidence going back to 2500 BC. Safflower has been grown in India since time immemorial and mentioned as kuswtiba in ancient scriptures. It is widely grown in the Middle East's hot and arid climate, which is the source of its origin and diversity. *Carthamus* is a Latinized equivalent for the Arabic word quartilum or gurtum, which refers to the color of safflower flower dye. In India, safflower is cultivated as one of the most important Rabi oilseed crops and it is tolerant to heat, severe drought, and salinity. Safflower (*C. tinctorius* L.) is an important oil seed crop of the tropical countries. Safflower is a member of the Compositae family, the *Asteraceae* subfamily, the Tubiflorae tribe, and the Angiosperm division Phenerogams. The safflower plant is a bushy, herbaceous annual with numerous branches classed as primary, secondary, and tertiary, each terminating in a globular structure known as the capitulum. The genus *Carthamus* contains 36 species, with *C. tinctorius* L. (2n=24) being the only cultivated safflower utilized for oil extraction and the remainder being wild species. Plants grow 30–150 cm tall, with globular flower heads (Capitula), and bright yellow, orange, or red flowers are common. Safflower oil has a great cooking quality, containing 75% linoleic acid on average, as well as tocopherols, which have an antioxidant impact and a high vitamin E content. India produces the most safflower in the world (24.64 MT) and has the largest acreage (4.3 lakh hectares); however, the average yield is just 537 kg/ha in 2018–2019. The two most major safflower-growing states are Maharashtra and Karnataka, which account for 72 and 23% of area and 63 and 35% of production, respectively (Govt. of India, Ministry of Agriculture and Farmers Welfare). The genotypic correlation coefficient indicates that there is a true association, whereas the phenotypic correlation coefficient could be random. Lower phenotypic correlation may result from the influence of the environment on the genetic connection of traits. The genotypic correlation coefficient is a measure of genetic relationship between traits that aid in determining which characters are essential and should be considered for yield improvement.

Path coefficient analysis is a standardized partial regression analysis that allows you to separate correlation coefficients into direct and indirect effect measures. Seed yield is the product of interaction of component traits. Path coefficient analysis, in addition to correlation studies, is an important attribute that influences seed yield. This aids in determining a character's importance during the selection process.

METHODS

During Rabi 2020–21, forty genotypes of safflower, including one check, were investigated at the Experimental Farm of College of Agriculture, Latur, under the of V.N.M.K.V., Parbhani. Each accession was cultivated in a single row with a spacing of 50 cm between rows and 20 cm between plants within a row, using the Randomized Block Design with two replications. To produce a productive crop, all of the proposed frameworks were followed. Five plants were randomly chosen and labeled from each row in a replication for recording observations, and the mean of the five plants was utilized for statistical analysis. Days to 50% flowering, days to maturity, plant height at maturity (cm), number of branches per plant, number of effective capitula per plant, number of seeds per capitulum, 100-seed weight (g), seed yield per plant (g), hull content (percent), oil content (percent), and hull content (percent) were all recorded (percent). For all of the characters, analysis of variance was used to determine the significance of differences between genotypes. Variances were determined for each character, and covariance analysis was performed on two characters at a time to determine the simple correlation between them. The interrelationship of different yield contributing characters at the genotypic level was determined using Johnson et al. (1955) method. According to Singh and Choudhury's formula, the simple correlation coefficient (r) between difference variables (character) at the genotype level (1977). Fisher and Yates table for significant "r" value at n −2° of freedom (n=total number of observations) was used to examine the significance of the correlation coefficient. To establish a cause and effect relationship, path coefficient analysis was carried out and the simple correlation

Table 1: Genotypic correlation coefficients of yield and yield components in safflower

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Number of seeds per capsule	Test weight (g)	Oil content (%)	Hull content (%)	Seed yield per plant (g)
Days to 50% flowering	1.000	0.534**	0.244*	0.116	0.166	0.130	0.029	0.233*	−0.050	0.174
Days to maturity		1.000	0.065	0.276*	0.054	−0.118	0.160	0.013	0.082	0.033
Plant height (cm)			1.000	0.189	0.148	0.710**	−0.168	−0.051	0.001	0.415**
Number of branches per plant				1.000	1.100**	−0.183	0.531**	−0.233*	0.263*	0.834**
Number of capsules per plant					1.000	−0.238*	0.456**	−0.161	0.235*	0.838**
Number of seeds per capsule						1.000	−0.592**	0.358**	−0.375**	0.207*
Test weight (g)							1.000	−0.371**	0.329**	0.609**
Oil content (%)								1.000	−1.015**	−0.139
Hull content (%)									1.000	0.138
Seed yield per plant (g)										1.000

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

Table 2: Estimates of genotypic path analysis direct and indirect effect of different characters on seed yield

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Number of seeds per capsule	Test weight (g)	Oil content (%)	Hull content (%)	Seed yield per plant (g)
Days to 50% flowering	0.188	−0.149	−0.088	0.065	0.018	0.138	0.023	−0.020	−0.001	0.174
Days to maturity	0.100	−0.279	−0.023	0.155	0.005	−0.126	0.131	−0.001	0.002	−0.033
Plant height (cm)	0.045	−0.018	−0.360	0.106	0.016	0.757	−0.138	0.004	0.004	0.415**
Number of branches per plant	0.021	−0.077	−0.068	0.564	0.120	−0.195	0.438	0.020	0.009	0.834**
Number of capsules per plant	0.031	−0.015	−0.053	0.620	0.109	−0.253	0.376	0.014	0.008	0.838**
Number of seeds per capsule	0.024	0.033	−0.255	−0.103	−0.026	1.068	−0.488	−0.031	−0.013	0.207*
Test weight (g)	0.005	−0.044	0.060	0.299	0.050	−0.631	0.825	0.033	0.011	0.609**
Oil content	0.043	−0.003	0.018	−0.131	−0.017	0.381	−0.305	−0.089	−0.035	−0.139
Hull content	−0.009	−0.022	−0.004	0.148	0.025	−0.400	0.271	0.090	0.034	0.138
Seed yield per plant (g)	0.174	−0.033	0.415**	0.834**	0.838**	0.207*	0.609**	−0.139	0.138	1.000

coefficients (genotypic) were partitioned into direct and indirect effect by path analysis as suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSIONS

Correlation coefficient analysis for seed yield per plant

The correlation coefficient is a statistical constant that indicates the degree of relationship between the different features in Table 1. For many parameters, including seed yield per plant, the genotypic correlation coefficient was calculated. Plant height (0.415), number of branches per plant (0.834), number of effective capitulum per plant (0.838), number of seed per capitulum (0.207), and test weight all showed a highly significant and positive correlate with the character seed output per plant (0.609). The negative and non-significant relationship between character oil content (−0.086) and days to maturity (−0.033) was discovered. Days to 50% flowering (0.174) and hull content (0.138) were the two characters that showed a non-significant but positive relationship. Nair *et al*. discovered a similar result (2006). Shivani *et al*. (2010), Mohtasham *et al*. (2012), Khalili *et al*. (2013), and Pattar and Patil all came to similar conclusions (2020).

It is important to remember that the characteristics, plant height, and number of seeds per capitulum all had a positive and strong relationship (g=0.710). The number of effective capitulum per plant, test weight, and hull content were all positively and highly linked with the character number of branches per plant. The number of effective capitulum per plant had a strong and positive relationship with test weight. As a result, these characteristics could be regarded crucial for increasing safflower seed production. These results are in conformity with those of Kamran and Ali (2006) and Mohtasham *et al*. (2012).

Path coefficient analysis for seed yield per plant

Path coefficient analysis is a standardized partial regression analysis that allows you to separate correlation coefficients into direct and indirect effect measures. The interaction of component qualities results in seed yield. The character number of seeds per capitulum had the strongest direct positive effect (1.068) on seed yield per plant, followed by test weight (0.825), number of branches per plant (0.564), and number of capsules per plant (0.109) according to the path analysis [Table 2]. Jawanjal *et al.* (2006) also provided information. Ali *et al.* (2008), Shivani *et al.* (2010), Golkar *et al.* (2012), and Sreenivasa *et al.* (2012) all came to similar conclusions (2011). Oil content (−0.089), days to maturity (−0.279), and plant height all had a direct detrimental impact (−0.360). Jawanjal *et al.* (2006), Shivani *et al.* (2012), and Pattar and Patil all came to similar conclusions (2020).

The results of this study clearly reveal that the characteristics number of branches per plant, plant height, seed yield per capitulum, and test weight have larger direct positive impacts and indirect positive effects through other traits. These findings are consistent with Pattar and Patil's findings (2020). Direct selection for these characters will improve the breeding efficiency for seed yields in safflower, according to their findings. As a result, a plant breeder working to boost safflower yield should place the greatest focus on the above-mentioned characters.

CONCLUSION

None

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