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Genotypic and Phenotypic Variability and Analysis of Character Association in Safflower (*Carthamus tinctorius* L.)

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The study undertaken in 13 varieties of safflower indicated that highest genotypic and phenotypic coefficient of variation was observed in number of seeds on primary branches followed by yield per plant. The lowest was for days to maturity. Heritability values ranged from 43.48 per cent for number of primary branches and 98.62 per cent for number of seeds on primary branches. These traits also combined with high genetic advance, indicating scope for the improvement of these characters through selection. Highly significant and positive correlation existed between yield per plant with number of seeds on primary branches and secondary branches and with number of primary branches.

Safflower (*Carthamus tinctorius L.*) has been grown in different parts of India for oil. In Rajasthan it has recently been introduced as an oilseed crop. It was felt worthwhile to study the available material for its genetic variability in different plant characters. A study was therefore, undertaken to partition the observed variability into heritable and non-heritable components. Estimation of correlation between yield and its contributing characters in safflower was also made.

MATERIALS AND METHODS

The material for the present study consisted of 13 cultivars received from diverse sources in South India. The trial was laid out in randomised block design with four replications during Rabi season 1973-74. Each variety in a replication had six rows of 5 meters length with a spacing of 60 cm x 30 cm. Five competitive plants were selected from the middle rows at random for recording observations. Their mean values were used for statistical analysis. Observations were recorded on ten plant characters viz. height of the plant, days to flower, days to maturity, number of primary branches, number of secondary branches, number of seeds on main branch, number of seeds on primary branches, number of seeds on secondary branches, 100-seed weight and yield per plant. The correlation coefficients and other genetic parameters were estimated as per the conventional procedures.

RESULTS AND DISCUSSION

The estimates of genotypic and phenotypic variances were the highest for the number of seeds formed on primary and secondary branches and were lowest for 100-seed weight (Table I). Bhargava *et al.* (1971) also observed the lowest genotypic and phenotypic variance for 1000 seed weight in yellowsarson. High degree of genotypic coefficient of variation was observed for number of seeds on primary bran-

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TABLE I. Mean and Range for various plant characters in safflower.

Character	Range	Mean	"F" value	C. D. (P=0.05)
Plant height (cm)	62-78	71.28 ± 2.87	6.55**	5.82
Days to flower	110-113	115.44 ± 0.81	57.13**	1.64
Days to maturity	114-153	149.05 ± 1.10	8.06**	2.24
No. of primary branches	8-12	9.98 ± 2.88	4.08*	1.76
No. of secondary branches	17-29	25.13 ± 1.43	8.25**	2.90
Seeds on main branch	10-18	13.47 ± 0.94	11.13**	1.91
Seeds on primary branches	72-170	126.69 ± 2.72	287.33**	5.49
Seeds on secondary branches	144-260	181.85 ± 4.02	101.92**	8.11
100-seed weight (g)	3.34-5.39	4.68 ± 0.13	26.20**	0.26
Yield/plant (g)	10.45-20.85	15 04 ± 0.51	63.2**	1.03

ches and yield per plant. Bhardwaj *et al.* (1969) in brown sarson and Bhargava *et al.* (1971) observed high coefficient of variation for yield per plant in yellow sarson. High coefficient of variation indicated high genetic variability in these characters.

Estimates of heritability values showed a wide range of variation from 43.48% for number of primary branches to 98.62% for the seeds formed on primary branches (Table II). High degree of heritability was observed for the numberof seeds formed on primary branches, secondary branches, yield per plant, days to flower and 100-seed weight. Our findings are in conformity with those of Bhardwaj *et al.* (1969) in brown sarson and Bhargava *et al.*(1961) in yellow sarson. The expected genetic advance expressed in percentage of mean revealed large differences among various characters studied. It ranged

TABLE II. Estimates of genotypic and phenotypic variances

Character	Genotypic variance	Phenotypic variance	Genotypic co-efficient of variation	Heritability %	Genetic advance in % of mean
Plant height (cm)	22.89	39.38	6.706	58.12	10.53
Days to flower	18.53	19.85	3.72	93.34	7.41
Days to maturity	4.29	6.72	1.38	63.83	2.26
No. of primary branches	1.19	2.73	10.82	43.48	14.81
No. of secondary branches	7.45	11.56	10.82	64.43	17.90
Seeds on main branch	4.53	6.32	15.79	71.71	27.52
Seeds on secondary branches	814.57	846.85	15.69	96.18	31.71
Seeds on primary branches	1059.36	1074.16	25.69	98.62	52.54
100-seed weight (g)	0.23	0.27	10.24	86.29	19.61
Yield/plant (g)	8.16	8.68	18.94	93.96	37.90

from 2.28% in days to maturity to 52.54% in number of seeds formed on primary branches. High genetic advance was obtained for number of seeds formed on primary branches, on secondary branches and yield per plant. Bhardwaj *et al.* (1969) and Bhargava *et al.* (1971) also reported high genetic advance for yield per plant in brown and yellow sarson respectively. In the present study high heritability values with high genetic advance was observed in number of seeds formed on primary branches, on secondary branches and yield per plant. This indicated that these characters are less influenced by the environment and selection for improvement with these traits will be more effective.

Correlations were worked out between yield and yield contributing characters. Positive and significant correlation of number of primary branches was observed with secondary branches, and highly significant with number of seeds on primary branches(Table III). There was no significant correlation between primary branches and yield per plant. There was positive and significant correlation between number of secondary branches and number of seeds on secondary branches, 100-seed weight and yield per plant. Number of seeds formedon primary and secondary branches were positively and highly correlated with yield per plant. Argikar *et al.* (1957) reported positive correlation between number of seeds and yield per plant. They reported a significant correlation between yield and1000 seed weight. Correlation studies indicated that for selection of high yielding plants more emphasis should be laid on the characters like number of secondary branches, number of seeds on primary branches and number of seeds on secondary branches.

TABLE III. Estimates of correlation co-efficients (r) between yield and plant characters.

Character	No. of secondary branches	Seeds on primary branches	Seeds on secondary branches	100-seed weight (g)	Yield/plant (g)
Primary branches	0.63*	0.70**	0.09	0.04	0.44
Secondary branches		0.26	0.65*	0.61*	0.56*
Seeds on primary branches			0.54	0.20	0.71**
Seeds on secondary branches				0.09	0.43**
100-seed weight (g)					0.43

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