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VARIABILITY PATTERN IN AGROMORPHOLOGICAL CHARACTERS IN SAFFLOWER (*CARTHAMUS TINCTORIUS* L.)

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ABSTRACT

Ninety eight germplasm accessions and five checks of safflower were studied for their variability for eight agromorphological characters. Coefficient of variability was high for yield per plant, number of primaries and secondaries per plant, and number of effective capitula per plant. Thirteen promising germplasm lines are identified for use in breeding programme.

Key words: Variability, *Carthamus tinctorius* L.

Variability is the basis of plant breeding. Safflower (*Carthamus tinctorius* L.) exhibited wide range of variability in agromorphological characters. Anderson [1] proposed metroglyph and index score method to study the pattern of morphological variations using the parents and hybrids. Chandra [2] compared Mahalanobis' D^2 method and metroglyph technique in the study of genetic divergence in linseed germplasm collection. Comparisons between the results of two analyses revealed striking similarity in group arrangement. It has been suggested that the metroglyph technique would be suitable for preliminary grouping prior to undertaking D^2 analysis [2]. The present investigation, therefore, is an attempt to understand the variability for different morphological characters in safflower using metroglyph technique.

MATERIALS AND METHODS

Ninety eight safflower germplasm accessions and five released varieties (Bhima, JSF 1, A 1, Manjira and HUS 305) were grown at the Agricultural Research Station Mulegaon, Solapur, in augmented randomized block design with five blocks. Each germplasm accession was represented by four rows of 5.0 m length with 45 x 20 cm spacing. The checks were sown after every five germplasm accessions. Observations on yield per plant, days to 50% flowering, plant height, number of primary and secondary branches, and effective capitula per plant, 100-seed weight, and average number of seeds per main capitulum were

recorded on ten competitive plants. The pictorialized scattered diagram method of Anderson [1] was used to analyse the variation pattern.

RESULTS AND DISCUSSION

The mean range and coefficient of variation and index score for eight morphological characters in safflower germplasm as well as checks are given in Tables 1 and 2, respectively. Characterwise results are discussed below:

Table 1. Range, mean, standard deviation and coefficient of variability for eight characters in safflower

Character	Genotypes	Range	Mean	Standard deviation	Coefficient of variation % (CV)
Days to 50% flowering	Germplasm	73–94	78.7	4.1	5.2
	Varieties	77–78	77.6	0.5	0.7
Plant height (cm)	Germplasm	42.6–79.8	58.8	6.8	11.5
	Varieties	47.0–65.4	56.0	6.7	11.9
Primaries/plant	Germplasm	4.0–18.8	8.4	2.7	32.6
	Varieties	5.4–11.2	8.3	2.5	29.8
Secondaries/plant	Germplasm	4.0–22.4	10.2	4.2	41.1
	Varieties	5.0–19.0	9.7	6.2	63.7
Effective capitula/ plant	Germplasm	5.4–33.0	16.9	5.7	33.5
	Varieties	8.8–23.4	16.9	6.8	40.3
Seeds/main capitulum	Germplasm	12.8–31.2	21.6	3.9	18.3
	Varieties	23.8–28.0	25.8	1.7	6.4
100-seed weight (g)	Germplasm	4.0–7.9	5.8	0.8	13.1
	Varieties	5.1–6.9	5.7	1.1	19.1
Seed yield/plant (g)	Germplasm	1.4–12.7	7.3	2.5	34.6
	Varieties	10.4–21.3	13.6	4.6	34.1

DAYS TO 50% FLOWERING

Days to 50% flowering ranged from 73 to 94 with an average of 78.7 ± 4.1. Out of the 103 accessions screened only 24 were early ($\leq$ 75 days) and 11 were late ($\geq$ 81 days). This character showed low variability. Yazdi-Samadi et al. [4] reported range of 75–100 for flowering days. Thombre and Joshi [5] found high genetic coefficient of variability and high degree of heritability for this character.

PLANT HEIGHT

Moderate variability was observed for this trait. Plant height ranged from 42 cm to 79 cm with the mean of 58.8 ± 6.8 cm in case of germplasm. The check varieties Manjira and JSF 1 scored low whereas Bhima scored high variability for plant height. Out of 103 genotypes, 37 were tall, 38 medium and 28 dwarf. Argikar and Solanki [3] reported that plant height ranged from 46.7 to 64.3 cm and was positively correlated with seed yield.

Table 2. Score index and values for different characters

Character	Character values at different indices		
	low index	interme-diate	high index
Days to 50% flowering	≥81	76–80	≤75
Plant height	≥55	56–61	≤62
Primaries/plant	≥5	6–15	≤ 16
Secondaries/plant	≥7	8–12	≤13
Effective capitula/plant	≥13	14–18	≤19
Seeds/main capitulum	≥17	18–25	≤26
100-seed weight	≥5	5–6	≤6
Seed yield/plant	≥4	5–8	≤9

NUMBER OF PRIMARIES PER PLANT

The mean number of primaries per plant was 8.4 ± 2.7 for germplasm lines and 8.3 ± 2.5 for checks, with the coefficient of variation 32.6% and 29.8% for germplasm and checks, respectively, indicating high variability. About 89.3% accessions showed intermediate, 9.7% low, and 9.9% high index score.

NUMBER OF SECONDARIES PER PLANT

This was the most variable character with CV 41.1% for germplasm and 63.6% for checks. Number of secondaries per plant ranged from 4.0 to 22.4 in the case of germplasm and from 5 to 19.0 in checks with the mean of 10.3 ± 4.2 and 9.7 ± 6.2, respectively, for germplasm and checks. Patil [8] reported positive correlation between number of secondaries per plant and seed yield.

NUMBER OF EFFECTIVE CAPITULA PER PLANT

This character also exhibited high variability both in germplasm and the checks varieties (CV 33.5% for germplasm and 40.3% for checks). The number of effective capitula/plant ranged from 5.4 to 33 and 8.8 to 23.4 with the mean of 16.9 ± 5.7 and 16.9 ± 6.8, respectively for germplasm and checks. The varieties Bhima and JSF 1 had high while Manjira and HUS 305 had low number of effective capitula/plant. Argikar and Solanki [3] reported the range of 8.9–38.1 capitula with positive correlation with seed yield in six varieties. Kotecha [9] and Paliwal et al. [10] also reported similar results.

NUMBER OF SEEDS PER MAIN CAPITULUM

This trait showed moderate to low variability with CV 18.3% for germplasm and 6.4% for the checks with the mean number of seeds 21.6 ± 4.0 and 25.8 ± 1.7 for germplasm and

Table 3. Promising germplasm lines of safflower

Germplasm line	Seed yield per plant	Days to 50% flowering	Plant height (cm)	Primaries per plant	Secondaries per plant	Effective capitula per plant	Seeds per main capitulum	100-seed wt. (g)
GMU 328	9.8	76	63.4	8.4	10.4	17.0	23.4	6.9
GMU 336	9.4	78	71.8	9.0	11.4	17.4	23.6	5.4
GMU 342	6.7	81	46.6	11.6	20.0	28.0	28.0	6.6
GMU 370	9.1	81	66.4	13.2	18.6	28.4	20.6	5.6
GMU 372	10.7	94	75.2	18.8	22.4	33.3	22.4	7.9
GMU 374	8.9	89	64.8	13.2	21.2	31.4	26.2	5.0
GMU 378	7.3	94	76.4	12.2	11.4	18.0	26.0	6.8
GMU 382	10.2	83	64.4	10.2	18.8	27.2	22.0	5.1
GMU 389	9.0	81	65.2	10.0	8.8	17.0	28.2	5.1
GMU 393	8.6	78	67.8	14.0	16.8	26.2	27.2	5.2
GMU 397	8.0	77	54.6	9.2	12.2	17.4	22.8	5.0
GMU 398	11.0	79	67.8	9.4	6.4	12.0	22.8	5.7
GMU 400	10.4	80	63.6	14.0	15.0	26.6	23.2	5.1
Bhima	11.6	77	65.4	11.2	19.0	22.2	28.0	6.8

the check varieties, respectively. The average number of seeds on the main capitula ranged from 12.8–31.2 in the germplasm and 23.8–28.0 in checks. The varieties Bhima and Manjira had high while the remaining checks had intermediate values for this trait. Deokar and Patil [6] observed high degree of genetic coefficient of variability (41.3%) for number of seeds/capitulum.

100-SEED WEIGHT

Moderate CV both for germplasm (13.1%) and checks (19.0%) suggest greater stability for this trait. Range for this trait was very narrow: 4.0–7.9 g for germplasm and 5.1–6.9 g for the checks, with the mean values of 5.8 $\pm$ 0.8 g and 5.7 $\pm$ 1.1 g for germplasm and checks, respectively. Except the variety HUS 305, all check varieties had 100-seed weight greater than 5.1 g. Argikar and Solanki [3] reported range of 3.5–7.6 g for 100-seed weight.

SEED YIELD PER PLANT

Seed yield per plant ranged from 1.4–12.7 g and 10.4–21.3 g with the mean yield of 7.3 $\pm$ 2.5 g and 13.6 $\pm$ 4.6 g, respectively, for germplasm and the checks. This trait exhibited

higher variability as 34.5% CV for germplasm and 34.1% for the checks. Higher genetic variability was reported for seed yield earlier also [5, 7].

Classification of safflower germplasm and checks on the basis of the index score showed that germplasm accessions GMU 372 and GMU 374 gave high total index score for the eight characters studied, followed by the varieties Bhima and JSF 1. The index score ranged from 10 to 23 with the maximum number of genotypes (20) having index score 18. The promising germplasm lines on the basis of index score are listed in Table 3. These entries can be used for intensive breeding programme.

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