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Study of Genetic Variability and Characterization of Sunflower (*Helianthusannuus* L.) Germplasm Accessions

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ABSTRACT

Germplasm accessions (64) of sunflower were evaluated for yield and yield components to study the extent of variation for different quantitative traits. The germplasm accessions were also characterized on the basis of qualitative traits. Highest phenotypic and genotypic coefficient variation were recorded for seed yield/ plant (47.78% and 47.27%) followed by number of filled seeds/head, total number of seeds/head, unfilled seeds/head, 100-seed weight, head diameter,. Low phenotypic coefficient variation and genotypic coefficient variation were recorded in days to maturity, days to 50 % flowering, and plant height. Qualitative traits also showed wide variability among the accessions.

Key words : Germplasm, Sunflower.

Sunflower is one of the important edible oilseed crops in the world. Concerted breeding efforts are needed to meet this demand. The nature and magnitude of variability present in the germplasm has significant impact on the success of plant breeding. Characterization of germplasm lines is useful in identifying suitable lines and to avoid duplication. Being stable over generations and environments, the qualitative characters are reliable for characterization of germplasm. Hence, the current study was conducted to estimate the amount of genetic variability for yield and yield components and to characterize the different germplasm accessions based on qualitative characters.

MATERIAL AND METHODS

The material for the present study comprised of 64 germplasm accessions of sunflower (GMU-401 to GMU-477) and two checks *viz.,* DRSF-108 and Morden. The experiment was conducted at Directorate of Oilseeds Research, Hyderabad during *Rabi* 2007-08. Each accession was sown in two rows with spacing of 60 cm between rows and 30 cm between plants. The experiment was laid out in Simple Lattice Design with two replications. In each accession, five plants were randomly selected and used for collection of data on yield and yield related characters *viz.,* Days to 50 per cent flowering, Days to maturity, plant height, stem diameter, head diameter, filled seeds/head, unfilled seeds/head, total number of seeds/head, seed filling per cent, 100-seed weight, oil content, hull content, seed yield/ plant. The phenotypic coefficients variation (PCV) and genotypic coefficients variation (GCV) were computed and classified as suggested by Burton and Dewane (1953). The germplasm accessions were characterized into 25 qualitative characters using Anonymous (1985) descriptors *viz.,* Hypocotyl anthocyanin colouration , Leaf colour, Leaf size , Leaf shape, Leaf blistering, Leaf Margin (Leaf serration) , Orientation of leaf blade, Leaf petiole pigmentation, Stem pubescence, Stem pigmentation, Bract pigmentation, Bract shape, Ray floret number, Ray floret shape, Ray floret colour, Disc floret pigmentation, Disc floret colour, Plant branching , Head shape, Head attitude, , Seed shape , Seed base color

RESULTS AND DISCUSSION

The variation in the selected germplasm for all the 13 characters is evident from the significant mean squares (Table 1). Different parameters like range, phenotypic coefficients variance, and genotypic coefficients variance are presented in (Table 2). The PCV and GCV found to the highest for seed yield/plant (47.78% and 47.27%) followed by number of filled seeds/head, total number of filled seeds/head, unfilled seeds/head, 100- seed weight, indicating the presence of greater variability, which gives ample scopes for improvement of these traits by simple selection. The high PCV and GCV observed for these traits in confirmation with earlier reports of Sujatha *et al*. (2002), Ranganatha *et al.* (2008), Rao *et al.* (2003). Moderate PCV and GCV

Table 1. Analysis of variance (mean squares) for seed yield and yield component characters in 64 sunflower genotypes

Source	df	Days to 50% flowering	Days to maturity	Plant height (cm)	Stem diameter (cm)	Head diameter (cm)	No. of filled seeds/ head	No. of unfilled seeds/ head	Total no. of seeds/ head	Seed filling per cent	Seed yield/ plant (g)	100-seed weight (g)	Oil content (%)	Hull content (%)
Replications	1	1.88	3.78	29.91	0.02	0.15	457.26	3675.82	7552.33	12.34	0.08	0.01	0.10	0.10
Treatments	63	11.92**	4.21**	253.02**	0.36**	14.13**	74674.66**	3805.19**	81109.77**	218.15**	297.52 **	2.09**	21.36**	18.92**
Blocks within replication	14	299	1.29	16.58	0.04	0.86	192.40	225.52	323.63	4.25	0.63	0.12	1.54	4.88
Error	49	3.19	1.41	15.95	0.03	1.13	446.71	205.37	625.24	3.99	0.13	3.92	4.41	2.59

*significance at 5% level **significance at 1% level

Table 2. Range and co-efficient of variability for seed yield and yield component characters in 64 sunflower genotypes

Source	d.f	Days to 50% flowering	Days to maturity	Plant height (cm)	Stem diameter (cm)	Head diameter (cm)	No. of filled seeds/ head	No. of unfilled seeds/ head	Total no of seeds/ head	Seed filling per cent	100-seed weight (g)	Seed yield/ plant(g)	Oil content (%)	Hullcontent (%)
Co-efficient of variance (%)	Phenotypic	4.56	1.84	9.26	15.02	17.44	37.58	24.83	29.08	14.66	19.68	47.78	11.10	12.00
	Genotypic	3.48	1.30	8.69	13.46	16.16	37.39	23.49	28.88	14.39	18.49	47.27	9.28	10.16
Range	Minimum	55.01	88.46	90.42	2.27	7.93	116.21	68.66	289.42	47.53	2.05	6.35	22.99	21.30
	Maximum	64.49	94.05	144.62	4.07	20.18	1137.63	321.48	1388.93	87.19	7.29	58.10	39.11	34.87
GAM		60.18	90.98	125.18	3.00	15.81	515.39	180.43	694.85	71.85	5.36	25.66	31.93	27.65
C.V		2.95	1.29	3.20	6.65	6.55	3.83	8.02	3.40	2.80	6.74	6.96	6.08	6.37
S.Em ±		1.25	0.83	2.83	0.14	0.73	13.96	10.24	16.70	1.42	0.25	1.26	1.37	1.24
CD 5 %		3.54	2.35	8.01	0.40	2.07	39.47	28.94	47.21	4.02	0.72	3.57	3.88	3.52
CD 1 %		4.71	3.12	10.65	0.53	2.75	52.47	38.47	62.75	5.34	0.96	4.74	5.16	4.68

GAM = Grand Mean CV = Coefficient Variation

have been observed for followed by head diameter, stem diameter, seed filling per cent, oil content and hull content Low phenotypic coefficient variation and genotypic coefficient variation were recorded for days to maturity, days to 50 per cent flowering and plant height. Low variability for these characters emphasize the need for generating more variability. Range was maximum for total number of seeds/head and number of filled seeds/head followed by unfilled seeds/head, plant height, days to maturity, days to 50 flowering seed filling per cent and seed yield/ plant, whereas minimum range for head diameter, oil content hull content followed by stem diameter and 100-seed weight.

Based on the range of the germplasm accession, GMU-462 recorded the highest days to 50 per cent flowering (64.49) and the accession GMU-437 highest days to maturity (90.89) and the accession DRSF-108 highest plant height (144.62cm) and the accession GMU-420 highest stem diameter (4.07 cm) and the accession GMU-444 highest head diameter (20.18 cm) and the accession GMU-433 maximum number of filled seeds/head (1137.63) and the accession DRSF-108 maximum unfilled seed/head (321.48) and the accession GMU-433 maximum number of total filled seeds/head (1388.93) and the accession GMU-431 maximum seed filling per cent (71.86) and the accession GMU-439 highest 100-seed weight (7.29 g) whereas the accession GMU-433 highest seed yield/plant (58.10 g) whereas the accession DRSF-108 highest oil content (39.11%) whereas the accession GMU-434 highest hull content (34.87%).

Based on the mean performance the germplasm accession GMU-444 recorded the lowest days to 50% flowering (55.01) whereas the accession GMU-453 lowest days to maturity (88.46) whereas the accession GMU-416lowest plant height (90.42cm) whereas the accession GMU-440 lowest stem diameter (2.27cm) whereas the accession GMU-411 lowest head diameter (7.93 cm) whereas the accession GMU-459 lowest number of filled seeds/head (116.21) whereas the accession GMU-431 lowest number of unfiled seeds/head (68.66) whereas the accession GMU-453 lowest total number of seeds/head (289.42) whereas the accession GMU-452 lowest seed filling per cent (47.53%) whereas the accession GMU-445 lowest 100-seed weight (2.05g) where as the accession GMU-459 lowest seed yield/plant (6.35g) whereas the accession GMU-450 lowest oil content (22.49 %) whereas the accession GMU-450 lowest hull content (21.30). which can be used for breeding for high yielding varieties and hybrids. Thus it can be concluded that no germanplasm accession was found to be good for all the quantitative characters.

Morphological characterization of exotic lines helps plant breeder in easy identification and to select genotypes under the process of selection (Table 3). Among 64 genotypes, greater variation was observed for the characters, *viz*., hypocotyl anthocyanin colouration, leaf base, serration of leaf margin, leaf size, leaf shape, orientation of leaf blade, ray floret shape, disc floret color, head shape, head attitude, seed shape, and seed color. Hypocotyl anthocyanin colouration was strong for 18 genotypes, medium for 42 genotypes, and absent for 4 genotypes. Under the leaf related characters, there were greater variations for all the characters under study. Leaf base was acute for 17 genotypes, obtuse for 47 genotypes. Leaf margin/serration was coarse for 33 genotypes, medium serration for 31 genotypes. Leaf size was big for 7 genotypes, medium for 54 genotypes, and small for 3 genotypes. Leaf shape was cordate for 39 genotypes, triangular for 20 genotypes and lanceolate for 5 genotypes. Orientation leaf blade was drooping for 47 genotypes, erect for 17 genotypes. Leaf color was green for 53, light green for 11. Leaf blistering was strong for 11, medium for 52 and absent for 1. Leaf petiole pigmentation was present for 18, absent for 46. Leaf hairiness was sparse for 8, absent for 56. Stem pubescence was strong for 18, medium for 45 and absent 1. Stem pigmentation was absent for 62 and present for 2. Ray floret number was for medium (30-40) 41 and for many (>40) 23. Ray floret shape was ovoid for 21 genotypes, elongate for 43 genotypes. Ray floret color was orange for 31 and yellow for 33. Disc floret color was yellow for 35 genotypes, 29 for orange genotypes. Disc floret pigmentation was absent for 25 and medium for 39. Pollen color was yellow for 64. Bract shape was round for 18 and elongate for 46. Bract pigmentation was absent for 64. Head shape was flat for 35 genotypes, concave for 1 genotypes and convex for 28 genotypes. Head attitude was half turned down for 18 genotypes, vertical for one genotype and turned down for 45 genotypes under study. Plant branching was present for 1 genotype and absent for 63 genotypes.

Seed shape and seed base color exhibited lot of variation 34 genotypes elongate, 28 genotypes for ovoid elongate and 2 genotypes ovoid wide and for seed base color black for 41 genotypes, grey for 22 genotypes and white for one genotype GMU-416. These characters are consistent and are highly useful in distinguishing the genotypes from other genotypes. The present findings are in agreement

Table 3. Morphological characterizations of qualitative characters of sunflower genotype.

S. No	Qualitative character	Frequency
1. Hypocotyl pigmentation		
a)	Strong	18
b)	Medium	42
c)	Absent	4
2. Leaf size		
a)	Big	7
b)	Medium	54
c)	Small	3
3. Leaf shape		
a)	Cordate	39
b)	Triangular	20
c)	Lanceolate	5
4. Leaf color		
b)	Green	53
c)	Light Green	11
5. Leaf Serration		
a)	Coarse	33
b)	Medium	31
6. Leaf blistering		
a)	Strong	11
b)	Medium	52
c)	Absent	1
7. Leaf base		
a)	Obtuse	47
b)	Acute	17
8. Orientation blade		
a)	Dropping	33
b)	Erect	31
9. Leaf Petiole Pigmentation		
a)	Present	18
b)	Absent	46
10. Leaf hairiness		
a)	Present	8
b)	Absent	56
11. Stem pigmentation		
a)	Present	2
b)	Absent	62
12. Stem pubescence		
a)	Strong	18
b)	Medium	45
C)	Absent	1

S. No	Qualitative character	Frequency
13. Ray floret color		
a)	Yellow	33
b)	Orange	31
14. Ray floret number		
a)	Medium(30-40)	41
b)	Orange (>40)	23
15. Ray floret shape		
a)	Ovid	21
b)	Elongate	43
16. Disc floret pigmentation		
a)	Absent	25
b)	Medium	39
17. Disc floret colour		
a)	Orange	29
b)	Yellow	35
18. Pollen color		
a)	Yellow	64
19. Bract shape		
a)	Elongate	46
b)	Round	18
20) Bract pigmentation		
a)	Absent	64
21. Plant branching		
a)	Present	1
b)	Absent	63
22. Head shape		
a)	Flat	35
b)	Concave	1
c)	convex	28
23. Head attitude		
a)	Half Turn down	18
b)	Vertical	1
c)	Turn down	45
24. Seed shape		
a)	Elongate	34
b)	Ovide Elongate	28
c)	Ovide wide	2
25. Seed base color		
a)	Grey	22
b)	White	1
c)	Black	41

with earlier findings, Jagadish *et al.* (1994); Suma and Virupakshappa (1994); Rajendra Prasad *et al*. (2003); Rajeswari (2004). This indicated that morphological characterization helps in identification of genotypes easily.

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