



Genetic variability in gaillardia (*Gaillardia pulchella*)

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ABSTRACT

A field experiment was conducted to find out variation in various gaillardia (*Gaillardia pulchella* Foug). Germplasm collected from different parts of the country and evaluation of these germplasms for various horticultural important traits. Seeds of 20 germplasms were sown and transplanted at experimental unit of Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi, during 2012-2013. Experiment was laid out in randomized block design with three replications and observations were recorded in monthly intervals. Significant variations were observed among gaillardia germplasm for analysis of variance. The phenotypic coefficients of variation (PCV) were higher than those of genotypic coefficients of variation (GCV) for all the characters studied. High heritability with high genetic advance as per cent mean was observed for plant height, number of leaves, number of branches/plant, leaf area, chlorophyll, days taken for first flowering, flower yield/plant, flower yield/ha, seed yield/plant, seed yield/ha, flower diameter, number of whorls/flower, number of petals/flower, stalk length, single flower weight and ten flower weight.

Key words: Gaillardia, Genetic advance, Heritability, Variability

Blanket flower known as gaillardia (*Gaillardia pulchella* Foug.) belongs to family Asteraceae and has a basic chromosomes number $X=18$ and $2n=36$ (Srivastava and Kandpal 2006). The crop has been named after a French botanist Mr M Gaillard, who cultivated this first (Bailey 1947). The genus gaillardia has around twenty species available, out of which, only *Gaillardia pulchella*, which is annual and *Gaillardia aristica*, perennial in nature are in cultivation (Anon. 1950). It is commercially grown for loose flower in Gujarat, Madhya Pradesh, Maharashtra, Karnataka and Rajasthan. It is cultivated for varied uses like cut flowers, for making garlands, veni, floral decoration and required on weddings, religious and other ceremonial and social occasions (Karetha *et al.* 2011). A huge quantum of variability exists in this crop with respect to shape, types, size, colour and growth habit etc. It is one of the hardiest annual that could be grown in a variety of soils under varied climatic conditions and also can withstand fairly high salinity and 50% of yield could be obtained even at 8.7 dS/m salinity level and this could be tried as a new flower crop for saline soils (Khimani 1991). In view of the importance, popularity and potentiality of this crop, there is a lot of scope for breeding new varieties with higher yield and superior quality flowers.

MATERIALS AND METHODS

The present investigation was carried out in the

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Department of Floriculture and Landscape Architecture, University of Horticultural Science, Arabhavi during August to January of 2012-2013. Twenty genotypes of gaillardia were grown in Randomized Block Design with three replications. Raised seedlings of 1 month after sowing were planted with spacing 45 between plants and between rows. Standard package of practices were followed for all the genotypes as per the recommendations of UAS, Dharwad (Anon. 2008). Observations were recorded on randomly selected 5 plants of each row discarding the border plants at both the ends. Data were as recorded on growth, yield and quality related parameters, viz. plant height (cm), plant spreads (cm), number of branches, leaf area (cm²), days taken to flowering, days taken for 50% flowering, duration of flowering (days, number of flower/plant, flower yield/plant (g), flower yield/ha (t), seed yield (g), seed yield/hectare (kg), flower diameter (cm), number of whorls, number of petals/flower, ten flower weight(g) and single flower weight (g) stalk length (cm), flower size (cm), flower weight (g) and and chlorophyll a, b and total. Chlorophyll content of leaf was analyzed by collecting the healthy, fully opened and matured leaves from the centre portion of the plants at peak growth stage. Chlorophyll 'a', Chlorophyll 'b' and total chlorophyll contents of leaf tissue were determined by non-destructive method of chlorophyll estimation using dimethyl sulphoxide (DMSO) as suggested by Shoaf and Lium (1976). Phenotypic and genotypic variability and heritability (broad sense) were estimated according to Burton and Devane (1953), and the genetic

advance as per cent mean was estimated as suggested by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences for all the characters studied, there by indicating tremendous potential for improvement through selection. The data presented in the Table 1 and Table 2 revealed a high range in number of leaves (288.63-457.33), flower yield/plant (66.60-174.44), seed yield/ha (651.20-1241.47), number of petals/plant (18.70-154.63). The phenotypic coefficient of variation was higher than those of genetic coefficient of variation that indicates greater genotype-environment (G×E) interaction. However, high phenotypic (80.69) and genotypic (79.09) coefficient of variation were found for number of

whorls/flower followed by number of petals/flower (PCV=57.13; GCV=57.12), single flower weight (PCV=38.34; GCV=34.51), leaf area (PCV=29.34; GCV=29.16) and flower yield/plant (PCV=26.80; GCV=25.06). Reena *et al.* (2005), Mathad *et al.* (2003) and Chaugule (1985) also reported high GCV and PCV for flower yield/plant. Higher genotypic coefficient of variation for above mentioned characters can be effectively utilized in future breeding programme. Low GCV and PCV were obtained for stem girth, plant spreads and duration of flowering. These results are in agreement with the results of Barigidad *et al.* (1992). Chaugule (1985) also observed lower values of GCV and PCV for duration of flowering.

High estimates of heritability (Broad sense) were obtained for all the characters studied. The highest heritability

Table 1 Estimates of mean, range, components of variance, heritability and genetic advance for growth parameters in gaillardia genotypes

Character	Mean ± SEM	Range	GV	PV	GCV (%)	PCV (%)	h ² (%)	EGA	GAM (%)
<i>Growth parameters</i>									
Plant height (cm) 60 DAP	70.73±1.60	48.00-84.67	81.42	89.07	12.76	13.34	91.00	17.69	25.01
Plant height (cm) 90 DAP	85.82±1.79	58.67-102.50	118.85	128.48	12.70	13.21	93.00	21.72	25.30
Plant height (cm) 120 DAP	95.43±1.66	65.33-112.67	125.82	134.09	11.75	12.13	94.00	22.42	23.50
Plant spread (cm) (East-West) 60 DAP	57.10±1.60	42.9-70.83	52.50	60.21	12.69	13.59	87.00	13.91	24.35
Plant spread (cm) (East-West) 90 DAP	63.50±1.96	53.05-74.01	27.53	39.04	8.26	9.84	71.00	9.14	14.39
Plant spread (cm) (East-West) 120 DAP	64.33±1.42	53.55-76.00	39.72	45.75	9.80	10.51	87.00	12.12	18.84
Plant spread (cm) (North-South) 60 DAP	62.10±1.60	47.90-75.82	52.50	60.21	11.67	12.50	87.00	13.91	22.39
Plant spread (cm) (North-South) 90 DAP	69.50±1.96	59.05-80.00	27.53	39.04	7.55	8.99	71.00	9.14	13.15
Plant spread (cm) (North-South) 120 DAP	70.33±1.42	59.55-82.02	39.72	45.75	8.96	9.62	87.00	12.12	17.24
Number of branches/plant (60 DAP)	17.86±0.29	13.52-24.48	7.92	8.17	15.76	16.00	97.00	5.71	31.98
Number of branches/plant (90 DAP)	20.87±0.30	17.44-27.16	7.48	7.76	13.11	13.35	96.00	5.51	26.40
Number of branches/plant (120 DAP)	21.75±0.22	17.98-28.22	7.94	8.08	12.96	13.07	98.00	5.74	26.38
Number of leaves/plant (60 DAP)	194.0±4.40	127.40-295.00	2653.14	2702.06	26.55	26.79	98.00	104.94	54.09
Number of leaves/plant (90 DAP)	385.71±5.18	288.63-457.33	2523.24	2603.89	13.02	13.23	97.00	101.96	26.44
Number of leaves/plant (120 DAP)	385.62±3.65	286.30-457.00	2536.73	2576.63	13.06	13.16	98.00	102.48	26.58
Leaf area (dm ²) 60 DAP	27.49±0.51	16.88-44.41	64.25	65.02	29.16	29.34	96.00	16.44	59.82
Leaf area (dm ²) 90 DAP	47.00±0.89	35.91-64.09	65.33	67.70	17.20	17.51	97.00	16.44	34.98
Leaf area (dm ²) 120 DAP	42.84±0.76	32.33-59.74	56.42	58.18	17.53	17.80	97.00	15.24	35.58
Stem girth (cm) 60 DAP	1.55±0.04	1.2-1.80	0.02	0.03	9.67	10.87	79.00	0.28	18.19
Stem girth (cm) 90 DAP	2.21±0.05	1.9-2.40	0.02	0.03	6.86	7.93	75.00	0.27	12.11
Stem girth (cm) 120 DAP	2.31±0.05	1.5-2.60	0.03	0.04	7.79	8.67	81.00	0.33	14.45
Chlorophyll 'a' (mg/g)	0.48±0.07	0.22-0.97	0.02	0.02	29.29	30.99	89.00	0.26	54.02
Chlorophyll 'b' (mg/g)	0.37±0.06	0.04-0.75	0.05	0.06	60.72	62.93	93.00	0.47	126.83
Total chlorophyll (mg/g)	0.85±0.17	0.49-1.71	0.07	0.09	32.29	35.33	84.00	0.52	61.07

Table 2 Estimates of mean, range, components of variance, heritability and genetic advance for flowering, yield and quality parameters in gaillardia genotypes

Character	Mean \pm SEM	Range	GV	PV	GCV (%)	PCV (%)	h ² (%)	EGA	GAM (%)
<i>Flowering parameters</i>									
Days taken for first flowering (Days)	48.44 \pm 0.96	34.29-62.78	61.73	64.47	16.22	16.58	96.00	15.84	32.70
Days taken for 50% flowering (days)	87.03 \pm 3.09	75.19-102.47	52.62	81.20	8.34	10.40	65.00	12.03	13.82
Duration of flowering (days)	125.09 \pm 1.07	109.76-148.00	99.82	103.24	7.99	8.12	97.00	20.24	16.07
<i>Yield parameters</i>									
Number of flower/plant	81.94 \pm 2.64	71.11-94.30	60.18	81.02	9.47	10.98	74.00	13.72	16.75
Flower yield (g/plant)	128.43 \pm 5.30	66.60-174.44	876.13	1000.56	25.06	26.80	88.00	57.34	48.54
Flower yield (tonnes/ha)	9.51 \pm 0.39	4.93-12.90	4.81	5.49	25.06	26.80	86.00	4.25	48.54
Seed yield (g/plant)	11.86 \pm 0.49	8.80-16.80	6.70	7.42	21.82	22.96	90.00	5.05	42.58
Seed yield (kg/ha)	877.59 \pm 36.18	651.20-1241.47	36679.81	40606.50	21.82	22.96	92.00	373.60	42.57
<i>Quality parameters</i>									
Flower diameter (cm)	5.63 \pm 0.20	4.90-7.16	0.45	0.57	11.88	13.45	78.00	1.22	21.60
Number of whorls/ flower	4.58 \pm 0.42	1.00-12.10	13.14	13.68	79.09	80.69	96.00	7.32	159.78
Number of petals/ flower	80.37 \pm 0.51	18.70-154.63	2107.38	2108.17	57.12	57.13	99.00	94.55	117.64
Stalk length (cm)	15.33 \pm 1.13	9.74-25.94	16.39	20.25	26.40	29.35	81.00	7.50	48.94
Ten flower weight (g)	27.03 \pm 2.61	14.20-45.00	86.99	107.42	34.50	38.34	80.00	17.08	63.19
Individual flower weight(g)	4.68 \pm 0.20	1.42-4.7	0.87	1.07	34.51	38.34	81.00	1.73	33.51

values were recorded for number of petals (99.00) followed by number of branches and number of leaves (98.00) each, leaf area and duration of flowering (97.00) each and days to first flowering, number of whorls/flower (96.00) each. These findings suggest the scope for improvement of these characters through direct selection. Barigidad *et al.* (1992) also observed highest heritability for number of petals per flower. Heritability estimates along with genetic advance as per cent mean is useful in prediction for the selection of individual. High heritability along with high genetic advance as per cent mean was observed for number of whorls/flower, number of petals/flower, plant height, number of leaves, number of branches/plant, leaf area, chlorophyll content, days taken for first flowering, flower yield/plant, flower yield/hectare, seed yield/plant, seed yield/hectare, flower diameter, stalk length, single flower weight and ten flower weight. These observations suggested that genotypic variation in the genotypes studied for said characters was probably due to high additive gene effects (Panse 1957). Similar results reported by Talukdar *et al.* 2003, Sirohi and Behera 2000, Barigidad 1992, Chaugule 1985, Anop *et al.* 2011, Chezhiyan *et al.* 1985 in chrysanthemum; Methew *et al.* 2005, Kavitha and Anburani 2010, Singh and Saha 2006, Singh *et al.* 2008 in marigold and in dahlia (Sashikala *et al.* 1995, Choudhary 1989). Selection for these characters would, therefore, be effective when based on phenotypic performance (Barigidad *et al.* 1992). High heritability with moderate genetic advance as per cent mean (GAM) was observed for stem girth, days taken for 50% flowering, duration of flowering, number of flowers plant. These characters having high heritability with medium GAM

indicated the existence of non additive gene action.

Thus, the findings of the present study indicated the presence of substantial variation for their future exploitation.

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