EVALUATION OF GERBERA (*Gerbera jamesonii* Bolus.) VARIETIES IN CONTROLLED CONDITION

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ABSTRACT

The field investigation was laid out in Saurastra condition to evaluate eight varieties of gerbera viz., 1314, Pertired, Alcochete, Petitamarel, Setubal, Caiman, Helena and 1133. The variability was assessed based on the morphological markers and different pigment content. The observations on growth, flowering and yield characters were recorded as morphological markers and analyzed separately. Among the morphological characters, vigorous growth in terms of plant spread (N-S and E-W) was found superior in variety 1314. Variety Pertired also formed maximum number of leaves per plant. With respect to flowering characters, earliness in first flower bud opening was registered in variety Pertired. Consequently the flower quality in respect of flower stalk diameter and fresh weight of flower were significantly higher in variety Pertired with significantly longest stalk length. Significantly highest yield per plant and per sq. m. per year was obtained in variety Pertired which was followed by variety 1314, while varieties 1314, Pertired and Alcochete obtained highest score with respect to consumer preference. According to the pigment analysis, variety 1133 showed more total carotenoid and total β-carotene content. However, variety Pertired showed significantly highest cynidins content of total anthocyanidins.

KEY WORDS: Controlled Condition, Gerbera, Morphological Markers, Pigment

INTRODUCTION

Gerbera commonly known as Transvaal Daisy, Barberton Daisy or African daisy (Baley, 1963; Dole and Welkins, 1999) is cultivated throughout the world under wide range of climatic conditions for its attractive colors (Sheela, 2006). Today gerbera is known as an important commercial flower crop and belong to the most important plant species in the world, together with the rose, chrysanthemum, carnation and tulip. Gerbera is grown commercially in India for export as well as for the domestic market.

The genus Gerbera was named in the honour of German botanist/naturalist, Traugott Gerber who travelled in Russia in 1743 and started first botanical garden in Moscow. However, for species, *G. jamesonii*, it is a matter of different opinion. *G. jamesonii* was named for Dr. L. S. Jamesson, a British colonial statesman in South Africa who was one of the discoveror of the species. The first official description of the South African species, *Gerbera*

jamesonii was made by J. D. Hooker in curt's Botanical Magazine (Sheela, 2006). This genus is native to South African and Asiatic regions. The Gerbera species belong to Asteraceae, which is the largest family of plants. The genus Gerbera consists of about forty species of hardy and perennial flowering plants, of which *Gerbera jamesonii* Bolus is only under cultivation. The other species are *G. asplenifolia, G. kunzeana, G. viridifolia*, etc. In India, it is distributed in the temperate Himalayas from Kashmir to Nepal at altitude of 1,300 to 3,200 meters (Bhattacharjee and De, 2003 a). It is mainly cultivated in West Bengal, North Eastern States, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. In Gujarat, the area under gerbera cultivation is concentrated around Surat, Navsari, Valsad, Vadodara and Ahmadabad districts. Due to its ability to withstand long transportation, gerbera has been considered suitable for export as well as domestic markets of India (Aswath and Rao, 2006).

MATERIALS AND METHODS

Experiment was conducted at Hi-tech Horticulture Park (Greenhouse Unit-4), Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh during the year 2015-16 and 2016-17. The present experiment was laid out in Completely Randomized Design (CRD) with three replications and eight varieties of gerbera *viz*., 1314, Pertired, Alcochete, Petitamarel, Setubal, Caiman, Helena and 1133. The observations on growth, flowering and yield characters were recorded as morphological markers and analyzed separately.

Pigment profiling

Plant Material

Eight gerbera varieties having different petal colours such as red (1314, Pertired, Alcochete, Setubal), pink (Petitamarel), yellow (Caiman), purple (Helena) and orange (1133) were grown in a greenhouse under standard and identical condition and petals were collected at the time of full bloom. The collected samples were kept in liquid N until they used for pigment profiling (Plate 1).

Determination of the total carotenoids content

Carotenoids were extracted from petals (1 mg) of each variety by soaking in MeOH: Acetone (1:1, v/v; 1 ml) for 2 h at room temperature and the absorbance at λmax was used for quantitative analysis of carotenoids (Tatsuzawa *et al*., 2010).

Determination of the total Anthocynidins

Pigments were extracted from 1 g petals (1 g from each variety) by soaking in 20 ml of 2 M HCL for 2 h at room temperature. The filtrated samples were hydrolyzed in boiling water bath for 2 h. After cooling, the reaction products were analyzed by analytical High Profiling Liquid Chromatography (HPLC), using authentic anthocyanidins as standards. Analytical HPLC was performed on a Agilent 1100 system, using a reverse phase C_{18} (4.6×250 mm) column (Zorbax Eclipse), at 40°C with a flow rate of 1 ml/min monitoring at 530 nm. The solvent was applied as a liner gradient system for 40 min from 20 to 85% solvent B (25% MeCN, 20% HOAc, 1.5% H_3PO_4 in H_2O) in solvent A (1.5% H_3PO_4 in H_2O) (Tatsuzawa *et al*., 2010).

Determination of the total β- carotene

An acetone extract of fresh petals (0.5 g) was partitioned between diethyl ether and aqueous NaCl. The organic layer was washed with water, and the residue was saponified with equivalent 5% KOH- MeOH for 1 h at room temperature. The saponified matter was then extracted with diethyl ether and washed with water. The organic layer was dried and dissolved in 1 ml MeOH and used in quantitative and HPLC analysis. Each extract was analyzed by HPLC, on a yong Lin Acme 9000 system, using a reverse phase C_{18} (4.6×250 mm) column

(Lichrosphere Rp 100) under the following condition: solvent A, methanol (MeOH)/methyl tert-butyl ether (MTBE)/H_2O = 90 : 6 :4 (v/v/v); solvent B, MeOH/ MTBE/ H_2O = 25 : 71 : 4; gradient, 0/100, 12/100, 96/0 (min/%A); flow rate, 1.0 mL/min; column temperature, 35ºC (Kishimoto *et al*., 2007).

RESULTS AND DISCUSSION

The data presented in Table 1 indicated that number of leaves per plant (48.85) was found to be significantly higher in variety Pertired over both the years, whereas the lowest number of leaves per plant was noted in variety Caiman (20.53) in pooled analysis. The plant spreading in North- South direction was found significantly the maximum (56.97 cm) in 1314 in pooled analysis, which was statistically at par with Partired (56.29 cm) and variety 1133 was recorded the minimum plant spread (25.49 cm) pooled over years. Plant spread in East-West direction was found significantly superior in variety Pertired (57.31) in pooled data (Table 1). Variation in plant spread was due to the inherent genetic character of the individual cultivar and also it depends upon the leaf length and leaf breadth of the cultivars as reported by Anop Kumari *et al.* (2010) and Bhosale *et al.* (2012) in gerbera.

The earliness in flower bud opening was recorded in variety Pertired (19.31 days) which was statistically at par with Helena (20.00). However, the flower bud opening was delayed in Petitamarel (31.77 days) in pooled analysis. Since early and late flowering characters are genetically controlled and this variation might be attributed to the inherent varietal character of the cultivars as have been reported by Dalal *et al.* (2005) and Vasudevan and Rao (2010) in gerbera.

Significantly superior flower stalk length was observed in variety Pertired (65.23 cm) over both the years, while the minimum stalk length (46.38 cm) was recorded in variety Petitamarel over both the years (Table 1). The data clearly indicated that the overall average flower stalk diameter was found significantly the highest in Pertired (0.62 cm), while the least flower stalk diameter (0.38 cm) was observed in variety Petitamarel (Table 1). The data also indicated that the overall average fresh weight of flower was produced significantly higher in variety Pertired (12.20 g), while it was minimum in Caiman (7.51 g) in pooled analysis (Table 2). These differences in cut flower quality with respect to fresh weight of flower, stalk length and stalk diameter may be due to the presence of additive genes present in the individual cultivar which express their entire genetic potential under control conditions. This was in accordance to the findings of Mantur and Patil (2010) in gerbera.

On the basis of visual appearance of flower, excellent flower quality achieved by variety 1314 (8.2/10), which was followed by Pertired (8.1/10) and V_3 Alcochete (7.8/10.0). However, the lowest score was noted in variety 1133 (4.8/10.0). It is evident from the data presented in Table 1 that the significantly the higher yield (204.27 flowers/square meter) was recorded in variety Pertired over both the years, which was statistically at par with 1314. However, the least number of flowers per square meter per year (154.17 flowers / square meter) was observed in variety Helena over the years (Table 2). The increase in flower yield may be attributed to the greater leaf area and more leaves per plant as well as plant spread which might have resulted in production and accumulation of maximum photosynthates, ultimately resulting in more number of flowers with bigger size. This was in accordance to the findings of Habibah *et al.* (2008) and Barooah and Talukdar (2009).

Varieties under investigation display the wide range of variation with respect to

flower colour and different pigment content in gerbera flowers. The overall average of total carotenoids content was significantly the highest (1.47 micro g/g) in variety 1133, which is orange in colour and was at par with variety Caiman. However, Petitamarel which is pink in colour recorded the lowest (0.05 micro g/g) total carotenoids in pooled data. The variety Pertired recorded significantly more cynidins content (154.15 ppm) pooled over years, while the lowest cynidins content (4.19 ppm) was observed in variety Caiman in pooled dats. Significantly higher β-carotene content (14.48 mg/kg) was observed in variety 1133 in pooled data, while the least β-carotene content (0.19 mg/kg) was observed in variety Helena over both the years.

CONCLUSION

On the basis of results and discussion, it can be concluded that variety Pertired produced the maximum excellent quality flowers/square meter with maximum fresh weight of flower, stalk length, stalk diameter, plant spreading area with more cynidins content and therefore, it can be suggested for growing under controlled condition.

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Table 1: Variation in number of leaves per plant, plant spread, days taken to flower bud opening, stalk length and stalk diameter in gerbera (Pooled data of 2015-16 and 2016-17)

Varieties	Number of Leaves per Plant	Plant Spread		Days Taken to Flower Bud Opening	Stalk Length (cm)	Stalk Diameter (cm)
		N-S	E-W			
1314	44.46	56.97	54.77	26.81	61.85	0.52
Pertired	48.85	56.29	57.31	19.31	65.23	0.62
Alcochete	40.60	45.77	46.37	22.50	49.25	0.52
Petitamarel	36.81	40.59	42.65	31.77	46.38	0.38
Setubal	24.80	33.30	33.23	22.45	51.08	0.42
Caiman	20.53	34.16	34.16	25.03	60.50	0.48
Helena	39.59	45.11	45.79	20.00	50.18	0.53
1133	37.88	25.49	27.60	22.55	52.66	0.53
Mean	36.69	42.21	42.73	23.80	54.64	0.50
S.Em.±	0.70	0.73	0.84	0.46	0.95	0.01
C.D. at 5 %	2.04	2.12	2.44	1.33	2.74	0.03

Table 2: Variation in fresh weight of flower, number of flower per square meter per year , consumer preference on the base of flower quality, total carotenoid, cynidins and cynidins contents in gerbera (Pooled data of 2015-16 and 2016-17)

Varieties	Fresh Weight of Flower (g)	Number of Flowers per Square Meter per Year	Scale (Out of 10.0)	Total Carotenoid (micro gram/g)	Cynidins (ppm)	β-Carotene (mg/kg)
1314	11.61	199.11	8.2	0.49	70.63	5.14
Pertired	12.20	204.27	8.1	1.05	154.15	7.54
Alcochete	9.47	176.17	7.8	0.75	94.09	4.52
Petitamarel	8.28	165.78	7.2	0.05	133.77	0.22
Setubal	9.05	174.03	6.0	0.50	62.98	5.58
Caiman	7.51	165.30	5.8	1.46	4.19	9.49
Helena	10.27	154.17	7.5	0.10	12.57	0.19
1133	8.91	192.72	4.8	1.47	46.16	14.48
Mean	9.66	178.94		0.73	72.31	5.89
S.Em.±	0.12	1.94		0.09	0.32	0.09
C.D. at 5 %	0.35	5.61		0.02	0.90	0.28

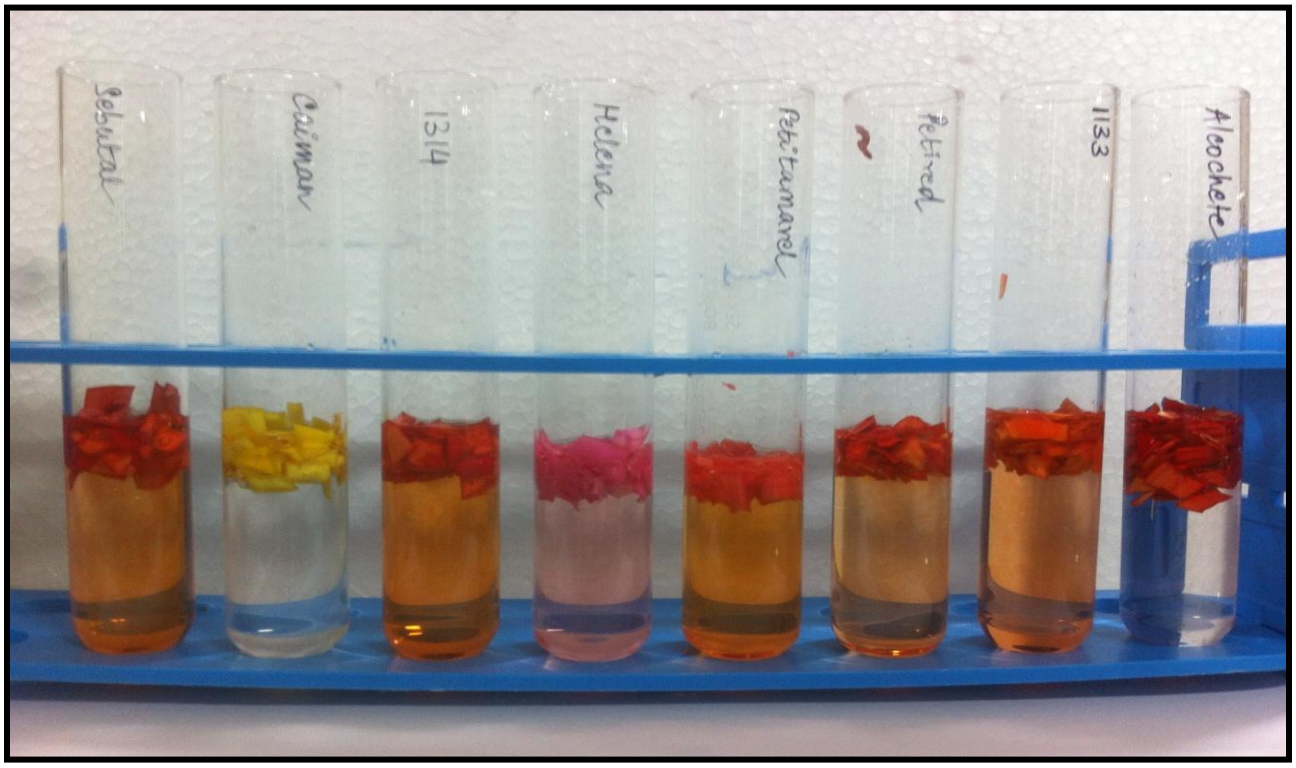

Plate 1: Pigment extraction from petals of gerbera flower

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