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MORPHOLOGICAL VARIABILITY OF DAHLIA (*Dahlia variabilis L.*) GENOTYPES UNDER SUBTROPICAL CONDITIONS OF PUNJAB

K K Dhatt and Simrat Singh*

Department of Floriculture and Landscaping,
Punjab Agricultural University, Ludhiana - 141004, Punjab

ABSTRACT

Morphological evaluation of different Dahlia genotypes was conducted at the research farm, Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana. Rooted cuttings of Dahlia were transplanted in 12 inch earthen pots filled with growing media comprising garden soil: farm yard manure (FYM) in 2:1 ratio. The treatments comprised eight Dahlia genotypes, named as accession numbers (Acc. no.). Statistically significant differences were revealed among different genotypes for all the parameters under evaluation. Accession no. 7 recorded highest number of flowers (18.0) per plant and maximum vase life (10.0 days). The genotype Acc.No. 6 reported highest average number of days (44.67 days) to flowering duration. Dahlia Acc. No. 6 and Accessions (No. 7, 10 and 11) were found suitable for bedding purpose and pot culture, respectively.

Keywords: Characters, Dahlia, Evaluation, Floral, Vegetative

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Dahlia (*Dahlia variabilis* L.) named after Belgian botanist Andreas Dahl belongs to family Asteraceae and is believed to be native to Mexico. This majestic geophyte perennial with half-hardy herbaceous stems exhibist inflorescence of diverse shapes, sizes (less than 2.5 cm to over giant 40 cm in diameter) and colour (Ohno *et al*., 2011). This tuberous rooted flowering plant belongs to the family Asteraceae, comprising 42 species with over 1000 distinct cultivars all over the world (Kamenetsky and Hiroshi, 2013). Dahlia was successfully introduced in Europe during early 1800's that led to the start of breeding Dahlias for development of new cultivars involving inter-specific cross among mainly four species *D. coccinea*, *D. pinnata*, *D. merckii* and *D. imperialis* (Bhattacharjee, 2006.).

The Dahlias were introduced in India as early as 1857 under the auspices of the Agri-Horticultural Society of India, Calcutta. Dahlias are widely planted in gardens as bedding plant, potted flowering plant and as cut flower that stays fresh in flower vases for several days. The dahlia is mostly preferred by florists and consumers owing to its majestic flower forms and sizes. Several Dahlia genotypes have been introduced in department of Floriculture and Landscaping, PAU, Ludhiana from different All India Coordinated Research Project (AICRP) centres dedicated to Dahlia breeding for novel characteristics. However, introductions of several forms of Dahlia genotypes from other geographical regions within the Indian sub-continent requires comprehensive evaluation for their morphological characteristics in the prevailing sub-tropical climatic condition of Punjab.

*Corresponding author : simratflori@pau.edu
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MATERIALS AND METHODS

The experiment was conducted during October 2018 – April 2019 at the research farm, Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana. The experimental site is located between 29°30–32°32′N and 73°55′– 76°50′E at an altitude of 247 m above mean sea level. The climate of the region is semi-arid with average annual rainfall of 650 mm. Majority of the rainfall (80%) occurs during a short span of two and half months (July–September). The mean maximum and minimum temperatures during the period of the experiment were 32°C & 17.7°C (October) and 34.6°C & 18.8 °C (April) ,respectively. The media mixture comprised 2 parts garden soil and 1 part well decomposed farm yard manure (FYM). The growing media mixture was sieved ensuring uniform consistency and pots were tapped three times during the media filling to ensure its proper packing.

Dahlia cuttings were taken from eight germplasm Acc. (named as Acc. no. 1, Acc. no. 3, Acc. no. 5, Acc. no.6, Acc. no. 7, Acc. no. 10, Acc. no. 11 and Acc. no. 13) maintained as mother stock. These cuttings were rooted under partial shade on sand beds that took nearly 30 days to attain transplantable stage. Rooted cuttings of uniform height (3 inches) and of same age (30 days) were transplanted in 12 inch earthen pots. Recommended pot cultural practices were carried for raising Dahlia plants. The various observations were recorded on various vegetative parameters such as plant height (cm), number of primary branches per plant, stalk length (cm), chlorophyll content (µg /cm^2); and amongst the floral characters such as number of flowers per plant, flower diameter (cm), weight of

each flower (g), days to first bud appearance after planting, days to full bloom, duration of flowering and vase life (days). The experiment was laid out in a completely randomized block design (CRD) with three replications. The data was analyzed using CPCS-1, software developed by Department of Mathematics and Statistics, Punjab Agricultural University, Ludhiana to calculate significant difference between different treatment means computed through least square difference (LSD) at 5% level of significance.

RESULTS AND DISCUSSION

Vegetative characteristics

Dahlia accessions revealed significant differences among various vegetative characters under evaluation (Table 1). The mean data for plant height ranged from 45.10 cm- 118.00 cm. Acc. No. 1 recorded maximum mean plant height that was found significantly highest amongst the other accessions. The Acc. no. 5 recorded minimum mean plant height which was also found significantly lowest. Accession no. 7 and accession no. 10 were measured with average plant height of 54.50 cm and 57.37 cm, respectively which were found at par with each other. Plant height showed variation among the different Dahlia accessions. This can be primarily attributed to individual genetic makeup of Dahlia germplasm as well as influence of the growing environment. The cultural practices being similar for the experiment couldn't be accounted for differential plant height. Similar observations were recorded while carrying genetic variability and correlation studies in dahlia (Vikas *et al.,* 2015) during assessment of Dahlia genotypes based on vegetative quality characteristics.

The mean stalk length measured for various Dahlia Accessions ranged from 6.43-16.07 cm. The Acc. no. 13 recorded highest average stalk length (16.07 cm) which was found at par with Acc. no. 11 (14.47 cm). The Acc. no.7 recorded significantly lowest mean stalk length (6.43 cm) followed by Acc. no. 10 recording mean stalk length of 7.93 cm. There is a direct co-relation between stalk length and vase life observed in Dahlia cut stems. Longer cut stems exhibited better vase life due to higher water uptake; efficient water conductivity and effective air-water balance resulting in higher turgidity and keeping quality of stems. Accumulation of reserve carbohydrates in longer stems also aids in exhibiting better vase life of Dahlia flowers. Harvesting the Dahlia stems at proper stage of maturity (when several ray florets are fully expanded) is another critical factor influencing the vase life (Dole *et al.*, 2009). The results were contrary to the above fact that longer cut stems accumulate higher amounts of reserve carbohydrates, likely to present longer vase life. This variation in number of days to vase life (Fig. 2) amongst different accessions of Dahlia can be attributed purely due to inheritance of different genotypes.

Statistically significant differences were observed in number of primary branches per plant amongst the various Dahlia accessions. The Acc. no. 1 recorded significantly highest number of primary branches (5.00) followed by Acc. no. 3 and Acc. no.7 each recording mean of 4.67 and 4.13 primary branches per plant, respectively. The Acc. no. 11 recorded lowest average number of primary branches per plant (1.33) which was found at par with Acc. no. 13 observed with average 1.77 primary branches per plant. Dahlia plants begin to take out lateral shoots at axils of the internodes on the succulent stem, that often requires disbudding to contain single or few bunch of flowers to bloom. The difference in number of branches could be attributed to the different genotypic make of Dahlia germplasm. More number of branches is likely to increase the leaf number that in turn increases the surface area and plant biomass. Greater plant biomass is likely to enhance the

Table 1. Vegetative and floral characteristics of different Dahlia genotypes

Dahlia Genotype Accessions (No.)	Plant height (cm)	Number of primary branches per plant	Chlorophyll content (µg /cm^2)	Number of flower per plant	Days to first bud after planting	Days to full bloom	Duration of flowering	Flower form
Acc. No. 1	118.00	5.00	51.00	8.33	55.67	61.00	31.00	Decorative
Acc. No. 3	99.67	4.67	57.33	7.33	61.00	73.67	40.00	Fimbriated
Acc. No. 5	45.10	2.07	53.10	13.80	59.33	71.00	30.67	Collarette
Acc. No. 6	61.37	1.60	40.87	14.13	53.00	64.33	44.67	Double orchid
Acc. No. 7	54.50	4.13	61.77	18.00	63.67	79.67	30.00	Decorative
Acc. No. 10	57.37	3.73	55.10	16.00	59.67	70.33	28.67	Peony flowered
Acc. No. 11	79.03	1.33	34.60	7.33	54.33	71.00	41.00	Fimbriated
Acc. No. 13	75.07	1.77	50.10	8.00	62.33	71.33	40.33	Single flowered
LSD (0.05)	5.90	1.60	6.50	3.13	3.90	2.17	2.70	-

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flower quality by increasing source and sink relationship in Dahlia (Manjula *et al.,* 2017).

The mean reading of chlorophyll content ranged from 34.60-61.77 µg /cm^2. The Acc. no. 7 recorded highest mean chlorophyll content (61.77 µg /cm^2) which was found at par with Acc. no. 10 and Acc. no. 3 each measured with average chlorophyll content of 55.10 and 57.33 µg /cm^2 , respectively. The variations in different dahlia germplasm entries for plant leaf tissue chlorophyll content is likely due to genetic pre-disposition coupled with differential impact on photosynthetic capacity and plant health status.

Flowering characteristics

Mean number of flowers per plant counted from various Dahlia accessions ranged from 7.33-18.00. The Acc. no. 7 recorded highest number of flowers per plant which was found at par with Acc. no. 10, observed with mean number of 16.0 flowers per plant. The Acc. no. 3 and Acc. no. 11 each recorded lowest average number of flowers (7.33) per plant. The above accessions were found statistically at par with Acc. no.1 and Acc. no.13, each counted with mean of 8.33 and 8.00 number of flowers per plant, respectively. The number of flowers produced per plant may be directly related to better plant architecture coupled with greater accumulation of photosynthates for utilization in production of quality blooms. Similar observations and conclusions were noted by several workers (Muthuswamy *et al*., 1981; Joshi *et al*., 1997; Pudelska and Hetman, 1998 and Mousumee *et al*., 2001) on variability studies carried for Dahlia.

The mean flower diameter amongst the various accessions of Dahlia evaluated ranged from 10.50-19.00 cm. The Acc. no. 3 recorded with maximum average flower diameter of 19.00 cm which was found statistically significant with the Acc. no.1 recording mean value of flower diameter as 16.17 cm. The Acc. no. 13 was observed with minimum average flower diameter of 10.50 cm, observed at par with Acc. no.7 recording mean flower diameter of 10.73 cm. Increase in flower diameter in different Dahlia accessions didn't show corresponding increase in flower weight (Fig. 1). This can be attributed to inheritance of characters in different Dahlia genotypes that resulted in variations in flower weight with similar flower diameter.

The average flower weight of various Dahlia accessions weighed ranged from 10.0-27.0 g. The Acc. no.3 recorded highest mean flower weight (27.00g) which was found at par with the flower weight recorded (25.23 g) in Acc. no. 6. The lowest mean flower weight (10.07g) was recorded in Acc. no.13 followed by Acc. no. 7 with average flower weight of 15.93 g. The different genetic make up of the Dahlia germplasm resulted in variation in flower diameter and flower weight per plant. Development of flower bud requires synthesis and accumulation of photosynthates (carbohydrate and sucrose) and their translocation through stems (sinks) to developing flower buds (sinks) as reported during studies on role of sugars in opening of cut flowers (Pun and Ichimura, 2003).

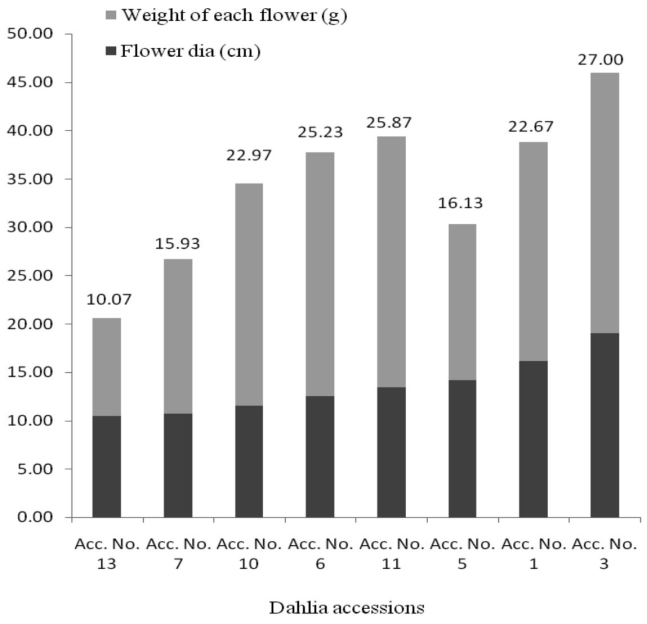

Fig. 1. Variation in weight of flower (g) in different Dahlia genotypes in increasing order of flower diameter (cm). Mean values for flower weight and flower diameter were found statistically significant (p<0.05) at LSD value of 1.82 and 0.65, respectively.

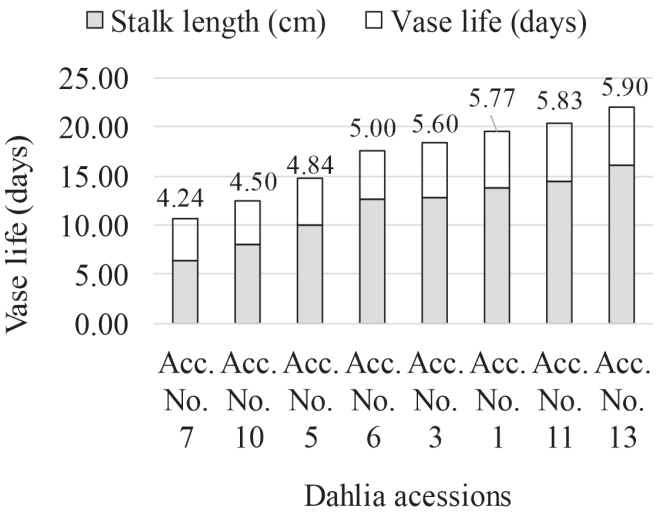

Fig. 2. Variation in vase life in different Dahlia genotypes in increasing order of stalk length. Mean values for stalk length and vase life were found statistically significant (p<0.05) at LSD value of 3.96 and 0.47, respectively.

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Mean number of days to appearance of first bud after planting ranged from 53.0-63.6 days. The Acc. no.7 took maximum number of days to first bud appearance which was observed to be par with Acc. no. 13 and Acc. no. 3, each recording mean number of days to first bud appearance of 62.33 and 61.00 days, respectively. The Acc. no. 6 was earliest in average number of days to show appearance of first bud (53.0 Days) followed by Acc. no. 11 and Acc. no.1 each recording 54.33 and 55.67 mean number of days to first bud appearance after planting. This variation may be attributed to varied genetic makeup of different cultivars along with prevailing environmental conditions. This observation was in close conformity with the results of Mishra *et al*. (1990).

Average number of days to full bloom ranged from 61.00-79.67 days after planting. The Acc. no. 7 took maximum mean number of days to full bloom which was found statistically significant with Acc. no.3 recorded with 73.67 mean number of days to full bloom after planting of Dahlia rooted cuttings. The Acc. no. 1 was earliest to bloom (61.00 days) which was found statistically significant diferent Acc. no. 6 recording 64.33 mean number of days to full bloom after the date of planting.

Significant differences were observed in duration of flowering amongst the various Dahlia cultivars evaluated. Mean days of duration of flowering ranged from 28.67-44.67- days. The Acc. no. 6 reported highest average number of days to flowering duration which was found statistically significant with accession no. 11 recording 41.00 mean number of days to duration of flowering. The Acc. no. 10 showed least mean number of days to flowering duration which was also found statistically significant with Acc. no. 1 recording mean number of 31.00 days to flowering duration. Dahlia genotypes exhibit flowering duration from less than two months (Protic, 1988 and Pudelska and Hetman, 1998) to maximum of five months (Lisichkova, 1999). This variation in duration of flowering among various dahlia cultivars has been attributed primarily to differences in genetic makeup coupled with the prevailing environmental conditions in the field.

Mean number of day of vase life of various Dahlia accessions varied from 4.240-5.90 days. The Acc. no. 13 recorded highest mean days of vase life (5.90 days) followed by Acc. no. 11 and Acc. no. 1 each recorded average days of 5.83 and 5.77 days of vase, respectively. The Acc. no. 7 reported lowest mean days of vase life (4.20 days) and was found at par with Acc. no. 10 with mean value of 4.80 days. The post harvest physiological processes of the plant such as cell turgidity, water loss through evapo-transpiration and breakdown of the reserve photosynthates markedly affect the vase life. Longer and sturdier stems account for higher water uptake and conductance within the xylem tissues. Longer stems in cut flowers also contain higher amounts of reserve carbohydrates as reported by Barman and Rajni (2004) and Sangama and Singh (2002) in Gladiolus.

In conclusion, morphological evaluation of eight Dahlia genotype accessions introduced from different geographical regions of India into subtropical conditions of Punjab exhibited variations in their vegetative and flowering characteristics. Based on their morphology and flower form, Dahlia Acc. no. 7, Acc. no. 10 and Acc. no. 11 have been found suitable for growing in 12 inch earthen pots. The Acc. no. 6 recorded highest number of days to flowering duration and was found suitable for bedding purpose. All the flowering and vegetative characters of different Dahlia genotypes were observed under the influence of genetic makeup of the concerned genotype along with their interaction with the prevailing environment.

Authors' contribution

Conceptualization and designing of the research work (KK, SS); Execution of field/lab experiments and data collection (SS); Analysis of data and interpretation (SS, KK); Preparation of manuscript (SS).

LITERATURE CITED

Barman D and Rajni K 2004. Effect of harvest maturity and spike length on post harvest life of gladiolus. *J Orn Hort* **7**:204-26.

Bhattacharjee S K 2006. *Advances in Ornamental Horticulture*. Vol 3, pp. 181-202. Pointer Publishers, Jaipur.

Dole J M, Zenaida V , Frankie L F and William F 2009. Postharvest evaluation of cut Dahlia, Linaria, Lupine, Poppy, Rudbeckia, Trachelium, and Zinnia. *Horttechnology* **3**:593-600.

Joshi R P, Mishra Y K and Solanki S S 1997. Performance of dahlia cultivars under U.P. hill conditions. *Prog Hort* **29**:175-78.

Kamenetsky R and Hiroshi O 2013. *Ornamental Geophytes: From Basic Science to Sustainable Production*. Pp. 598. CRC Press, Boca Raton, New York.

Lisichkova 1999. A study on new varieties of dahlia suitable for cut flower production. *Rasteniev'dni Nauki* **36**:152-57.

Manjula B S, Nataraj S K, Hegde P P, Anitha G and Ayesha N 2017. Evaluation of dahlia genotypes (*Dahlia variabilis* L.) for growth, yield and quality traits under hill zone of Karnataka. *Environ Ecol* **4**:365-69.

Mishra H P, Singh K P, Mishra G M and Prasad B 1990. Performance of some dahlia (*Dahlia variabilis*) varieties under late planted condition in calcareous soil of plains. *Haryana J Hort Sci* **19**:284-90.

Mousumee M, Mohanty C R, Mahapatra K C and Mishra M 2001. Genetic variability with respect to floral traits in dahlia. *J Orn Hort* **4**:79-82.

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Muthuswamy S, Thangaraj T, Nanjan K and Vedamuthu P 1981. A study on the performance of Dahlia (*Dahlia variabilis*) and Gladiolus (*Gladiolus grandiflorus*) in Shevaroys. *South Ind Hort* **9**:237-38.

Ohno S, Hosokawa M, Hoshino A, Kitamuraet Y 2011. A BHLH transcription factor, DvIVS, is involved in regulation of anthocyanin synthesis in Dahlia (*Dahlia variabilis*). *J Exp Bot* **14**:5105-16.

Protic N 1988. New dahlia cultivars. *Rasteniev'dni Nauki* **25**:52-55.

Pudelska K and Hetman J 1998. The influence of growing conditions on the growth and flowering of dahlia *Dahlia* × *cultorum*. *Folia Univ Agricult Stetin Agricultura* **70**:105-14.

Pun U K and Ichimura K 2003. Role of sugars in senescence and biosynthesis of ethylene in cut flowers. *Food Tech* **37**:219-24.

Sangama and Singh K P 1999. Effect of flower spike length on various floret qualities in gladiolus. *J Orn Hort* **2**:144-45.

Vikas H M, Patil V S and Dorajeerao A V D 2015. Evaluation of dahlia genotypes based on vegetative quality character. *Plant Arch* **1**:283-86.

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