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RESEARCH ARTICLE

DUS Characterization of Dahlia (*Dahlia variabilis*)

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Abstract

Characterisation and evaluation of native germplasm are fundamental for facilitating genetic improvement, safeguarding varieties, and conserving biodiversity. In this study, thirty-two dahlia (*Dahlia variabilis* L.) genotypes were evaluated over two consecutive years (2022–23) and (2023–24) at the Regional Horticultural Research and Training Station (RHRTS) Dhaulakuan, Sirmour (H.P). Morphological characteristics (51) were used for the identification and grouping of dahlia genotypes. A set of 51 morphological traits was used to distinguish and classify the genotypes in line with the DUS (Distinctiveness, Uniformity, Stability) testing framework developed by RHRTS, Dhaulakuan, Sirmour, in collaboration with BCKV, Kalyani (West Bengal) funded by PPV & FRA, India. The DUS characteristic profile was developed for all 32 genotypes, enabling clear varietal grouping and identification.

Keywords: Characterization, DUS, Dahlia, Genotype

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Introduction

Dahlia (*Dahlia variabilis* L.) is a highly valued tuberous-rooted, perennial and herbaceous flowering plant, celebrated for its stunning and showy blooms. Native to Mexico, it was introduced to India in 1857 by the Agri-Horticultural Society of India (formerly the Royal Agri-Horticultural Society of India). Dahlias are grown for ornamental purposes due to their aesthetic characteristics, which are crucial for the ornamental industry. They are easy to grow both in the ground and pot. Dahlias are extensively used for exhibition, garden display and home decoration and as a cut flower. It is commercially propagated by stem cuttings. Also propagated by seeds, division of tuberous roots and micro-propagation methods. Because of the harsh weather conditions in India during the summer, it is primarily produced as a winter bloom. The Netherlands is a major producer of tuberous-rooted Dahlias, supplying 50 million tubers annually to international markets (Singh *et al.,* 2023; Kumar *et al.,* 2024).

National and international intellectual property authorities such as the UPOV (International Union for the Protection of New Varieties of Plants) and India's PPV&FRA (Protection of Plant Varieties and Farmers' Rights Authority) rely on phenotypic (DUS: Distinctness, Uniformity, Stability) traits as the foundation for registering plant varieties and granting breeders' rights. These morphological characteristics serve not only to

distinguish varieties for legal protection, but also support broader investigations in genetics, taxonomy, evolutionary studies, diversity assessment and their economic utilization. With this in mind, the present research aimed to explore the existing diversity within dahlia (*Dahlia variabilis* L.) germplasm. The study evaluated thirty-two dahlia genotypes using a set of 51 DUS descriptors to assess variability and distinct morphological traits**.**

Materials and Methods

The present study was carried out at the Regional Horticultural Research and Training Station Dhaulakuan, Sirmour, with three replications. Terminal (apical) cuttings were used as a vegetative method for the rapid multiplication of true-to-type plants. Healthy, disease-free tubers were first planted in pots or sand beds under protected conditions. When new shoots emerged and attained a length of 7–10 cm, the terminal portions were selected for cuttings. Terminal cuttings were taken with 2–3 nodes and a few leaves. The lower leaves were removed to reduce transpiration losses. The basal portion of the cutting was treated with rooting hormones such as IBA at 500–1000 ppm to promote early and better root initiation. The media combination of cocopeat + sand was found to be best for root development during Sept-October. Rooted cuttings were transplanted in the fields having a plot size of 1.2 m × 1.2 m with a spacing of 60 cm × 40 cm. Observations were recorded on ten randomly selected plants in each replication as per DUS guidelines. The data on 51 different morphological characters were collected from the selected genotypes (10 plants/genotype) during two consecutive years (2023 and 2024) based on the PPV&FRA - drafted DUS guidelines of dahlia. Qualitative and pseudo-qualitative characteristic parameters were recorded by visual assessment, and quantitative parameters were measured physically under daylight conditions on ten plants per replication by excluding border rows. Flower colour observations were standardized using the Royal Horticultural Society (RHS) colour chart. Colour determinations using a colour chart were made in the middle of the day in a room without direct sunlight because daylight varies. These determinations are made with the plant part placed against a contrasting background. Genotypes studied were Aditya, Agni, Bhikhu's Mother, Black Eternity, Blackout, Chitchor, Cooch Behar, Dust Stone Red, Dust Stone Orange, Eternity, Gargi, Giani Zail Singh, Glory of India, Good Day, Hiranmoyee, Jishu, Kamla, Kenya Blue, Kenya White, Kenya Orange, Kenya Yellow, Kenya Gerua, Lal Bai, Matungini, Minu, Mother Teresa, Piusenia Pink, Piusenia White, Provujee, SP Kamla, Shubhra and Tenzing Norgay.

Results and Discussion

Vegetative characters

Anthocyanin pigmentation, growth habit, stem girth: Vegetative traits utilized for the characterization of the germplasm, along with the number of genotypes identified for each trait, are presented in Table 1. A

Table 1: Genotypes identified for each characteristic state in the studied dahlia germplasm

Sr. No.	Characteristic	State and No. of genotypes
1	Leaf Anthocyanin	Absent (28) Present (4)
2	Bud Anthocyanin	Absent (29) Present (3)
3	Position of terminal bud on stem	Straight (20) Curved (12)
4	Plant growth habit	Upright (27) Spreading (5)
5	Plant Height (cm)	Very short (<50) (2) Short ⩾51-70) (8) Medium (⩾ 70-90) (9) Tall (⩾ 90-110) (6) Very tall (>110) (7)
6	Stem anthocyanin	Absent (26) Present (6)
7	Stem colour	Yellow Green 145B (2) Greyed Orange 177A (7) Greyed Purple 187A (23)
8	Stem Girth (mm)	Thin (<9) (3) Medium (⩾ 9-14) (19) Thick (>14) (10)
9	Leaf Type	Simple (4) Pinnate (27) Bipinnate (1)
10	Leaf Wing	Absent (19) Present (13)
11	Leaf Texture	Hard (17) Soft (15)
12	Leaf glossiness	Absent (24) Present (8)
13	Leaf pubescence	Absent (23) Present (9)
14	Leaf Length (cm)	Small (<10) (2) Medium (⩾10 -20) (20) Large (>20) (10)
15	Leaf Width (cm)	Narrow (<10) (2) Medium (⩾10 -20) (28)

		Broad (>20) (2)
16	Leaf colour RHS Colour charts	Yellow Green 146A (5) Green 137A (24) Purple Green NN137A (3)
17	Leaf Tip	Pointed (12) Tapering (9) Triangular (10) Elongated (1)
18	Leaf Shape	Ovate (14) Elliptic (16) Oblanceolate (2)
19	Leaf vein	Depressed (10) Flat (10) Raised (12)
20	Leaflet shape of base	Acute (10) Obtuse (10) Rounded (1) Asymmetric (3) Truncate (3) Cordate (0)
21	Peduncle length (cm)	Short (<20) (6) Medium (⩾20-40) (20) Long (>40) (7)
22	Anthocyanin of peduncle	Absent (21) Present (11)
23	Length of peduncle above leaf node (cm)	Short (<10) (6) Medium (⩾10-15) (21) Long (>15) (5)
24	Flower heads: position in relation to foliage	Below foliage (1) At same level (3) Above foliage (28)
25	Flower head attitude	Drooping (5) Horizontal (5) Upright (22)
26	Flower head length (cm)	Short (<5) (4) Medium (⩾5- 10) (21) Long (> 10) (7)
27	Flower head diameter (cm)	Miniature (< 10) (2) Small (⩾10- 15) (5) Medium (⩾15-17) (16) Large (⩾17- 20 cm) (4) Dinner - plate sized (>20 cm) (5)
28	Flower head type	Single (1) Semi double (1) Daisy eyed (2) Decorative (14) Pompon (12) Cactus (2)
29	Flower collar segments	Absent (29) Present (3)
30	Flower Disc	Absent (29) Present (3)
31	Ray floret: upper surface	Smooth (16) Keeled (16)
32	Ray florets: No. of keels	One (2) Two (28) More than two (2)
33	Ray floret: twisting	Absent (28) Present (4)
34	Ray floret: shape of apex	Pointed (23) Dentate (4) Rounded (2) Tapering (1) Dome (1) Twisted (1)
35	Length of Ray florets(cm)	Short (<5) (7) Medium (⩾5- 10) (16) Long (>10) (9)
36	Width of Ray florets (cm)	Narrow (<3) (7) Medium (⩾3- 5) (18) Broad (>5 (7)
37	Ray florets: Longitudinal axis	Incurving (25) Straight (4) Reflexing (3)
38	Ray floret: number of colours	Single (25) Bicoloured (4) Multicoloured (3)
39	Ray Floret: Colour of lower surface	Same (25) Different (7)
40	Flower Colour: Ray floret primary colour (RHS colour charts)	White 155 (4) Yellow 3 (6) Orange 25 (5) Red N45 (8) Red Purple 59 (7) Purple NN 78 (2)
41	Distribution of second colour of ray florets	At Tips (6) At basal (1) At margins (1) Blended (24)
42	Ray floret: profile in cross section at mid-point	Flat (1) Concave (26) Convex (5)
43	Ray floret: Position of twisting	Apical (6) Middle (22) Basal (5)
44	Anthocyanin on Epicalyx	Absent (22) Present (10)
45	Shape of Epicalyx	Rounded (5) Elongated (27)
46	Flowering period (No. of days after transplanting)	Early (11) Mid (12) Late (9)
47	Duration of flowering (days)	Short (4) Medium (14) Long (14)
48	Vase life (days)	Short (<4) (20) Medium (⩾4- 6) (7) Long (>6) (5)
49	Shape of tubers	Rounded (8) Elongated (24)

considerable degree of variability was observed among the genotypes for most of the evaluated parameters. Anthocyanin pigmentation in the leaf and bud was absent in approximately 98% of the genotypes, with the exception of 'Black Eternity' and 'Tenzing Norgay', where its presence was recorded. The terminal bud was predominantly straight across genotypes, except in 'Tenzing Norgay', which exhibited a curved bud. Growth habit varied from upright to spreading, with the majority of genotypes displaying an upright growth pattern. Plant height ranged from very short to short and medium to tall categories. The overall plant architecture, determined by growth type, habit, and height, plays a crucial role in optimizing resource acquisition from the environment. Most genotypes were categorized as medium to tall in height, except for 'Black Eternity' and 'Minu', which exhibited shorter stature. Kumar *et al.,* (2022) and Thakur *et al.,* (2022) have previously documented such discrepancies, emphasizing the intricate interplay between genetic composition and environmental factors in influencing plant characteristics.

Stem girth classified the cultivars into three categories: thin (<9 mm), medium (9–14 mm) and thick (>14 mm). Most genotypes exhibited medium stem thickness, except for 'Dust Stone Red', 'Dust Stone Orange', 'Matungini' and 'Minu'. Variability in stem girth can be attributed to both genetic differences among cultivars and environmental influences, as also reported by Mounika and Saravanan (2019). Leaf types ranged from simple to pinnate and bipinnate, with the majority of genotypes exhibiting bipinnate leaves and lacking leaf wings. Leaf glossiness and pubescence were largely absent, and most genotypes displayed hard leaf texture. Leaf length ranged from small (<10 cm) to medium (10–20 cm) and large (>20 cm), with most genotypes falling in the medium category for both length and width. These traits collectively reflect the extensive morphological diversity characteristic of dahlia. Leaf colour, assessed using the RHS colour chart, was predominantly yellow-green (146A), while 'Black Eternity' exhibited a distinct purple-green (137A) hue.

Leaf tips were categorized as pointed, tapering, triangular and elongated. Leaf shape varied among genotypes, ranging from ovate to elliptic and oblanceolate, with the majority of genotypes exhibiting an elliptic shape, an acute leaflet base and a triangular tip. Peduncle length ranged from short to long, with medium-length peduncles being most prevalent among the genotypes. Anthocyanin pigmentation was absent in most of the genotypes studied, except for 'Tenzing Norgay' and 'Black Eternity', where it was distinctly present.

Flowering characteristics

Flower head position, flower diameter, colour of florets: Flower heads exhibited upright posture and flower head position above foliage in maximum genotypes. Flower head length was predominantly medium (5–10 cm) across genotypes, consistent with standard dahlia phenotyping protocols. Flower diameter ranged from miniature (>10–15 cm), small (⩾ 10–15 cm), medium (⩾ 15–17 cm), large (⩾ 17–20 cm) to dinner-plate size (>20 cm). Miniature-sized flower heads were observed in genotypes such as 'Dust Stone Red', 'Dust Stone Orange', and 'Mother Teresa', whereas 'Kenya Blue', 'Kenya White', 'Kenya Gerua', and 'Matungini' were classified as dinner-plate types.

Among the various dahlia genotypes, flower types ranged from single, semi-double, daisy-eyed double and double to decorative, pompon and cactus forms. The majority of genotypes exhibited the decorative flower type, while single-flowered types were recorded in 'Agni', and semi-double flowers were observed in 'Lal Bai'. In most genotypes, the flower collar and disc were absent, except in a few genotypes such as 'Cooch Behar', 'Kamla', and 'Glory of India'. In approximately 95% of genotypes, ray florets exhibited two keels. More than two keels were recorded in 'Matungini' and 'Giani Zail Singh', whereas a single keel was noted in 'Piusenia Pink' and 'Piusenia White'. The apex of ray florets was generally pointed, and twisting was absent in the majority of genotypes. Ray floret length varied from short (<5 cm) to medium (⩾ 5–10 cm) and long (>10 cm), with most genotypes exhibiting medium length and width, along with an incurving longitudinal axis. Most dahlia genotypes produced flowers with uniformly coloured ray florets, except for 'Good Day', which exhibited multicoloured florets. Bicoloured ray florets were observed in genotypes such as 'Bhikhu's Mother', 'Gargi', 'Giani Zail Singh', 'Lal Bai', and 'Mother Teresa'.

In all genotypes, the distribution of the second colour on ray florets was blended, with a concave profile observed in cross-section at the midpoint. Flower colour is a key ornamental trait in dahlia, and six distinct flower colour groups were identified among the studied genotypes, following DUS (Distinctness, Uniformity, and Stability) characterization guidelines. The position of ray florets varied among apical, middle, and basal regions, with approximately 80% of genotypes displaying florets positioned at the middle. Anthocyanin pigmentation in the epicalyx was absent in most genotypes, and an elongated epicalyx shape

was observed in 90% of them. Flowering period was categorized into early (<70 days), mid (⩾ 70–100 days), and late (>100 days). The majority of genotypes fell under the early and mid-flowering categories, while only a few exhibited a short flowering duration. Vase life was generally short in most genotypes, though it varied significantly among cultivars, likely due to differences in carbohydrate accumulation. Similar results were also recorded by Kumar *et al.,* (2021). Regarding tuber morphology, 90% of the genotypes possessed elongated tubers, while a few exhibited round-shaped tubers.

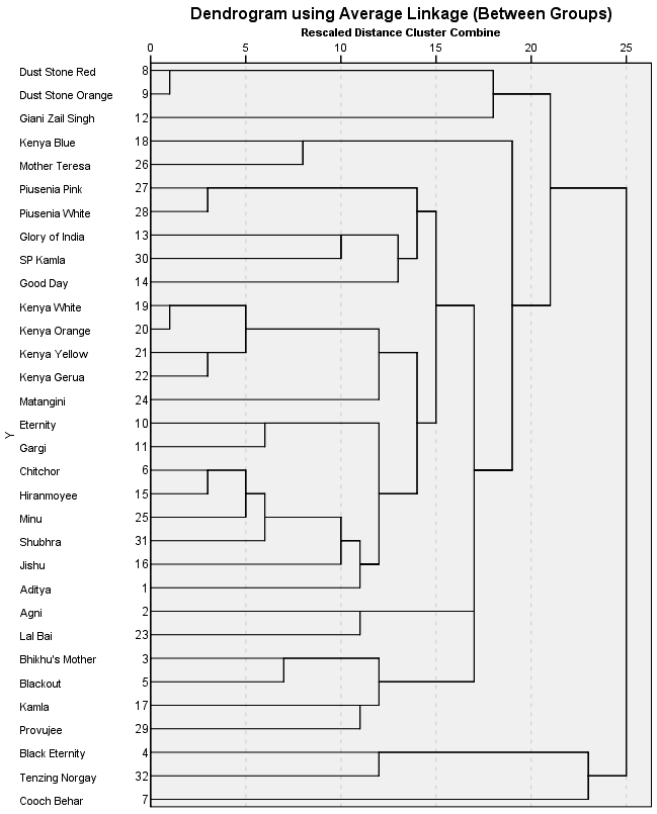

Fig. 1: Hierarchical cluster analysis dendrogram of dahlia genotypes based on morphological data using average linkage (between groups).

Conclusion

The present study revealed the vast variability within characterized dahlia genotypes for different vegetative and flowering traits. Characterized data of different traits could be used as a reference collection for the identification of dahlia varieties. Hierarchical cluster analysis separated the genotypes into different clusters (Fig. 1). The information on different traits is also helpful for future improvement programmes for developing novel type varieties. The given information will also help the breeders and nurserymen to seek the protection of their new material under PPV and FRA, New Delhi.

References

Kumar R, P Thakur, YC Gupta and R Dogra (2022) Genetic variation of dahlia cultivars evaluated in sub-tropical Himalayas and path coefficient analysis of flowering and vegetative characters. *Prog. Hortic.* 54(1): 82-87.

Kumar R, P Thakur, YC Gupta, AK Joshi, P Sharma, A Sharma and S Singh (2021) Evaluation of dahlia (*Dahlia variabilis* L.) cultivars for growth and flowering characteristics under sub-montane, sub-tropical low hill zone of Himachal Pradesh. *Int. J. Farm Sci.* 11(1-2): 19-23.

Kumar M, P Thakur, B Kashyap, P Kumar, A Sharma, B Bhardwaj and AH Shah (2024) Effect of different planting dates on tuber production in dahlia (*Dahlia variabilis* L.) under low hill conditions of Himachal Pradesh, India. *Plant Cell Biotechnol. Mol. Biol.* 25: 71-78.

Mounika T and SS Saravanan (2019) Response of different dahlia (*Dahlia variabilis* L.) varieties under Prayagraj agro-climatic conditions. *Int. J. Curr. Microbiol. Appl. Sci.* 8(8): 2389-97.

Singh S, KK Dhatt and PK Bodla (2023) Exploring genetic diversity of dahlia (*Dahlia variabilis*) germplasm using multivariate statistical analysis. *J. Hortic. Sci.* 18: 67-76.

Thakur P, AH Shah, Y Adhikari, M Kumar and S Verma (2022) Dahlia cultivation in India and abroad: a review. *Int. J. Plant Soil Sci.* 4(19): 240-51.