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## Classification and evaluation of gerbera cultivars

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### ABSTRACT

An experiment was conducted to classify and evaluate the available gerbera cultivars (*Gerbera jamesonii*, Hook) in Bangladesh. We used twenty four gerbera cultivars and those were coded from V<sub>1</sub>-V<sub>24</sub>. It was found that V<sub>8</sub>, V<sub>9</sub>, V<sub>10</sub>, V<sub>11</sub>, V<sub>12</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>, V<sub>20</sub>, V<sub>21</sub>, V<sub>22</sub>, V<sub>23</sub> and V<sub>24</sub> were performed as best in terms of different growth, yield also the quality contributing characters. These cultivars (V<sub>8</sub>-V<sub>12</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>-V<sub>24</sub>) also provided plenty of variation for leaf area (ranges from 215.7 cm<sup>2</sup> to 231.1 cm<sup>2</sup>). We found that flower head diameter was >10.0 cm (except V<sub>8</sub>), peduncle diameter was >8.0 mm, standard peduncle length >30.0 cm and petal thickness >0.39 mm (except V<sub>8</sub>) for these the best performing cultivars (V<sub>8</sub>-V<sub>12</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>-V<sub>24</sub>). On the other hand we had classified these 24 gerbera cultivars into 5 classes according to their blooming pattern. The five classes are singles (V<sub>1</sub>, V<sub>4</sub>, V<sub>14</sub>) doubles (duplex) (V<sub>5</sub>, V<sub>12</sub>, V<sub>18</sub>, V<sub>21</sub>, V<sub>22</sub>, V<sub>23</sub>, V<sub>24</sub>), crested doubles (V<sub>2</sub>, V<sub>3</sub>, V<sub>6</sub>, V<sub>7</sub>, V<sub>8</sub>, V<sub>10</sub>, V<sub>11</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>, V<sub>20</sub>), full crested doubles (V<sub>9</sub>) and quilled crested doubles (spider) (V<sub>13</sub>, V<sub>17</sub>).

**Key Words:** *Gerbera jamesonii*, Classification and Performance

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### I. Introduction

Gerbera (*Gerbera jamesonii* Hook.) is an important cut flower having single, double and spider flowers belongs to Asteraceae family. The color variation, their meaning, size of flowers, long lasting behavior and wide adoptability for culture made gerbera a flower of choice for cultivation in Bangladesh. There is a great demand for gerbera in Bangladesh. In the recent years, floriculture is fast emerging as highly competitive, commercial and economic activity with potential for earning valuable foreign exchange. Thus in these circumstances several adventures, enthusiastic entrepreneurs and nursery men are utilizing this opportunity and are introducing latest and improved gerbera cultivars from abroad for cultivation. Classification of flower bloom is a technique for grouping of flower bloom using specific features such as arrangement of florets. Flower blooms were classified according to their blooming pattern is generally done for the visual differentiation of flowers (Taufique et al., 2016). Classification of flower according to their bloom can help to the commercial grower to isolate for a better way of marketing. Though gerbera has a numerous number of hybrids, but findings the classification from this will also helpful for future gerbera breeder for the development of hybrid. Performance of each gerbera cultivars varies with the region, season and other growing condition (Hossain et al., 2015;

Mehraj et al., 2014; Jamal Uddin et al., 2014; Horn et al., 1974). There is always demand for novel types with high yielding genotypes. Hence it is need to evaluate new cultivars for their quantitative and qualitative parameters and finally to recommend the suitable cultivars for Bangladesh. Therefore, present investigation was carried out with a view to classify and evaluate the performance of the gerbera cultivars available in Bangladesh.

## II. Materials and Methods

This experiment was conducted at Rooftop Garden under *Zabiotech*, Department of Horticulture, Sher-e-Bangla Agricultural University, Bangladesh during the months of December 2012 to July 2013 to classify and evaluation of gerbera cultivars. The experiment was laid out in completely randomized design (CRD) with three replications. Same aged micropropagated seedlings were collected from Krishibid Upokoron Nursery, Sher-e-Bangla Nagar, Dhaka-1207 and these were used in the experiment. Soil and cow-dung (1:1) were mixed and pots were filled 7 days before transplanting. We applied cowdung @ 1 t ha<sup>-1</sup>, cocodust @ 2000 kg ha<sup>-1</sup>, urea 350 @ kg ha<sup>-1</sup>, TSP 250 @ kg ha<sup>-1</sup>, MOP 300 @ kg ha<sup>-1</sup>, zipsum 165 @ kg ha<sup>-1</sup>, boric acid 12 @ kg ha<sup>-1</sup> and zinc oxide 4 @ kg ha<sup>-1</sup> in soil of well ploughed field (BARI, 2011). Then we filled the experimental pot with the fertilized field soil. We used 24 cultivars for this experiment and coded these from V<sub>1</sub> to V<sub>24</sub>. Data were collected on leaves number, plant height, leaf area, chlorophyll content, number of flower, flower head diameter, peduncle diameter, peduncle length and petal thickness from each pot within the period. Leaves number, plant height, leaf area and chlorophyll content were measured at 100 days after transplanting. Leaf area was measured by non-destructive method using CL-202 Leaf Area Meter (USA). SPAD-502 Chlorophyll Meter was used for measuring chlorophyll content in percentage (%). Peduncle diameter and petal thickness were measured by using Digital Caliper-515 (DC-515). All parameters were statistically analyzed by using MSTAT-C program. Mean for all the treatments was calculated, analysis of variance for each of the characters was performed by F-test and difference between treatments was evaluated by Least Significant Difference (LSD) at 5% level of significance (Gomez and Gomez 1984). We employed SPSS (Statistical Package for the Social Sciences) to build the Dendrogram for grouping the variants according to the morphological and yield contributing characters.

## III. Results and Discussion

### Classification of gerbera cultivars

Gerbera blooms comprise three types of florets: The center (disc, eye) contains disc florets; around the center is a ring of intermediate trans florets; and the petals that compose the outer ring are known as ray florets. There are five standard types of gerbera flowers.

**Singles:** Gerbera flowers that posed one row of non overlapping petals (ray florets) usually with a green center (disc florets). Among the 24 gerbera cultivars V<sub>1</sub>, V<sub>4</sub>, V<sub>14</sub> belonged to the class of singles.

**Doubles (Duplex):** Gerbera flowers that posed two rows of overlapping petals, with a green or dark center. V<sub>5</sub>, V<sub>12</sub>, V<sub>18</sub>, V<sub>21</sub>, V<sub>22</sub>, V<sub>23</sub>, V<sub>24</sub> were doubles or duplex.

**Crested doubles:** Gerbera flowers that posed two rows of overlapping petals, with one or more inner rows of shorter petals (Trans florets), and a green or dark center. V<sub>2</sub>, V<sub>3</sub>, V<sub>6</sub>, V<sub>7</sub>, V<sub>8</sub>, V<sub>10</sub>, V<sub>11</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>, V<sub>20</sub> were the crested doubles.

**Full crested doubles:** Gerbera flowers that posed solid overlapping rows of petals, with inner rows of shorter petals that cover the center entirely. Among the gerbera cultivars only V<sub>9</sub> belonged to the class of full crested doubles.

**Quilled crested doubles (Spider):** Gerbera flowers that posed overlapping rows of spike-shaped petals, with one or more inner rows of shorter petals, and a green or dark center. V<sub>13</sub>, V<sub>17</sub> were quilled crested doubles or spider.

Similarly flower bloom classification was also done in chrysanthemum (Taufique et al., 2016).

**Table 01. Classification of 24 gerbera cultivars**

Class	Varieties
Singles	V <sub>1</sub> , V <sub>4</sub> , V <sub>14</sub>
Doubles (Duplex)	V <sub>5</sub> , V <sub>12</sub> , V <sub>18</sub> , V <sub>21</sub> , V <sub>22</sub> , V <sub>23</sub> , V <sub>24</sub>
Crested doubles	V <sub>2</sub> , V <sub>3</sub> , V <sub>6</sub> , V <sub>7</sub> , V <sub>8</sub> , V <sub>10</sub> , V <sub>11</sub> , V <sub>15</sub> , V <sub>16</sub> , V <sub>19</sub> , V <sub>20</sub>
Full crested doubles	V <sub>9</sub>
Quilled crested doubles (Spider)	V <sub>13</sub> , V <sub>17</sub>

### Evaluation of gerbera cultivars

**Leaves number:** Number of leaves was varied significantly among the cultivars. Maximum number of leaves was found from V<sub>4</sub> (65.5) whereas minimum from V<sub>20</sub> (14.3) at 100 days after transplanting (Table 02). Variation in leaf production per plant has also reported by Hossain et al. (2015); Mehraj et al. (2014); Jamal Uddin et al. (2014); Kandpal et al. (2003); Mahanta et al. (2003); Reddy et al. (2003) and Kannan and Ramdas (1990) in gerbera.

**Plant height:** Plant height of gerbera cultivars was varied significantly among the cultivars. Tallest plant was obtained from V<sub>1</sub> (55.9 cm) whereas shortest from V<sub>15</sub> (39.9 cm) at 100 days after transplanting (Table 02). Variations in plant height in gerbera cultivars were also observed by Hossain et al. (2015); Mehraj et al. (2014) and Reddy et al. (2003). The plant height is being genetical factor, it is expected to vary among the cultivars (Sarkar and Ghimaray, 2004).

**Leaf area:** Leaf area of the gerbera cultivars was showed significant variation. Maximum leaf area was found from V<sub>10</sub> (231.1 cm<sup>2</sup>) followed by V<sub>16</sub> (229.7 cm<sup>2</sup>) whereas minimum from V<sub>1</sub> (145.6 cm<sup>2</sup>) at 100 days after transplanting (Table 02). Leaf area of plants may vary among the cultivars due to the genetic factor. Singh and Ramachandran (2002) and Thomas et al. (2004) also found the variation in leaf area among the cultivars.

**Chlorophyll content:** Chlorophyll content was measured at 100 days after transplanting and found that V<sub>1</sub> had the maximum chlorophyll content (55.9%) followed by V<sub>7</sub> (55.0%) whereas minimum from V<sub>10</sub> (45.2%) (Table 02). Mehraj et al. (2013) found that chlorophyll content ranges from 37.7-53.0% in gerbera. Chlorophyll content significantly varied due to the variation of cultivars (Mehraj et al., 2014). That result is closely similar to the findings of the current experiment.

**Number of flower:** Number of flower of gerbera cultivars was varied significantly. Maximum number of flower was found from V<sub>3</sub> (24.2) whereas minimum from V<sub>15</sub> (13.1) (Table 02). From the current experiment, number of flower production was varied among the cultivars of gerbera. Similar result was reported by Hossain et al. (2015); Mehraj et al. (2014); Jamal Uddin et al. (2014); and Gotz (1983).

**Flower head diameter:** Flower head diameter was varied significantly among the cultivars. Maximum flower head diameter was found from V<sub>9</sub> and V<sub>10</sub> (12.9 cm) which was statistically similar with V<sub>11</sub> (12.7 cm) while minimum from V<sub>5</sub> and V<sub>6</sub> (7.0 cm) which was statistically similar with V<sub>7</sub> (7.1 cm) (Table 02). Large differences were found in flower diameter among different cultivars (Hossain et al., 2015; Mehraj et al., 2014; Jamal Uddin et al., 2014; Gotz, 1983).

**Peduncle diameter:** Maximum peduncle diameter was provided by V<sub>24</sub> (12.9 mm) which was statistically similar with V<sub>16</sub> (12.7 mm) (Table 02). On the other hand minimum from V<sub>1</sub> and V<sub>7</sub> (3.1 mm) which was statistically similar with V<sub>6</sub> (3.3 mm) (Table 02). Gerbera provided maximum peduncle diameter was 0.64 cm (Acharya et al., 2010) while minimum 2.7 mm (Mehraj et al., 2013). A significant variation was found among the cultivars of gerbera by Hossain et al. (2015); Mehraj et al. (2014) and Jamal Uddin et al. (2014). As the diameter of peduncle increases the carbohydrates content of peduncle also increases which helps in increasing the stability of vase life of the cut flowers thereby prolonging the vase life of cut flowers and for that reason peduncle length might play an important role in the post harvest vase life of cut flowers.

**Peduncle length:** Maximum peduncle length was found from V<sub>15</sub> (46.7 cm) followed by V<sub>16</sub> (44.2 cm) whereas minimum from V<sub>6</sub> (24.1 cm) (Table 02). It was found that the longest peduncle 57.9 cm

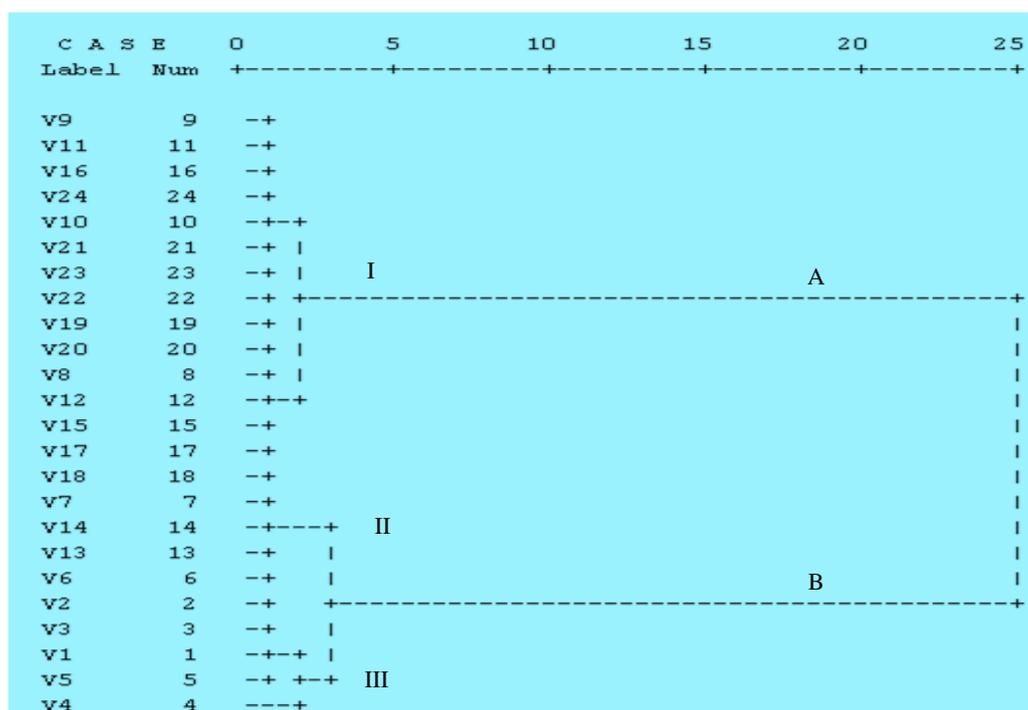
(Acharya et al., 2010) while shortest 26.7 cm (Mehraj et al., 2013). The variation in peduncle length among the cultivars was due to the genetic characters of particular genotype (Ambad et al., 2001 and Kandpal et al., 2003). Peduncle length is one of the characters, which decides the quality cut flowers. Similarly variation in peduncle length was also observed in gerbera by Hossain et al. (2015); Mehraj et al. (2014) and Jamal Uddin et al. (2014).

**Petal thickness:** Maximum petal thickness was observed from V<sub>10</sub>, V<sub>16</sub> and V<sub>24</sub> (0.45 mm) followed by V<sub>9</sub> (0.44 mm) whereas minimum from V<sub>6</sub> (0.16 mm) (Table 02). Similar results were also obtained by Hossain et al. (2015) and Jawaharlal (2002) in gerbera. Such type of varietal differences might be due to the inherent genetical characters associated with the genotypes.

### Cluster analysis

Dendrogram present the information concerning which observations are grouped together at various levels of similarity and dissimilarity. Each observation is considered its own cluster. Horizontal lines extend up for each observation and at various similarity and dissimilarity values, these lines are connected to the lines from other observations with a vertical line. The observations continue to combine until. The results of the cluster analysis (Ward's method) based on varietals characteristics are presented in the Figure01; the cluster diagram (also called cluster trees) revealed two major groups. Groups A and B. Group A comprised of single clusters (Cluster I). Cluster I containing eight variety (V<sub>21</sub>, V<sub>10</sub>, V<sub>23</sub>, V<sub>22</sub>, V<sub>19</sub>, V<sub>20</sub>, V<sub>8</sub> and V<sub>12</sub>). Group B consist of two clusters (Cluster II and Cluster III). Dendrogram shows that the varieties in one cluster are mostly identical and have less diversity. Cluster analysis was also previously done by many researcher in gerbera (Hossain et al., 2015); chrysanthemum (Mehraj et al., 2016); rice (Touhiduzzaman et al., 2016).

#### Dendrogram Using Average Linkage (Between Groups) Rescaled distance between clusters combines



**Figure 01. Dendrogram of 24 gerbera cultivars using average linkage (between groups) rescaled distance cluster combine (WARD's method).**

**Table 02. Performance of gerbera 24 cultivars to different characters**

Variety	At 100 DAT				Number of flower	Flower head diameter (cm)	Peduncle diameter (mm)	Peduncle length (cm)	Petal thickness (mm)
	Leaves number	Plant height (cm)	Leaf area (cm <sup>2</sup> )	Chlorophyll content (%)					
V <sub>1</sub>	53.5 b	55.9 a	145.6 w	55.9 a	22.7 b	9.3 g	3.1 p	27.0 q	0.18 l
V <sub>2</sub>	51.6 c	51.5 e	150.7 r	54.6 c	21.5 d	7.7 k	3.6 o	31.9 o	0.22 j
V <sub>3</sub>	46.0 e	54.0 c	149.5 s	56.0 a	24.2 a	8.4 i	4.1 n	32.5 n	0.21 k
V <sub>4</sub>	65.5 a	55.2 b	155.9 n	53.7 e	21.9 c	8.2 j	3.7 o	34.3 k	0.23 i
V <sub>5</sub>	48.8 d	50.2 h	147.8 u	53.3 f	21.2 e	7.0 m	4.1 n	40.8 f	0.22 j
V <sub>6</sub>	29.2 j	54.0 c	153.6 p	54.1 d	20.5 f	7.0 m	3.3 p	24.1 r	0.16 m
V <sub>7</sub>	35.4 h	51.1 f	148.9 t	55.0 b	22.8 b	7.1 m	3.1 p	34.5 j	0.18 l
V <sub>8</sub>	18.6 o	43.0 m	216.0 k	48.7 j	13.7 q	8.7 h	9.3 i	36.6 h	0.28 g
V <sub>9</sub>	16.6 r	43.2 lm	227.4 d	45.9 l	15.5 m	12.9 a	12.6 b	43.4 d	0.44 b
V <sub>10</sub>	17.2 p	43.0 m	231.1 a	45.2 n	15.9 kl	12.9 a	12.3 c	43.8 c	0.45 a
V <sub>11</sub>	17.0 pq	43.8 j	227.0 e	45.4 mn	15.7 lm	12.7 a	12.5 bc	42.9 e	0.43 c
V <sub>12</sub>	24.2 l	41.3 p	214.0 m	48.3 k	14.7 o	7.4 l	5.3 m	43.7 c	0.40 e
V <sub>13</sub>	32.0 i	50.6 g	153.2 q	53.3 f	20.3 g	7.4 l	3.6 o	37.7 g	0.18 l
V <sub>14</sub>	38.6 f	51.9 d	147.0 v	55.1 b	19.4 i	8.1 j	7.9 k	35.4 i	0.26 h
V <sub>15</sub>	26.6 k	39.9 q	219.8 i	48.8 j	13.1 r	8.8 h	7.3 l	46.7 a	0.40 e
V <sub>16</sub>	16.9 q	43.5 k	229.7 b	45.5 m	16.2 j	12.8 a	12.7 ab	44.2 b	0.45 a
V <sub>17</sub>	36.6 g	51.4 e	156.0 n	53.0 g	20.0 h	10.5 f	10.4 h	32.8 m	0.22 j
V <sub>18</sub>	36.6 g	49.7 i	155.0 o	54.0 d	20.7 f	11.4 e	12.1 d	32.1 o	0.22 j
V <sub>19</sub>	15.6 s	43.0 m	218.9 j	49.4 h	13.5 q	11.8 d	8.7 j	34.6 j	0.40 e
V <sub>20</sub>	14.3 t	42.5 n	215.7 l	49.1 i	14.1 p	12.1 c	10.3 h	34.1 l	0.41 d
V <sub>21</sub>	21.2 m	42.2 o	220.8 h	48.8 j	15.0 n	12.2 c	10.8 g	32.0 o	0.40 e
V <sub>22</sub>	18.5 00	42.5 n	223.7 f	49.0 i	14.5 o	12.1 c	11.4 f	32.7 mn	0.39 f
V <sub>23</sub>	19.5 n	42.5 n	221.8 g	48.2 k	14.3 p	12.3 bc	11.7 e	31.7 p	0.41 d
V <sub>24</sub>	17.0 q	43.3 l	229.1 c	45.5 m	16.0 k	12.4 b	12.9 a	43.1 e	0.45 a
LSD									
0.05	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.01
CV%	0.1	0.3	0.3	0.3	0.8	1.4	1.7	0.4	2.8



**Figure 02. Gerbera cultivars**

#### IV. Conclusion

V<sub>1</sub>, V<sub>4</sub>, V<sub>14</sub> (single), V<sub>5</sub>, V<sub>12</sub>, V<sub>18</sub>, V<sub>21</sub>, V<sub>22</sub>, V<sub>23</sub>, V<sub>24</sub> (doubles/duplex), V<sub>2</sub>, V<sub>3</sub>, V<sub>6</sub>, V<sub>7</sub>, V<sub>8</sub>, V<sub>10</sub>, V<sub>11</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>, V<sub>20</sub> (crested doubles), V<sub>9</sub> (full crested doubles) and V<sub>13</sub>, V<sub>17</sub> (quilled crested doubles or spider) cultivars were classified into five different groups. Further classification study of these flower with their leaf

shape is suggested. From the above result and discussion it can be stated that V<sub>8</sub>, V<sub>9</sub>, V<sub>10</sub>, V<sub>11</sub>, V<sub>12</sub>, V<sub>15</sub>, V<sub>16</sub>, V<sub>19</sub>, V<sub>20</sub>, V<sub>21</sub>, V<sub>22</sub>, V<sub>23</sub> and V<sub>24</sub> can be suggested to cultivate commercially for higher market value.

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