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Morphological and phytochemical diversity in various *Hibiscus* germplasms

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Abstract
The present study assessed twenty different germplasms of *Hibiscus rosa sinensis* for morphological and their neutraceutical potential in form of phytochemicals consecutively for two years. Significant variation with regard to morphological parameters like plant height, plant spread, flower diameter, number of flowers per plant per year and flower weight per plant per year as well as neutraceutical aspects like protein, carbohydrates and iron among different germplasm were observed. With regard to plant height, significantly maximum plant height was observed with NH_{10} while minimum plant height was recorded in germplasm NH_{17}. Maximum plant spread in North to South and East to West direction were observed in germplasm NH_{14} whereas, it was minimum in germplasm NH_{18}. Among different germplasms, NH_{16} showed maximum flower diameter which was followed by NH_{17} and NH_8 while it was minimum in NH_{12}. Maximum number of flowers per plant per year were observed in germplasm NH_{12} which was followed by NH_3. Screening of all the twenty germplasms showed significantly higher protein in the flowers of NH_{16} which was followed by NH_{14} and NH_1. Higher carbohydrate content was found in the flowers of NH_{14}, NH_5 which was followed by NH_1 and NH_2 while higher iron content was present in NH_{12} which was followed by HG_{14}, HG_8 and NH_6.

Keywords: *Hibiscus rosa sinensis* germplasms, carbohydrate, protein, iron

Introduction

Hibiscus is a quite large genus of flowering plants in the mallow family, *Malvaceae* that are native to warm-temperate, subtropical and tropical regions throughout the world. Different species of *Hibiscus* has been widely studied and exploited for neutraceutical and medicinal uses. *Hibiscus rosa sinensis* (Family: Malvaceae) commonly known as the rose mallow, chinese hibiscus, china rose and shoe flowers is an evergreen woody, glabrous, showy shrub 5-8 feet in height, widely cultivated in the tropics as an ornamental plant and has several forms with varying colours of flowers (Kirtikar and Basu, 2004) [10]. It is a native of Asia, specifically China, India and the Pacific islands (Adhirajan *et al*., 2003) [1]. Although, *Hibiscus rosa-sinensis* bearing attractive and colourful flowers, is widely and popularly grown as ornamental plant in landscaping and as common house plant (Patel *et al*., 2020) and has been traditionally used as edible for promotion of human health. *Hibiscus* flowers are enriched with various phytochemicals that are generally incorporated into a variety of products such as colourants, cosmetics, nutraceuticals, food, beverages, textile, paper industries (Eman *et al*., 2017; Dahiya and Kaur, 2019) [8, 4] which can be attributed for its medicinal properties. Therefore, this study aimed to assess morphological diversity and phyto-chemicals in different *Hibiscus* germplasms.

Materials and Methods

The experimental material comprising of 20 genotypes of *Hibiscus rosa sinensis* were selected and collected from different areas of Navsari district of South Gujarat region. These were planted and evaluated in Randomized Blocked Design with three replications during 2019-2020 to 2020-2021 at the Advance Technology Centre of Soilless System for Production of Various Crops at the Department of Floriculture and Landscape Architecture, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. Various morphological parameters and phytochemical content were recorded during both the years. Observation on flower diameter was taken at three months interval in each year.

For the phytochemicals analysis, samples of 10 gm weight of flowers from each twenty germplasms were collected during experiment. These samples were thoroughly washed with distilled water and then dried in laboratory condition at 28 °C temperature and 60% RH.

Dried samples were finely ground and powdered to pass through 40 mesh sieve and further chemical analysis for carbohydrates, protein and iron content were carried out. Phytochemicals like total protein, total carbohydrates and iron content were estimated as mentioned below:

Total protein content (µg/g)
The total protein content was determined by Lowry's method (Sadasivam and Manickam, 1996) [17] and results are given in µg/g dry extract. Standard graph computed to total protein is given in Fig 2.

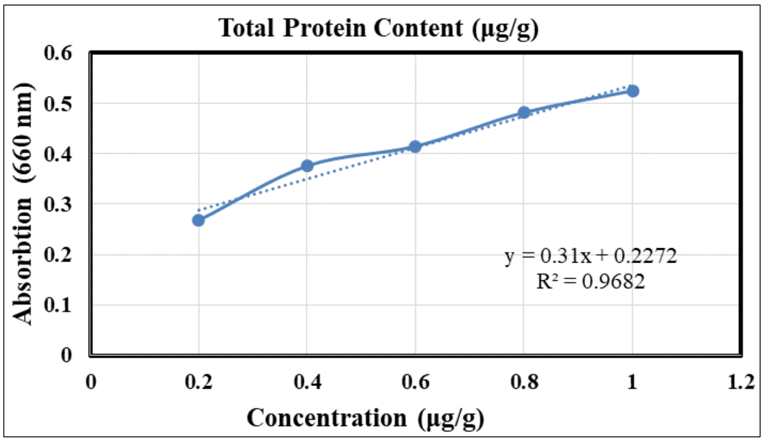

Fig 1: Total Protein Content (µg/g)

Total carbohydrates content (µg/g)
Total carbohydrate was determined by Anthrone method (Sadasivam and Manickam, 1996) [17] and results are given in µg/g dry extract. Standard graph computed to total carbohydrate is given in Fig 1.

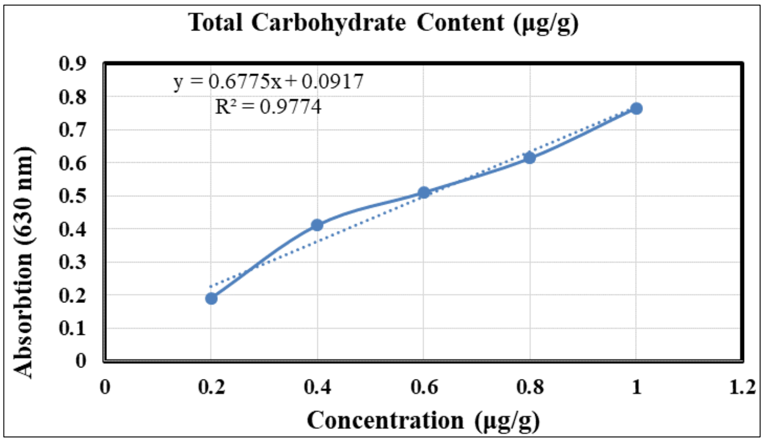

Fig 2: Total Carbohydrate Content (µg/g)

Iron content (ppm)
The iron content in flower sample was determined by Atomic Absorption Spectrophotometer (AAS) (Elwell and Gridley, 1967) [7].

Statistical analysis
The data arrived was subjected to statistical analysis of variance for Split Plot Design as described by Panse and Sukhatme (1985) [13] in which treatments were considered as main plot factor and year as a sub plot factor.

Results and Discussion
An inquisition of data revealed variation in plant height and plant spread among different germplasm of *Hibiscus*, as shown in Table-1.Germplasm NH_{10} showed maximum plant height (112.55 cm). The minimum plant height was recorded in germplasm NH_{17} (91.29 cm). Significant variation was found in plant spread of various germplasms. Maximum plant spread North to South direction were observed in germplasm NH_{14} (99.91 cm) as well as in East to West Direction (95.89 cm) also. Minimum plant spread in North to South direction (67.89 cm) and East to West direction (62.46 cm) were recorded in germplasm NH_{18}.
The differences among plant height and plant spread of cultivars could be due to influence of the genetic makeup. Differences in vegetative growth parameters between varieties have been earlier reported in various ornamental plants *viz*., gerbera (Deka *et al*., 2015 and Sil *et al*. 2017) [6, 19], chrysanthemum (Srilatha *et al*., 2015) [18], adenium (Singh *et al*., 2017) [20], nerium (Parashuram *et al*., 2018) [14].
Among different germplasms, maximum flower diameter (12.67 cm) was observed in germplasm NH_{16}. Further, minimum flower diameter was measured with germplasm NH_{12} (1.41 cm) as shown in Table-2. Maximum number of flowers per plant per year (2675.60) were observed in germplasm $NH_{12.}$ Flower colour for all the germplasms was observed with RHS colour chart, 2015 and are shown in Table-3. Variation was observed in colours of flowers from white, red, pink and orange. Variation in flower diameter among different germplasm might be due to the genetic

makeup of the varieties. Similar results were observed in marigold (Deepa *et al*., 2016) [5], adenium (Singh *et al*., 2017) [20], nerium (Parashuram *et al*., 2019) [14]. Variation in flower diameter and number of flowers per plant have been earlier observed in various varieties of different ornamental plants. These kinds of results are in accordance with the earlier findings in gerbera (Jangde *et al*., 2019) [9], in chrysanthemum (Srilatha *et al*., 2015) [18], in China aster (Lohar *et al*., 2018 and Aditya *et al*., 2019) [12, 2].

Variations was observed in phytochemical content of germplasms as shown in Table 4. Germplasm NH_{16} recorded maximum protein content (0.96 µg/g) which was followed by germplasm NH_1 (0.74 µg/g) and NH_{14} (0.79 µg/g) while it was found minimum in germplasm NH_{20} (0.33 µg/g). Maximum total carbohydrate content (0.33 µg/g) was found in germplasm NH_{14} and NH_5 that was followed by NH_1 and NH_2 (0.28 µg/g), NH_7 and NH_{19} (0.27 µg/g), NH_6 (0.26 µg/g) and NH_{11} (0.25 µg/g). Germplasm NH_8 and NH_{10} (0.18 µg/g) recorded minimum carbohydrate content. Screening of all the germplasms showed the presence of total protein content in the petals. Germplasm NH_{12} recorded maximum iron content (265.58 ppm) which was followed by germplasm NH_{14} (222.93 ppm). Minimum iron content was observed in NH_{19} (21.05 ppm). Differences in different phytochemical contents could be attributed to its genetic makeup and its better adaptability to the prevailing environmental condition. Similar kinds of results have been earlier observed in different varieties of gerbera (Prajapati, 2013 and Soad *et al*., 2011) [16, 22], tuberose (Kumar and Singh, 2004) [11], gladiolus (Singh *et al*., 2008) [21] and marigold (Ahluwalia *et al*., 2014) [3].

Table 1: Plant height (cm) and Plant spread (cm) of *Hibiscus* germplasms

Hibiscus Germlasms	Plant height (cm)			Plant spread (N-S) (cm)			Plant spread (E-W) (cm)		
	2019-2020	2020-2021	Pooled	2019-2020	2020-2021	Pooled	2019-2020	2020-2021	Pooled
NH_1	76.97	121.72	99.35	54.86	93.54	74.20	50.75	89.60	70.18
NH_2	83.11	124.42	103.77	68.12	105.51	86.81	63.60	102.10	82.85
NH_3	82.31	127.61	104.96	75.25	113.85	94.55	69.86	108.68	89.27
NH_4	76.07	117.60	96.84	62.13	100.90	81.51	56.37	97.15	76.76
NH_5	82.03	116.03	99.03	71.18	109.05	90.11	65.68	103.48	84.58
NH_6	78.95	120.15	99.55	69.42	109.50	89.46	63.96	103.34	83.65
NH_7	82.03	126.32	104.18	66.18	105.31	85.75	59.07	100.43	79.75
NH_8	84.84	132.00	108.42	77.12	116.98	97.05	72.30	111.31	91.81
NH_9	79.17	118.75	98.96	48.45	87.96	68.20	43.78	82.55	63.16
NH_{10}	87.00	138.11	112.55	75.89	114.91	95.40	70.85	110.12	90.48
NH_{11}	79.95	123.70	101.82	62.20	101.92	82.06	56.95	97.58	77.27
NH_{12}	81.58	122.26	101.92	72.42	111.86	92.14	67.19	106.86	87.03
NH_{13}	77.23	119.77	98.50	51.93	91.59	71.76	46.94	86.94	66.94
NH_{14}	85.73	129.72	107.72	80.40	119.43	99.91	76.58	115.20	95.89
NH_{15}	77.16	122.62	99.89	53.35	93.39	73.37	48.44	88.98	68.71
NH_{16}	76.20	125.86	101.03	52.16	91.48	71.82	47.64	87.50	67.57
NH_{17}	72.72	109.87	91.29	50.13	89.03	69.58	45.67	84.58	65.12
NH_{18}	75.92	116.09	96.00	48.11	87.67	67.89	42.20	82.71	62.46
NH_{19}	76.15	123.80	99.97	52.70	90.11	71.41	47.52	86.26	66.89
NH_{20}	82.01	123.68	102.85	58.84	90.46	74.65	53.48	87.19	70.33
Mean	79.86	123.00	101.43	65.54	101.22	81.88	57.44	96.63	77.03
	G	Y	G × Y	G	Y	G × Y	G	Y	G × Y
S.Em±	3.24	1.26	5.63	2.83	0.70	3.17	2.90	0.73	3.27
C.D. @5%	9.27	3.60	NS	8.12	2.02	NS	8.32	2.09	NS
C.V.%	7.82	9.62		8.48	6.71		9.24	7.37	

Table 2: Flower diameter (cm) of *Hibiscus* germplasms

Hibiscus Germplasm	1st year			2nd year			Pooled
	Aug- 2019	Dec-2019	Apr-2020	Aug-2020	Dec-2020	Apr-2021	
NH_1	5.57	7.03	6.41	5.56	7.10	6.44	6.35
NH_2	10.25	10.79	10.90	10.25	10.73	10.72	10.61
NH_3	8.22	8.96	8.92	8.22	8.50	8.88	8.62
NH_4	8.88	8.89	8.78	8.88	8.48	8.42	8.72
NH_5	7.33	8.80	8.24	7.32	8.04	8.25	8.00
NH_6	7.93	8.42	8.89	7.93	8.77	8.60	8.42
NH_7	6.44	10.38	8.35	6.44	8.65	8.63	8.15
NH_8	11.32	11.19	11.07	11.32	10.54	10.66	11.02
NH_9	9.48	9.17	9.52	9.48	9.47	9.41	9.42
NH_{10}	7.29	8.41	9.04	7.29	7.90	7.77	7.95
NH_{11}	7.82	7.61	7.94	7.82	7.76	7.63	7.76
NH_{12}	1.36	1.44	1.41	1.37	1.46	1.44	1.41
NH_{13}	7.61	7.34	7.32	7.61	7.50	7.58	7.49
NH_{14}	8.94	9.46	9.59	8.94	9.55	9.66	9.36
NH_{15}	9.49	9.98	10.06	9.48	9.96	9.91	9.81
NH_{16}	12.24	12.90	12.95	12.24	12.90	12.81	12.67
NH_{17}	11.85	11.21	11.43	11.85	10.99	10.86	11.36

NH_{18}	9.37	9.38	9.29	9.38	9.34	9.34	9.35
NH_{19}	10.85	10.60	10.96	10.84	11.04	10.90	10.86
NH_{20}	10.87	10.77	10.87	10.87	10.88	10.75	10.83
Mean	52.56	65.64	80.17	94.60	109.93	123.00	8.91
	G	Y	G × Y	M	G × M	Y × M	G × Y× M
S.Em±	0.14	0.05	0.23	0.06	0.29	0.09	0.42
C.D.@5%	0.40	NS	NS	0.18	0.83	NS	NS
C.V.%	6.70	7.95		8.23			

Table 3: Number of flowers per plant per year and Flower colour of *Hibiscus* germplasms

***Hibiscus* Germplasm**	**Number of flowers per plant per year**			**Flower colour**	
	1st year	**2nd year**	**Pooled**	**Group**	**Colour**
NH_1	719.60	816.53	768.06	53 C	Strong red
NH_2	306.73	293.26	300.00	45 B	Vivid red
NH_3	1412.20	1967.23	1689.71	50 A	Strong red
NH_4	291.33	303.76	297.55	155 A	Pale yellow green
NH_5	1226.20	1666.13	1446.16	55 B	Strong purplish pink
NH_6	280.60	295.96	288.28	29 A	Brilliant orange
NH_7	1196.93	1665.16	1431.05	NN 155 A	Yellowish white
NH_8	745.26	973.03	859.15	N 45 A	Moderate red
NH_9	285.00	300.40	292.70	55 A	Deep purplish pink
NH_{10}	825.80	1102.73	964.26	54 A	Strong purplish red
NH_{11}	347.33	326.10	336.71	32 B	Strong reddish orange
NH_{12}	2202.13	3149.06	2675.60	44 B	Vivid reddish orange
NH_{13}	288.40	299.63	294.01	13 C	Brilliant yellow
NH_{14}	1220.73	1717.53	1469.13	43 A	Vivid reddish orange
NH_{15}	294.46	305.06	299.76	N 172 D	Moderate orange
NH_{16}	270.20	297.43	283.81	12 A	Vivid yellow
NH_{17}	272.60	295.33	283.96	55 B	Strong purplish pink
NH_{18}	276.13	300.00	288.06	29 A	Brilliant orange
NH_{19}	275.73	297.86	286.80	14 B	Vivid yellow
NH_{20}	267.33	289.93	278.63	N 30 B	Vivid reddish orange
Mean	650.24	833.11	741.67		
	G	Y	G × Y		
S.Em±	5.57	1.16	5.20		
C.D.@5%	15.97	3.32	14.86		
C.V.%	1.84	1.21			

Table 4: Total protein (µg/g), Total carbohydrate (µg/g) and Iron content (ppm) of *Hibiscus* germplasms

***Hibiscus* Germplasm**	**Total protein (µg/g)**			**Total carbohydrates (µg/g)**			**Iron content (ppm)**		
	1st year	**2nd year**	**Pooled**	**1st year**	**2nd year**	**Pooled**	**1st year**	**2nd year**	**Pooled**
NH_1	0.73	0.74	0.73	0.28	0.29	0.28	54.50	53.30	53.90
NH_2	0.61	0.62	0.61	0.28	0.28	0.28	53.53	55.23	54.38
NH_3	0.57	0.60	0.58	0.20	0.20	0.20	37.83	38.40	38.11
NH_4	0.55	0.56	0.56	0.21	0.22	0.22	31.43	32.56	32.00
NH_5	0.48	0.49	0.48	0.31	0.34	0.33	18.63	19.13	18.88
NH_6	0.55	0.56	0.55	0.25	0.27	0.26	138.07	141.63	139.85
NH_7	0.42	0.43	0.42	0.26	0.28	0.27	21.23	21.90	21.56
NH_8	0.55	0.56	0.56	0.18	0.19	0.18	142.90	143.00	142.95
NH_9	0.67	0.67	0.67	0.21	0.23	0.22	36.76	35.86	36.31
NH_{10}	0.58	0.56	0.57	0.18	0.19	0.18	92.50	93.56	93.03
NH_{11}	0.59	0.59	0.59	0.24	0.26	0.25	96.30	97.40	96.85
NH_{12}	0.62	0.65	0.64	0.24	0.22	0.23	264.73	266.43	265.58
NH_{13}	0.59	0.61	0.60	0.24	0.24	0.24	43.93	46.40	45.16
NH_{14}	0.79	0.78	0.79	0.32	0.34	0.33	221.50	224.36	222.93
NH_{15}	0.61	0.63	0.62	0.22	0.26	0.24	69.26	70.56	69.91
NH_{16}	0.97	0.95	0.96	0.21	0.23	0.21	21.93	23.43	22.68
NH_{17}	0.49	0.51	0.50	0.20	0.21	0.21	107.16	109.10	108.13
NH_{18}	0.60	0.63	0.62	0.22	0.24	0.23	53.76	54.90	54.33
NH_{19}	0.47	0.49	0.48	0.26	0.28	0.27	20.23	21.86	21.05
NH_{20}	0.32	0.34	0.33	0.24	0.24	0.24	76.76	76.36	76.56
Mean	0.59	0.60	0.59	0.24	0.25	0.24	80.15	81.27	80.71
	G	Y	G × Y	G	Y	G × Y	G	Y	G × Y
S.Em±	0.01	0.003	0.014	0.004	0.001	0.006	1.24	0.35	1.58
C.D.@5%	0.03	0.009	NS	0.01	0.004	NS	3.56	1.01	NS
C.V.%	5.40	4.13		4.65	4.40		3.78	3.40	

Conclusion
Based on the study, different germplasms have been found suitable for various purpose. Germplasms NH_{10} and NH_{14} having good height and plant spread can be used for landscaping as screening and hedges. Germplasms having good flower size and producing more number of flowers, *viz*., NH_{16}, NH_{17}, NH_8, NH_{12} and NH_3 are found suitable for landscaping and home gardening. Germplasms NH_1, NH_2, NH_5, NH_6, NH_8, NH_{12}, NH_{14} and NH_{16} contain higher phytochemicals like protein, carbohydrate and iron can be recommended for edible purpose.

References

1. Adhirajan N, Kumar TR, Shanmugasundaram N, Babu M. *In vivo* and *in vitro*. Evaluation of hair growth potential of *Hibiscus rosa sinensis* Linn. Journal of Ethnopharmacology. 2003;88:235-239.
2. Aditya G, Naik MR, Ramaiah M, Tanuja PB, Ramakrishna M. Study on performance of some genotypes of china aster (*Callistephus chinensis* L. Ness) under shade net conditions in Rayalaseema region of Andhra Pradesh. Bulletin of Enviroment, Pharmacology and Life Science. 2019;8(4):77-82.
3. Ahluwalia P, Kaur A, Dhillon GK. Effect of different drying methods on chemical and functional properties of marigold petals. International Journal of Food and Nutritional Science. 2014;3:54-59.
4. Dahiya, Kaur P. National and therapeutic uses of *Hibiscus rosa sinensis*. International Journal of Food Science and Nutrition. 2019;4(5):94-98.
5. Deepa VP, Patil VS. Evaluation of marigold hybrids (*Tagetes* spp.) for their growth and yield potential under dharwad condition. Journal of Farm Sciences. 2016;29(2):235-237.
6. Deka K, Talukdar MC. Evaluation of gerbera (*Gerbera jamesonii* Bolus) cultivars for growth and flower characters under Assam conditions. J Agric. Vet. Sci. 2015;8(4):28-30.
7. Elwell WT, Gridley JAF. In: Atomic absorption spectrophotometry, Pergamon Press Ltd., London; c1967. p. 221.
8. Eman A Shobhy, Khadija G Abd Elaleem, Hagir G Abd Elaleem. Potential antibacterial activity of *Hibiscus rosa sinensis* Linn flowers extracts. International Journal of Current Microbiology and Applied Sciences. 2017;6(4):1066-1072.
9. Jangde T, Sharma G, Jangde B, Banjara NC. Evaluation of gerbera (*Gerbera jamesonii*) cultivars under naturally ventilated polyhouse in Chhattisgarh plain. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):2112-2114.
10. Kiritikar KR, Basu BD. Indian Medicinal Plant, Darshan Singh Mahendra Pal Singh. A New Cannaught Place, Dehradun. 2004;1:23.
11. Kumar J, Singh D. Postharvest life of tuberose cultivar Pearl Double spike as affected by GA_3, NAA and sucrose. Journal of Ornamental Horticulture. 2004;7(2):188-191.
12. Lohar A, Majumdar J, Sarkar A, Rai B. Evaluation of African marigold (*Tagetes erecta* L.) varieties for morphological and biochemical characters under West Bengal condition. International Journal of Current Microbiology and Applied Sciences. 2018;7(10):241-248.
13. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Science. Indian Council of Agricultural Research, New Delhi; c1985.
14. Parashuram M, Rajadurai KR, Haripriya S, Joel AJ. Reproductive Biology Studies in Nerium Cultivars (*Nerium oleander* L.). International Journal of Current Microbiology and Applied Sciences. 2019;8(07):377-392.
15. Patel H, Singh A, Patel NB, Bhandari AJ, Shah HP. Effect of foliar spray of plant growth regulators on growth of potted hibiscus, International Journal of Chemical Studies. 2020;8(6):119-122.
16. Prajapati P. Morphological, physiological, biochemical and molecular variability study in different varieties of gerbera (*Gerbera jamesonii* bolus) grown under polyhouse. 2013; Thesis submitted to Department of Floriculture and Landscape Architecture, Navsari Agricultual University, Navsari, Guajarat.
17. Sadasivam S, Manickam A. Biochemical Methods, New Age International (P) Limited, New Delhi, 1996;2:124-126.
18. Srilatha V, Kumar SK, Kiran YD. Evaluation of chrysanthemum (*Dendranthema grandiflora* Tzvelev) varieties in Southern zone of Andhra Pradesh. Agricultural Science Digest. 2015;35(2):155-157.
19. Sil M, Sarkar MM, Raghupathi B, Mondal S. Varietal evaluation of gerbera (*Gerbera jamesonii*.) grown in a polyhouse. International Journal of Current Microbiology and Applied Sciences. 2017;6(7):810-814.
20. Singh A, Bhandari AJ, Chavan S, Patel NB, Patel AI, Patel BN. Evaluation of *Adenium obesum* for potted ornamentals under soilless growing system. International Journal of Current Microbiology and Applied Sciences. 2017;6(12):2141-2146.
21. Singh S, Kumar J, Kumar P. Effect of plant growth regulators and sucrose on post-harvest physiology, membrane stability and vase life of cut spikes of gladiolus. Plant Growth Regulators. 2008;55:221-229.
22. Soad, Ibrahim MM, Lobna ST, Rawia AE. Extending Postharvest Life and Keeping Quality of Gerbera Cut-Flowers Using Some Chemical Preservatives. Journal of Applied Science and Research. 2011;7(7):1233-1239.