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Evaluation of gladiolus varieties for post-harvest parameters

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Abstract

Gladiolus as a cut flower has earned its place of importance owing to its utility in bouquets, in indoor decoration and flower arrangements. It should be noted that different species and cultivars have different floral vase life, which is an important quality of good cut flower. Hence, an experiment was conducted to study the post-harvest parameters of gladiolus varieties in Research laboratory of the Department of Horticulture, Banaras Hindu University, Varanasi. The longevity of 3rd and last florets was maximum for American Beauty (2.67 days, 3.33 days). The variety Pink Friendship recorded maximum number of florets open at a time (6.00), maximum solution uptake (35.67 ml), maximum diameter of 1st, 3rd, 5th and last florets (9.55 cm, 10.27 cm, 9.08 cm and 8.62 cm, respectively), maximum length of 1st, 3rd and 5th florets (11.23 cm, 10.53 cm and 9.33 cm, respectively), maximum rachis length harvest, 3rd, 6th and 9th day (51.17, 54.00, 52.33 and 50.53 cm, respectively) and maximum spike weight at harvest, 3rd, 6th and 9th day (85.44, 84.85, 78.44 and 65.54 g, respectively). The maximum percentage of open florets was recorded the variety IIHR (90.30%). Maximum vase life of spike was in the variety American Beauty (13.67 days). The maximum spike length at harvest, 3rd, 6th and 9th day was recorded in the variety Dhanvantari (74.93, 75.57, 75.53 and 75.53 cm, respectively).

Keywords: Gladiolus, vasselife, post-harvest, longevity

1. Introduction

Gladiolus is one of the top cut flower, it is considered as Queen of bulbous plant due to its large area of cultivation and is also known as sword lily and corn flag. Pliny the Elder coined from Latin word *gladius* meaning a sword like on account of its sword like foliage (Deshraj, 2008) [4]. Gladiolus was found growing in Asia Minor over 2000 years ago and was called corn lily, whereas, the European species was cultivated for more than 500 years. It belongs to family- iridaceae, sub-family- ixiodeae and order- iridales with around 260 different species (Singh, 2014). Its basic chromosome number is n=15, most species are heteroploids with chromosome number of 2n= 30 to 120. Gladiolus is a tender, unbranched leafy herb, which produces attractive spikes with a number of florets opening acropetally over a period of time, the spikes are available in different kinds of colours, either single coloured or mixture of colours and in various sizes. As a cut flower it has earned its place of importance owing to its utility in bouquets, in indoor decoration and flower arrangements. It should be noted that different species and cultivars have different floral vase life, which is an important quality of good cut flower. The genetic make-up of the flower species, as well as differences in cultivars within the same species, greatly impacts the shelf life of cut flowers, even though a number of other factors also have an impact (Nalage *et al.*, 2019) [10]. Therefore, investigations on the vase life of gladiolus cultivars are more significant for determining how well they perform in relation to these crucial characteristics.

2. Materials and Method

The experiment was conducted in Research lab of the Department of Horticulture, Banaras Hindu University, Varanasi. Post harvest studies were carried out on 21 varieties of gladiolus *viz.* Priscilla, American Beauty, Sunayna, Aldebaran, Nova Lux, Pink Friendship, IIHR, Chandini, Subhangini, Tiger Flame, Punjab Dawn, Punjab Morning, Dhanvantari, Green, Arti, Chemistry, Jyotsna, Pusa Shubham, Surya Kiran, White Prosperity and Darshan. Standard package of practice was followed for all the varieties during growth in field. The spikes were harvested when 3-4 basal florets started showing colour and 1st floret was about to bloom, harvested spikes were brought from field to laboratory for vase life studies.

Spikes were placed in 4% sucrose solution and observations were recorded once every 3 days. The obtained data was later subjected to statistical analysis.

3. Results and Discussion

The perusal of table 1 indicates significant differences in all the parameters except longevity of 3rd, 5th and last floret and also indicates that maximum number days to opening of 3rd floret was taken by variety Aldebaran (3.33 days) and IIHR (3.33 days) which was at par with Priscilla (3.00 days), Chandini (3.00 days), Jyotsna (3.00 days), Subhangini (2.67 days), Nova Lux (2.67 days) and Darshan (2.67 days), whereas, the minimum days was taken by Pink Friendship (1.67 days) and Chemistry (1.67 days). The days taken for opening of 5th floret was found significant and maximum in the variety Surya Kiran (4.50 days) and Jyotsna (4.50 days) which was statistically at par with the varieties Aldebaran (4.33 days), IIHR (4.33 days), Priscilla (4.00 days), Darshan (4.00 days), Chandini (4.00 days), Dhanvantari (4.00 days), Pusa Shubham (4.00 days) and Nova Lux (3.33 days), whereas, it was minimum in the variety Pink Friendship (2.33 days) followed by Chemistry (2.67 days). The days taken for opening of last floret was maximum in the variety American Beauty (11.67 days) which was statistically at par with the varieties Priscilla (11.00 days), IIHR (10.67 days), Punjab Dawn (10.67 days), Punjab Morning (10.00 days) Pink Friendship (9.67 days), Subhangini (9.33 days) and White Prosperity (9.33 days), whereas, it was minimum in the variety Green (5.67 days) and Arti (5.67 days). The longevity of 1st floret was maximum in the variety Priscilla (3.33 days) which was statistically at par with the varieties IIHR (3.00 days), Jyotsna (3.00 days), American Beauty (2.67 days) and Punjab Dawn (2.67 days) whereas, it was minimum in the variety Tiger Flame (1.67 days) and Darshan (1.67 days). The longevity of 3rd floret was maximum in the variety American Beauty (2.67 days) whereas, minimum was in the variety Jyotsna (1.50 days). The longevity of 5th floret was maximum in the variety Pink Friendship (3.67 days) whereas, minimum was in the variety Nova Lux (1.67 days). The longevity of last floret was found non-significant and was maximum in the varieties American Beauty (3.33 days), Arti (3.33 days) and Sunayna (3.33 days) whereas, minimum was in the variety Jyotsna (2.00 days) and Chemistry (2.00 days). Opening of florets in a spike is largely due to interaction of higher water potential and reserve carbohydrate maintained in the floral spike in addition to the environmental factors like light and temperature. In absence of use of any floral preservative as bud opening solution the variation observed in interaction effect of above factors influencing bud opening might be due to difference in the inherent character of varieties (Patra and Mohanty, 2015) [12].

The perusal of table 2 indicates significant differences among all except length of last floret and also indicates that the diameter of 1st floret was maximum in the variety Pink Friendship (9.55 cm) which was at par with the varieties American Beauty (9.68 cm), IIHR (8.53 cm), Priscilla (8.37 cm), White Prosperity (8.17 cm) and Sunayna (8.17 cm). The diameter of 3rd floret was maximum in the variety Pink Friendship (10.27 cm). The diameter of 5th floret was maximum in the variety Pink Friendship (9.08 cm) which was at par with the varieties American Beauty (9.08 cm) and IIHR (8.00 cm). The diameter of last floret was maximum in the variety Pink Friendship (8.62 cm) which was at par with the

varieties Priscilla (8.27 cm), IIHR (8.02 cm) and Surya Kiran (7.75 cm). Whereas, the minimum flower diameter for 1st, 3rd, 5th and last florets was found in variety Darshan (5.08 cm), Darshan (4.33 cm), Chandini (4.57 cm) and Darshan (4.32 cm) respectively. While, maximum length of 1st floret was recorded in the variety Pink Friendship (11.23 cm) which was at par with the variety Dhanvantari (10.40 cm), White Prosperity (10.40 cm), American Beauty (10.33 cm) and Priscilla (10.30 cm). Maximum length of 3rd floret was recorded in the variety Pink Friendship (10.53 cm) which was at par with the variety American Beauty (9.67 cm) and White Prosperity (9.50 cm). Maximum length of 5th floret was recorded in the variety Pink Friendship (9.33 cm) which was at par with the variety Surya Kiran (9.00 cm), American Beauty (8.93 cm), Dhanvantari (8.83 cm), White Prosperity (8.60 cm), IIHR (8.53 cm), Subhangini (8.47 cm), Sunayna (8.40 cm), Pusa Shubham (8.37 cm), Arti (8.17 cm) and Priscilla (8.13 cm). Length of last floret was non-significant and was maximum in the variety Pink Friendship (10.27 cm). The minimum length of 1st, 3rd, 5th and last florets was found in the variety Aldebaran (6.67 cm), Chandini (5.53 cm), Chandini (5.17 cm) and Chemistry (6.33 cm), respectively. Variation in terms of length and diameter of florets might be due to differences in the genetic makeup of the varieties. Similar variation in parameters was also found by Singh *et al.* (2013) [16], Singh *et al.* (2017) [17] and Sisodia *et al.* (2018) [18] in gladiolus varieties.

The perusal of table 3 indicates significant differences among all the parameters and highest number of florets open at a time in the variety Pink Friendship (6.00) which was statistically at par with varieties Nova Lux (5.67), Surya Kiran (5.50) and American Beauty (5.00), while, least in the variety Darshan (2.00). The percentage of open florets ranged from 90.30% to 59.60%. The maximum percent was recorded in the variety IIHR (90.30%) which was statistically at par with the varieties Darshan (87.04%), Jyotsna (83.98%), Tiger Flame (82.35%), Green (81.76%), Punjab Morning (81.06%), Chemistry (80.68%), American Beauty (79.94%), Nova Lux (79.68%), Sunayna (77.94%), Dhanvantari (77.78%) and Pusa Shubham (75.38%), whereas, it was minimum in the variety Punjab Dawn (59.60%). Maximum vase life was found in the variety American Beauty (13.67 days) which was at par with the varieties Priscilla (12.67 days), IIHR (12.33 days), Punjab Dawn (12.33 days), Punjab Morning (12.00 days) and Surya Kiran (11.50 days), whereas, minimum vase life was in the variety Chemistry (7.33 days) followed by Chandini (7.67 days). Solution uptake was maximum in the variety Pink Friendship (35.67 ml) which was at par with the varieties American Beauty (32.00 ml), whereas, minimum uptake was in Arti (6.00 ml). The maximum spike length at harvest, 3rd, 6th and 9th day were recorded in the variety Dhanvantari (74.93, 75.57, 75.53 and 75.53 cm, respectively) which was at par with the varieties Pink Friendship (72.50, 75.30, 75.40 and 75.20 cm, respectively), Tiger Flame (71.60, 72.23, 72.23 and 72.10 cm, respectively), White Prosperity (68.93, 70.13, 70.03 and 70.03 cm, respectively), IIHR (68.00, 68.00, 68.00 and 67.37 cm, respectively) and Surya Kiran (67.00, 67.60, 67.60 and 67.35 cm, respectively), whereas, it was minimum in the variety Pusa Shubham (39.70, 39.70, 39.83 and 39.50, cm respectively) followed by Darshan (41.27, 41.70, 41.80 and 41.60 cm, respectively). Similar variation in longevity of spike and solution uptake among gladiolus varieties was reported by Kumar and Yadav (2005) [7], Singh *et al.* (2013)

[16], Mishra (2015) [9], Meena *et al.* (2016) [8] and Kumar *et al.* (2018) [18]. The reason for the same might be due to variation in the number of florets. Similar variation in length of spike and florets per spike were recorded in earlier studies by Rani *et al.* (2007) [13], Negi *et al.* (2014) [11], Kadam *et al.* (2014) [5], Rao and Sushma (2015) [14] which might be due to the variation in genetic makeup of varieties.

The perusal of table 4 indicates significant differences among all the parameters and also indicates maximum rachis length at harvest, 3rd, 6th and 9th day were recorded in the variety Pink Friendship (51.17, 54.00, 52.33 and 50.53 cm, respectively) which was at par with the varieties Tiger Flame (48.40, 49.07, 49.00 and 48.90 cm, respectively), Surya Kiran (49.05, 49.35, 49.55 and 49.45 cm, respectively), White

Prosperity (47.77, 48.80, 48.90 and 49.45 cm respectively) and Subhangini (46.10, 48.10, 47.47 and 47.47 cm, respectively), whereas, it was minimum in the variety Pusa Shubham (24.33, 24.67, 24.70 and 24.93 cm, respectively) followed by Darshan (24.77, 25.20, 25.40 and 24.93 cm, respectively). The maximum spike weight at harvest, 3rd, 6th and 9th day was in the variety Pink Friendship (85.44, 84.85, 78.44 and 65.54 g, respectively). The minimum spike weight at harvest, 3rd day, 6th day and last day was in the variety Pusa Shubham (21.52 g), Pusa Shubham (21.17 g), Darshan (16.89 g) and Punjab Morning (12.40 g), respectively. Similar results for post-harvest were also reported by Choudhary *et al.* (2011) [2], Sarkar *et al.* (2014) [15], Ahmed *et al.* (2018) [1] and Kumar *et al.* (2018) [18].

Table 1: Performance of varieties for opening of florets in post-harvest study

	Days to 3 rd floret opening	Days to 5 th floret opening	Days to last floret opening	Longevity of 1 st floret	Longevity of 3 rd floret	Longevity of 5 th floret	Longevity of last floret
Priscilla	3.00	4.00	11.00	3.33	2.33	3.00	2.67
American Beauty	2.00	3.67	11.67	2.67	3.00	2.67	3.33
Sunanya	2.00	3.67	8.67	2.33	2.33	2.67	3.33
Aldebaran	3.33	4.33	7.67	2.33	2.00	3.00	2.33
Nova Lux	2.67	3.33	8.00	2.00	2.00	1.67	2.33
Pink Friendship	1.67	2.33	9.67	2.33	2.67	3.67	2.33
IIHR	3.33	4.33	10.67	3.00	2.00	2.67	2.67
Chandini	3.00	4.00	7.00	3.00	2.00	2.67	2.33
Subhangini	2.67	3.33	9.33	2.33	1.67	2.33	2.33
Tiger Flame	2.33	3.33	8.00	1.67	2.00	2.33	2.67
Punjab Dawn	2.33	3.67	10.67	2.67	2.67	2.33	3.00
Punjab Morning	2.33	3.00	10.00	2.33	1.67	2.00	3.00
Dhanvantari	2.67	4.00	9.00	2.33	2.00	2.33	3.00
Green	2.00	3.00	5.67	2.00	2.67	2.67	2.67
Arti	2.33	3.33	5.67	2.00	2.00	2.67	3.33
Chemistry	1.67	2.67	6.33	2.00	2.33	2.33	2.00
Jyotsna	3.00	4.50	8.00	3.00	1.50	2.00	2.00
Pusa Shubham	2.33	4.00	6.67	2.00	2.33	2.67	3.00
Surya Kiran	2.50	4.50	10.50	2.50	2.50	2.00	2.50
White Prosperity	2.33	3.67	9.33	2.33	2.33	2.33	2.33
Darshan	2.67	4.00	7.00	1.67	2.00	2.00	2.33
S.E.	0.29	0.27	0.83	0.25	0.36	0.34	0.34
C.D. 5%	0.82	0.78	2.38	0.73	NS	NS	NS

Table 2: Performance of varieties for diameter of florets in post-harvest study

	Diameter of 1 st floret (cm)	Diameter of 3 rd floret (cm)	Diameter of 5 th floret (cm)	Diameter of last floret (cm)	Length of 1 st floret (cm)	Length of 3 rd floret (cm)	Length of 5 th floret (cm)	Length of last floret (cm)
Priscilla	8.37	7.88	7.60	8.27	10.30	8.83	8.13	8.37
American Beauty	9.68	8.65	8.20	6.42	10.33	9.67	8.93	9.68
Sunanya	8.17	8.08	7.08	7.12	9.07	8.57	8.40	8.17
Aldebaran	6.00	7.58	7.25	266.50	6.67	8.00	7.77	6.00
Nova Lux	6.60	6.17	5.63	6.48	8.57	8.33	7.93	6.60
Pink Friendship	9.95	10.27	9.08	8.62	11.23	10.53	9.33	9.95
IIHR	8.53	7.37	8.00	8.02	9.87	8.83	8.53	8.53
Chandini	7.02	4.47	4.57	5.67	7.80	5.53	5.17	7.02
Subhangini	5.97	6.43	6.38	5.92	8.93	8.73	8.47	5.97
Tiger Flame	7.88	6.90	6.45	5.30	9.90	8.90	7.47	7.88
Punjab Dawn	7.67	6.80	6.70	5.17	8.30	8.67	7.47	7.67
Punjab Morning	7.68	6.72	5.97	5.22	8.67	7.90	7.47	7.68
Dhanvantari	7.85	7.10	7.08	6.97	10.40	9.00	8.83	7.85
Green	6.72	5.68	5.75	5.50	8.00	7.33	7.00	6.72
Arti	6.10	4.92	4.93	5.58	8.77	8.33	8.17	6.10
Chemistry	5.25	5.08	4.78	4.80	7.00	7.30	6.30	5.25
Jyotsna	6.43	5.98	6.93	5.95	7.75	8.00	7.00	6.43
Pusa Shubham	5.73	6.02	6.78	6.02	7.37	7.40	8.37	5.73
Surya Kiran	7.53	8.75	7.70	7.75	9.00	7.80	9.00	7.53
White Prosperity	8.17	7.08	7.10	7.33	10.40	9.50	8.60	8.17

Darshan	5.08	4.33	4.67	4.32	8.23	7.10	7.03	5.08
S.E.	0.60	0.44	0.39	56.57	0.44	0.47	0.33	1.26
C.D. 5%	1.71	1.25	1.13	NS	1.24	1.35	0.96	NS

Table 3: Performance of varieties for florets open at a time, percentage of open florets, vase life and total solution uptake in post-harvest study

	Number of florets open at a time	Percentage of open florets	Vase life (days)	Total solution uptake (ml)	Spike length at harvest (cm)	Spike length at 3 rd day (cm)	Spike length at 6 th day (cm)	Spike length at 9 th day (cm)
Priscilla	4.33	71.65	12.67	18.67	60.20	61.53	61.60	61.23
American Beauty	5.00	79.94	13.67	32.00	63.90	65.07	65.00	64.93
Sunanya	4.00	77.94	11.00	18.00	61.93	62.27	62.43	62.33
Aldebaran	3.67	66.33	8.33	7.67	48.37	48.90	48.73	48.67
Nova Lux	5.67	79.68	9.33	15.67	53.57	54.17	54.13	54.03
Pink Friendship	6.00	60.00	11.00	35.67	72.50	75.30	75.40	75.20
IIHR	3.67	90.30	12.33	16.67	68.00	68.00	68.00	67.37
Chandini	4.00	71.81	7.67	11.33	52.50	52.87	52.83	52.17
Subhangini	4.67	73.28	10.33	21.67	63.30	64.80	64.87	64.63
Tiger Flame	3.00	82.35	9.67	13.33	71.60	72.23	72.23	72.10
Punjab Dawn	4.33	59.60	12.33	16.33	50.13	51.30	51.47	51.27
Punjab Morning	4.00	81.06	12.00	13.67	51.87	51.83	51.80	51.60
Dhanvantari	3.33	77.78	11.00	19.00	74.93	75.57	75.53	75.53
Green	4.00	81.76	8.33	8.67	44.67	44.70	44.60	44.60
Arti	2.67	72.88	8.00	6.00	54.20	54.83	54.80	54.50
Chemistry	4.33	80.68	7.33	11.67	48.00	48.10	47.83	47.80
Jyotsna	3.50	83.98	9.00	14.00	52.30	53.80	53.60	53.60
Pusa Shubham	4.00	75.38	8.33	9.00	39.43	39.70	39.83	39.50
Surya Kiran	5.50	74.58	11.50	19.00	67.00	67.60	67.60	67.35
White Prosperity	4.33	62.13	9.33	22.33	68.93	70.13	70.03	70.03
Darshan	2.00	87.04	8.67	10.33	41.27	41.70	41.80	41.60
S.E.	0.48	5.46	0.81	2.13	3.09	3.16	3.16	3.12
C.D. 5%	1.38	15.62	2.32	6.08	8.84	9.03	9.02	8.92

Table 4: Performance of varieties for rachis length in post-harvest study

	Rachis length at harvest (cm)	Rachis length at 3 rd day (cm)	Rachis length at 6 th day (cm)	Rachis length at 9 th day (cm)	Spike weight at harvest (g)	Spike weight at 3 rd day (g)	Spike weight at 6 th day (g)	Spike weight at 9 th day (g)
Priscilla	38.77	40.10	40.07	39.90	49.21	51.34	41.43	30.72
American Beauty	42.97	43.60	43.80	43.33	59.60	61.84	54.47	42.30
Sunanya	37.77	38.00	38.07	38.10	40.74	43.04	35.78	26.31
Aldebaran	31.70	32.07	32.17	31.70	35.40	33.13	26.71	22.56
Nova Lux	39.60	39.87	39.87	39.80	46.89	46.24	36.47	30.54
Pink Friendship	51.17	54.13	52.33	50.53	85.44	84.85	78.44	65.54
IIHR	39.30	38.77	38.93	38.67	36.72	37.78	29.35	22.39
Chandini	28.07	28.17	28.30	27.70	23.13	23.75	18.62	13.20
Subhangini	46.10	47.40	47.47	47.47	50.23	55.02	45.34	34.38
Tiger Flame	48.40	49.07	49.00	48.90	47.76	41.50	33.21	25.22
Punjab Dawn	33.70	34.70	34.60	34.50	33.84	36.11	30.26	23.14
Punjab Morning	29.47	29.60	29.57	29.57	31.81	31.25	23.57	12.40
Dhanvantari	43.00	43.50	43.37	43.47	37.46	37.28	30.79	26.80
Green	27.37	26.87	27.07	27.07	30.12	24.54	19.47	13.60
Arti	32.13	32.57	32.57	32.30	28.59	23.95	20.25	14.54
Chemistry	27.43	27.33	27.13	27.27	32.24	29.67	22.05	19.41
Jyotsna	31.00	32.00	32.00	32.00	32.73	34.14	28.33	21.13
Pusa Shubham	24.33	24.67	24.70	24.53	21.52	21.17	17.39	12.65
Surya Kiran	49.05	49.35	49.55	49.45	51.43	47.65	44.98	37.15
White Prosperity	47.77	48.80	48.90	48.83	53.92	56.35	47.34	38.25
Darshan	24.77	25.20	25.40	24.93	22.50	20.75	16.89	12.47
S.E.	2.08	2.13	2.12	2.11	3.54	3.52	3.15	2.08
C.D. 5%	5.94	6.08	6.06	6.04	10.12	10.07	9.01	5.94

4. References

- Ahmed Z, Dhatt K, Singh K. Relative performance of parent and hybrid cultivars of gladiolus (*Gladiolus hybridus* Hort.) for post-harvest attributes and response to different holding solutions. International Journal of Current Microbiology and Applied Sciences. 2018;7(2):2826-2834.
- Choudhary M, Moond SK, Kumari A, Beniwal BS. Evaluation of gladiolus (*Gladiolus x hybridus* hort.) varieties for cut flower production under sub-humid conditions of Rajasthan. Crop Research. 2011;41(1-3):123-126.

3. Chourasia A, Viradia RR, Ansar H, Madle SN. Evaluation of different gladiolus cultivars for growth, flowering, spike yield and corm yield under Saurashtra region of Gujarat. *The Bioscan*. 2015;10(1):131-134.
4. Deshraj. *Floriculture at a Glance*. Kalyani Publishers. New Delhi; c2008. p. 135.
5. Kadam GB, Kumar G, Saha TN, Tiwari AK, Kumar R. Varietal evaluation and genetic variability studies on gladiolus. *Indian Journal of Horticulture*. 2014;71(3):379-384.
6. Kumar H, Meravi HK, Kumar A, Sankar VM. Post-harvest studies of different varieties of gladiolus. *International Journal of Chemical Studies*. 2018;6(4):368-372.
7. Kumar R, Yadav DS. Evaluation of gladiolus cultivars under sub-tropical hills of Meghalaya. *Journal of ornamental Horticulture*. 2005;8(2):86-90.
8. Meena B, Moond SK, Meena RR, Singh P, Singh D. Effect of genotype and planting geometry on flower quality and vase life of gladiolus (*Gladiolus × hybridus* Hort.). *The Bioscan*. 2016;11(4):2711-2714.
9. Mishra P. Post harvest flowering behaviour of some gladiolus varieties grown under Faizabad climatic condition. *Hort. Flora Research Spectrum*. 2015;4(1):64-66.
10. Nalage NA, Haldankar PM, Gawankar MS, Rathod NG. Evaluation of different gladiolus varieties (*Gladiolus hybridus* Hort.) under Konkan conditions of Maharashtra. *International Journal of Chemical Studies*. 2019;7(2):2018-2021.
11. Negi R, Kumar S, Dhiman SR. Evaluation of different cultivars of gladiolus (*Gladiolus grandiflorus* L.) suitable for low hills of Himachal Pradesh. *Indian Journal of Science of Research and Technology*. 2014;2(6):6-11.
12. Patra SK, Mohanty CR. Vase life study in different varieties of gladiolus. *International Journal of Agricultural Science and Research*. 2015;5(2):27-32.
13. Rani R, Prasad KK, Ranjan R. Studies on varietal performance in gladiolus. *Orissa Journal of Horticulture*. 2007;35(2):35-38.
14. Rao KD, Sushma K. Performance of different new genotypes of gladiolus. *Agricultural Science Digest-A Research Journal*. 2015;35(2):134-137.
15. Sarkar I, Chakravorty S, Maitra S. Evaluation of gladiolus cultivars with respect to flowering attributes in Darjeeling hills of West Bengal, India. *Indian Journal of Agricultural Research*. 2014;48(5):360-366.
16. Singh AK, Anuj K, Ghimire NR. Studies of gladiolus cultivars for post-harvest characters. *Environment and Ecology*. 2013;31(2):418-421.
17. Singh AK, Sisodia A, Sisodia V, Ray P. Performance of Indian and exotic varieties of gladiolus under Eastern UP conditions. *Journal of Ornamental Horticulture*. 2017;20(3-4):153-157.
18. Sisodia A, Kumawat P, Singh AK. Performance of gladiolus varieties for flowering traits. *Journal of Pharmacognosy and Phytochemistry*. 2018;7(3):3383-3386.