Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; SP6: 156-160

Narendra Chaudhary
Scientist, ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan, India

SS Sindhu
Head, Division of Floriculture and Landscaping, ICAR-IARI, New Delhi, India

Ramesh Kumar
Former Director of Directorate of Floricultural Research, ICAR-IARI, New Delhi, India

TN Saha
Scientist, ICAR-Directorate of Floricultural Research, Pune, Maharashtra, India

DVS Raju
Principal Scientist, ICAR-Directorate of Floricultural Research, Pune, Maharashtra, India

Ajay Arora
Principal Scientist, Division of Plant Physiology, ICAR-IARI, New Delhi, India

RR Sharma
Principal Scientist, Division of Food Science and PHT, IARI, New Delhi, India

Asheesh Sharma
Assistant Professor, JNKVV, CoA, Powarkheda, Hoshangabad, Madhya Pradesh, India

Corresponding Author:
Narendra Chaudhary
Scientist, ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer, Rajasthan, India

International Web-Conference
On
New Trends in Agriculture, Environmental & Biological Sciences for Inclusive Development
(21-22 June, 2020)

Evaluation of LA hybrids and Oriental lilies under protected and open conditions

Narendra Chaudhary, SS Sindhu, Ramesh Kumar, TN Saha, DVS Raju, Ajay Arora, RR Sharma and Asheesh Sharma

Abstract
An experiment was carried out to evaluate LA hybrids and Oriental lilies under protected and open conditions. The fresh bulbs of 9 cultivars (4 cultivars of LA hybrid *viz*. Salmon Classic, Bright Diamond, Red Alert, Pavia and 5 cultivars of Oriental lily *viz.* Mero Star, Medusa, Canberra, Rialto and Avocado) of *Lilium* were used as experimental material. The results showed that number of leaves, leaf area, plant height, total number of buds, bud diameter, total number of flowers, duration of flowering, vase life, weight of bulblets and diameter of bulblets found superior under protected condition in both LA hybrids and Oriental lilies, while days to visible bud formation and and weight of bulb recorded superior under open condition in both LA hybrids and Oriental lilies. Among the cultivars of LA hybrid, total number of buds, flower bud length, total number of flowers, diameter of flowers, weight of bulblets and diameter of bulb recorded maximum in Bright Diamond, whereas bud diameter, duration of flowering and weight of bulb registered maximum in Pavia. Among the cultivars of Oriental lily, number of buds and flowers, flower bud length and diameter recorded maximum in Rialto, whereas duration of flowering, weight and diameter of bulb and bulblets recorded maximum in Avocado.

Keywords: *Lilium*, LA hybrid, oriental, protected, open

Introduction
Lilium is one of the important commercial bulbous cut flower growing throughout the world. The genus *Lilium* belongs to the family Liliaceae and comprised more than 80 species in North America, Asia, and Europe with considerable variation in plant architecture, flower shapes, sizes, colours, fragrances and bulb morphologies. (Grassotti and Gimelli, 2011 [6], De Jong, 1974 [4]). *Lilium* ranks fourth among top ten cut flower of the world next to rose, chrysanthemum and tulip (Anon, 2014 [3]). LA hybrids (Longiflorum x Asiatic) and Oriental lilies are widely used in the floral industry as cut flowers as well as potted plants. These cultivars combined the wide colour range of the Asiatics, with the delicacy of flower form and fragrance of the Longiflorum. They are brightly-coloured trumpet type lilies and the LA gets a trumpet shape, a great strength and an extended vase life from the Longiflorum, while Asiatic traits gift the LA hybrid with warmer, brighter colour range and an upright calyx which cause the flowers to face upwards. Oriental hybrids, derived from *Lilium auratum*, *L. speciosum*, *L. japonicum* and *L. rubellum.* Oriental lilies are known for their large flowers, pleasant scent and attractive white, pink, and cream colours. The flower sizes are the largest and most spectacular among all the lilies. These features make them of great value as cut flowers.
In India, Lilium is one of the important commercial bulbous cut flowers growing in Nilgiri hills in Southern peninsula and Himachal Pradesh in the North West Himalayas and some part of hilly areas of Uttarakhand and Jammu and Kashmir.
Liliums are propagated commercially through bulbs. The cut Liliums although fetches a good price, often the cost of bulbs constitutes a major expenditure of *Lilium* production especially in those areas where bulb formation is poor (such as tropical and sub tropical areas). Fresh purchase of planting material every season results in increased cost of production. Further, the growers are to be assured of the supply of quality planting material without which *Lilium* production is not sustainable. Keeping the above said facts in view, the present

investigation has been planned to evaluate LA hybrid and Oriental lilies for their growth, flowering and bulb production under protected and open environment conditions.

Materials and Methods

The present experiment was conducted at the experimental farm of Directorate of Floricultural Research, IARI, New Delhi. The fresh bulbs of 9 cultivars (4 cultivars of LA hybrid *viz.* Salmon Classic, Bright Diamond, Red Alert, Pavia and 5 cultivars of Oriental lily *viz.* Mero Star, Medusa, Canberra, Rialto and Avocado) of *Lilium* procured from reliable source. These healthy and fresh bulbs used and selected as experimental material. These bulbs were planted in protected condition (Shade net house with shading percentage of 50%) as well as in open field condition. Spacing of 30cm x 20cm was maintained in two row planting method with planting depth of 12-15cm in both the growing environment. The experiment was laid out in Factorial RBD with three replication using 18 bulbs of each cultivar per replication. Uniform cultural practices were carried out throughout the experimentation. However, watering was given as per need under protected and open field conditions. Observations on various parameters were recorded in each replication per treatment. The data were statistically analyzed as suggested by Gomez and Gomez (1984) [5]. A probability of $p \leq 0.05$ was considered significant.

Results and Discussion

A perusal of data (Table 1) revealed that all of the vegetative attributes of LA hybrids and Oriental lilies were significantly affected by growing environment, cultivar and interaction of growing environment and cultivar. Effect of growing environment showed that among the LA hybrids, days to shoot emergence (6.65 & 7.67 d), number of leaves per plant (45.98 and 39.35), leaf area (24.46 and 13.24 cm^2) and plant height (83.30 and 39.20 cm) were recorded under protected and open condition respectively, irrespective of cultivars. Among the Oriental lilies, days to shoot emergence (6.44 and 7.28 d), number of leaves per plant (36.97 and 30.63), leaf area (40.19 and 24.36 cm^2) and plant height (92.88 and 60.51 cm) were registered under protected and open condition respectively, irrespective of cultivars. Vegetative characters in both the groups of lilies observed superior under protected condition. This could be attributed to high photosynthetic rate under protected environment. Similar results were also reported by Kumar *et al*. 2014 [10] in Gerbera, Hlatshwayo and Wahome (2010) [7] in Carnation.

The cultivar effect showed that among the cultivars of LA hybrid, number of leaves varied from 38.63 to 48.87. The maximum recorded in Red Alert (48.87) followed by Bright Diamond (43.70) and minimum in Salmon Classic (38.63), irrespective of growing environments. The interaction of growing environment and cultivar showed that maximum number of leaves recorded in Red Alert (50.27) under protected condition.

Table 1: Effect of growing environment and cultivar on days to shoot emergence, number of leaves per plant, leaf area and plant height of LA-hybrids and Oriental lilies

Cultivar	Days to shoot emergence			Number of leaves/plant			Leaf area (cm^2)			Plant height (cm)		
	E_1	E_2	Mean	E_1	E_1	Mean	E_1	E_2	Mean	E_1	E_2	Mean
LA-hybrids												
Salmon Classic	6.60	7.60	7.10	42.20	35.07	38.63	27.87	17.68	22.78	85.53	39.07	62.30
Bright Diamond	6.60	7.53	7.07	47.07	40.33	43.70	18.41	8.83	13.62	78.47	39.20	58.83
Red Alert	6.67	7.67	7.17	50.27	47.47	48.87	31.29	16.73	24.01	91.47	40.07	65.77
Pavia	6.73	7.87	7.30	44.40	34.53	39.47	20.25	9.70	14.98	77.73	38.47	58.10
Mean	6.65	7.67		45.98	39.35		24.46	13.24		83.30	39.20	
CD $_{0.05}$												
Environment (E)	0.18			1.03			1.47			1.26		
Cultivar (C)	NS			1.46			2.07			1.78		
E X C	NS			2.07			NS			2.52		
Oriental lilies												
Avocado	6.27	6.80	6.53	54.80	49.07	51.93	23.45	11.29	17.37	112.6	79.20	95.90
Rialto	6.40	7.07	6.73	33.80	30.67	32.23	45.99	30.36	38.17	98.53	58.20	78.37
Canberra	6.60	7.33	6.97	34.80	27.73	31.27	53.86	34.40	44.13	83.93	52.47	68.20
Medusa	6.40	7.47	6.93	31.87	28.67	30.27	38.08	24.81	31.44	101.3	74.80	88.07
Mero Star	6.53	7.73	7.13	29.60	17.00	23.30	39.58	20.94	30.26	68.00	37.87	52.93
Mean	6.44	7.28		36.97	30.63		40.19	24.36		92.88	60.51	
CD $_{0.05}$												
Environment (E)	0.12			0.53			1.20			1.09		
Cultivar (C)	0.19			0.84			1.90			1.72		
E X C	0.28			1.19			2.69			2.43		

E_1: Protected environment, E_2: Open field environment

Leaf area varied from 13.62 to 24.01 cm^2. The maximum and minimum recorded in Red Alert (24.01 cm^2) and in Bright Diamond (13.62 cm^2) respectively, irrespective of growing environments. Plant height varied from 58.10 to 65.77 cm. The maximum and minimum registered in Red Alert (65.77 cm) in Pavia (58.10 cm) respectively, irrespective of environments. Interaction effect depicted that maximum plant height recorded in Red Alert (91.47 cm) under protected condition. Among the cultivars of Oriental lilies, days to shoot emergence varied from 6.53 to 7.13 days. Earliest emergence recorded in Avocado (6.53 d) followed by Rialto (6.73 d), whereas latest noticed in Mero Star (7.13 d), irrespective of growing environments. The interaction effect revealed that earliest shoot emergence found in Avocado (6.27 d) under protected condition. Number of leaves varied from 23.30 to 51.93. The maximum recorded in Avocado (51.93) and minimum in Mero Star (23.30), irrespective of environments. Interaction effect showed that maximum number of leaves recorded in Avocado (54.80) under protected condition. Leaf area diversified from 17.37 to 44.13

cm^2). The maximum recorded in Canberra (44.13 cm^2) followed by Rialto (38.17 cm^2) and minimum in Avocado (17.37 cm^2), irrespective of environments. Interaction effect revealed that maximum leaf area recorded in Canberra (53.86 cm^2) under protected condition. Plant height diversified from 52.93 to 95.90 cm. The maximum registered in Avocado (95.90 cm) and minimum in Mero Star (52.93 cm), irrespective of environments Combination of environment and cultivar revealed that maximum plant height registered in Avocado (112.6 cm) under protected condition. The variation in the growth attributes might be owing to difference in genetic makeup of the cultivars. Such variation in the vegetative growth parameters was earlier reported by Kumar *et al*. (2017) [11], Jhon and Khan (2002) [8] in tulip germplasm and Kumar *et al*. (2014) [10] and Ahlawat *et al*. (2012) [1] in gerbera.

Perusal of data (Table 2 and 2a) revealed that floral attributes of LA hybrids and Oriental lilies significantly affected by growing environment, cultivar and interaction of environment and cultivar. The effect of growing environment revealed that among the LA hybrid, days to visible bud formation (76.25 and 74.99 d), total number of buds (5.03 and 4.35), bud diameter (25.57 and 23.40 mm), total number of flowers (5.03 and 4.35), duration of flowering (10.87 and 9.97 d) and vase life (9.93 and 8.83 d) were recorded under protected and open condition respectively, regardless of cultivars. Among the Oriental lily, days to visible bud formation (89.44 and 88.37 d), total number of buds (3.31 and 2.59), bud diameter (22.69 and 21.39 mm), flower bud length (9.44 and 8.89 cm), total number of flowers (3.31 and 2.59), diameter of flowers (17.53 and 16.63 mm), duration of flowering (11.52 and 10.96 d) and vase life (11.95 and 11.19 d) were registered under protected and open condition respectively, irrespective of cultivars. All the floral characters (except days to visible bud formation) in both the groups of lilies observed superior under protected condition. This might be due to the more favourable environment, higher CO_2 and photosynthetic efficiency under protected as compared to open field conditions. These findings are in agreement with the results obtained by Kumar *et al*. (2014) [10] in Gerbera, Hlatshwayo and Wahome (2010) [7] in Carnation, Nangare *et al*. (2015) [12] in Tomato.

The cultivar effect depicted that among the cultivars of LA hybrid, days to visible bud formation varied from 71.50 to 79.35 days. Earliest and latest bud formation recorded in Salmon Classic (71.50 days) and Pavia (79.35 days) respectively, irrespective of environments. Interaction showed that earliest bud formation recorded in Salmon Classic (70.80 d) under open condition. Number of buds diversified from 3.93 to 5.53. The maximum registered in Bright Diamond (5.53) followed by Pavia (4.93) and minimum in Salmon Classic (3.93), regardless of environments. Bud diameter varied from 23.12 to 25.59 mm. The maximum recorded in Pavia (25.59 mm) followed by Bright Diamond (24.94 mm) and minimum in Red Alert (23.12 mm), irrespective of environments. Combined effect showed that maximum bud diameter recorded in Salmon Classic (26.76 mm) under protected condition.

Table 2: Effect of growing environment and cultivar on days to visible bud formation, total number of buds, bud diameter and flower bud length of LA-hybrids and Oriental lilies

Cultivar	Days to visible bud formation			Total number of buds			Bud diameter (mm)			Flower bud length (cm)		
	E_1	E_2	Mean	E_1	E_2	Mean	E_1	E_2	Mean	E_1	E_2	Mean
LA-hybrids												
Salmon Classic	72.20	70.80	71.50	4.47	3.40	3.93	26.76	21.81	24.29	9.23	7.70	8.47
Bright Diamond	78.00	76.20	77.10	5.93	5.13	5.53	25.68	24.21	24.94	8.73	9.20	8.97
Red Alert	75.00	74.07	74.53	4.60	4.13	4.37	23.71	22.52	23.12	8.00	9.70	8.85
Pavia	79.80	78.90	79.35	5.13	4.73	4.93	26.12	25.05	25.59	8.33	8.75	8.54
Mean	76.25	74.99		5.03	4.35		25.57	23.40		8.58	8.84	
CD 0.05												
Environment (E)	0.04			0.20			1.10			NS		
Cultivar (C)	0.05			0.28			1.55			0.39		
E X C	0.08			NS			2.20			0.55		
Oriental lilies												
Avocado	82.80	81.60	82.20	2.80	2.33	2.57	22.12	20.61	21.37	9.73	9.33	9.53
Rialto	91.60	90.40	91.00	5.27	3.60	4.43	26.58	23.43	25.01	10.53	10.20	10.36
Canberra	91.20	90.40	90.80	3.13	2.53	2.83	22.01	21.24	21.62	9.55	9.12	9.34
Medusa	87.20	86.00	86.60	2.87	2.33	2.60	24.18	24.54	24.36	9.17	8.24	8.70
Mero Star	94.40	93.47	93.93	2.47	2.13	2.30	18.56	17.15	17.86	8.24	7.57	7.90
Mean	89.44	88.37		3.31	2.59		22.69	21.39		9.44	8.89	
CD 0.05												
Environment (E)	0.02			0.20			0.59			0.15		
Cultivar (C)	0.03			0.32			0.94			0.23		
E X C	0.05			0.45			1.33			NS		

E_1: Protected environment, E_2: Open field environment

Table 2a: Effect of growing environment and cultivar on total number of flowers, diameter of flowers, duration of flowering and vase life of LA-hybrids and Oriental lilies

Cultivar	Total number of flowers			Diameter of flowers (cm)			Duration of flowering (d)			Vase life (d)		
	E_1	E_2	Mean	E_1	E_2	Mean	E_1	E_2	Mean	E_1	E_2	Mean
LA-hybrids												
Salmon Classic	4.47	3.40	3.93	13.37	12.07	12.72	11.00	10.20	10.60	9.93	8.93	9.43
Bright Diamond	5.93	5.13	5.53	15.10	15.47	15.28	10.60	9.80	10.20	9.87	8.93	9.40
Red Alert	4.60	4.13	4.37	14.73	15.27	15.00	11.07	9.47	10.27	10.00	8.53	9.27
Pavia	5.13	4.73	4.93	14.80	15.10	14.95	10.80	10.40	10.60	9.93	8.93	9.43

Mean	5.03	4.35		14.50	14.48		10.87	9.97		9.93	8.83	
CD $_{0.05}$												
Environment (E)	0.20			NS			0.16			0.27		
Cultivar (C)	0.28			0.28			0.23			NS		
E X C	NS			0.40			0.32			NS		
Oriental lilies												
Avocado	2.80	2.33	2.57	15.43	14.63	15.03	12.40	11.60	12.00	12.60	11.07	11.83
Rialto	5.27	3.60	4.43	18.63	17.80	18.22	11.20	10.60	10.90	12.00	11.27	11.63
Canberra	3.13	2.53	2.83	20.43	19.40	19.92	10.80	10.20	10.50	12.53	12.00	12.27
Medusa	2.87	2.33	2.60	15.63	14.87	15.25	11.80	11.60	11.70	11.80	11.20	11.50
Mero Star	2.47	2.13	2.30	17.50	16.43	16.97	11.40	10.80	11.10	10.80	10.40	10.60
Mean	3.31	2.59		17.53	16.63		11.52	10.96		11.95	11.19	
CD $_{0.05}$												
Environment (E)	0.20			0.20			0.01			0.25		
Cultivar (C)	0.32			0.31			0.01			0.40		
E X C	0.45			NS			0.01			NS		

E_1: Protected environment, E_2: Open field environment

Flower bud length varied from 8.47 to 8.97 cm. The longest and shortest registered in Bright Diamond (8.97 cm) and Salmon Classic (8.47 cm) respectively, irrespective of environments. Interaction revealed that longest flower bud length registered in Red Alert (9.70 cm) under open condition. Number of flowers varied from 3.93 to 5.53. The maximum recorded in Bright Diamond (5.53) followed by Pavia (4.93) and minimum in Salmon Classic (3.93), irrespective of environments. Diameter of flowers diversified from 12.72 to 15.28 mm. The maximum and minimum recorded in Bright Diamond (15.28 cm) and Salmon Classic (12.72 cm) respectively, irrespective of environments. Combined effect revealed that maximum diameter of flowers recorded in Bright Diamond (15.47 cm) under open condition. Duration of flowering varied from 10.20 to 10.60 days. The maximum noticed in Pavia (10.60 d) which was at par with Salmon Classic (10.60 d) and minimum in Bright diamond (10.20 d), irrespective of environments. Interaction effect showed that maximum duration of flowering reported in Red Alert (11.07 d) under protected environment. The cultivar effect found to be non significant with respect to the vase life. Among the Oriental lilies, days to visible bud formation varied from 82.20 to 93.93 days. Earliest and latest recorded in Avocado (82.20 d) and Mero Star (93.93 days) respectively, irrespective of environments. Interaction showed that earliest bud formation recorded in Avocado (81.60 d) under open condition. Number of buds varied from 2.30 to 4.43. The maximum and minimum recorded in Rialto (4.43) and Mero Star (2.30) respectively, irrespective of environments. Interaction effect showed that maximum number of buds recorded in Rialto (5.27) under protected condition. Bud diameter diversified from 17.86 to 25.01mm. The maximum and minimum recorded in Rialto (25.01 mm) and Mero Star (17.86 mm) respectively, irrespective of environments. Combined effect revealed that maximum bud diameter recorded in Rialto (26.58 mm) under protected condition. Flower bud length varied from 7.90 to 10.36 cm. The maximum and minimum recorded in Rialto (10.36 cm) and Mero Star (7.90 cm) respectively, irrespective of environments. Total number of flowers varied from 2.30 to 4.43. The maximum and minimum recorded in Rialto (4.43) and Mero Star (2.30) respectively, irrespective of environments. Combined effect depicted that maximum number of flowers recorded in Rialto (5.27) under protected condition. Diameter of flowers varied from 15.03 to 19.92 cm. The maximum registered in Canberra (19.92 cm) followed by Rialto (18.22 cm) and minimum in Avocado (15.03 cm), irrespective of environment. Duration of flowering varied from 10.50 to 12.00 days. The maximum and minimum recorded in Avocado (12.00 d) and Canberra (10.50 d) respectively, irrespective of environments. Interaction depicted that maximum duration of flowering recorded in Avocado (12.40 d) under protected condition. Vase life varied from 10.60 to 12.27 days. The maximum and minimum reported in Canberra (12.27 d) and Mero Star (10.60 d) respectively, irrespective of environments. The variation in the floral attributes might be due to genotype variation of the cultivars of LA hybrid and Oriental lilies. These findings are in conformity with the results reported by Kumar *et al*. (2017) [11], Ahmed and Khurshid (2004) [2], Jhon and Khan (2002) [8] in tulip germplasm, and Kumar *et al*. (2014) [10], Ahlawat *et al*. (2012) [1] in gerbera.

Perusal of data (Table 3) revealed that bulb attributes of LA hybrids and Oriental lilies significantly affected by growing environment, cultivar and interaction of environment and cultivar. Effect of growing environment showed that among the LA hybrids, weight of bulb (22.88 and 36.40 g), weight of bulblets (1.08 and 0.80 g), diameter of bulb (38.92 and 39.70 mm) and diameter of bulblets (13.65 and 12.12 mm) were registered under protected and open conditions respectively, irrespective of cultivars. Among the Oriental lilies, weight of bulb (29.33 and 38.76 g), weight of bulblets (1.28 and 0.94 g), diameter of bulb (43.48 and 47.06 mm) and diameter of bulblets (13.79 and 11.95 mm) were registered under protected and open conditions respectively, irrespective of cultivars. Weight of bulb and diameter of bulb recorded low under protected condition in both LA hybrid and Oriental lilies. This might be due to diversion of more food material to flowering attributes like total number of buds, bud diameter, total number of flowers and duration of flowering under protected condition. These finding are in close conformity with Kumar *et al*. (2014) [10] in Gerbera.

Table 3: Effect of growing environment and cultivar on weight of bulb, weight of bulblets, diameter of bulb and diameter of bulblets of LA-hybrids and Oriental lilies

Cultivar	Weight of bulb (g)			Weight of bulblets (g)			Diameter of bulb (mm)			Diameter of bulblets (mm)		
	E_1	E_2	Mean	E_1	E_2	Mean	E_1	E_2	Mean	E_1	E_2	Mean
LA-hybrids												
Salmon Classic	16.87	49.00	32.93	1.03	0.82	0.92	37.67	43.11	40.39	13.35	11.90	12.63
Bright Diamond	35.33	20.60	27.97	1.15	0.80	0.98	47.94	33.51	40.73	14.40	12.17	13.29
Red Alert	18.00	29.00	23.50	1.08	0.76	0.92	32.29	42.05	37.17	14.21	12.36	13.28
Pavia	21.33	47.00	34.17	1.05	0.83	0.94	37.77	40.14	38.96	12.65	12.05	12.35
Mean	22.88	36.40		1.08	0.80		38.92	39.70		13.65	12.12	
$CD_{0.05}$												
Environment (E)	2.24			0.03			NS			0.64		
Cultivar (C)	3.17			0.04			1.55			NS		
E X C	4.48			0.05			2.20			NS		
Oriental lilies												
Avocado	47.67	56.87	52.27	1.74	1.33	1.54	48.95	50.80	49.88	13.57	12.13	12.85
Rialto	19.67	32.33	26.00	1.15	0.91	1.03	43.63	47.58	45.61	14.71	11.82	13.27
Canberra	19.33	31.93	25.63	1.02	0.81	0.91	34.78	46.80	40.79	13.22	11.86	12.54
Medusa	33.00	28.33	30.67	1.30	0.85	1.07	44.46	41.48	42.97	13.94	11.92	12.93
Mero Star	27.00	44.33	35.67	1.19	0.79	0.99	45.59	48.62	47.11	13.52	12.01	12.77
Mean	29.33	38.76		1.28	0.94		43.48	47.06		13.79	11.95	
$CD_{0.05}$												
Environment (E)	4.92			0.04			1.45			0.30		
Cultivar (C)	7.77			0.06			2.29			NS		
E X C	NS			0.08			3.24			0.66		

E_1: Protected environment, E_2: Open field environment

The cultivar effect depicted that among the cultivars of LA hybrid, bulb weight varied from 23.50 to 34.17 gm. The maximum and minimum recorded in Pavia (34.17 g) and Red Alert (23.50 g) respectively, regardless of environments. Interaction effect revealed that maximum weight of bulb recorded in Salmon Classic (49.00 g) under open field condition. Weight of bulblets varied from 0.92 to 0.98 gm. The maximum recorded in Bright Diamond (0.98 g) and minimum recorded in Red Alert (0.92 g) which was at par with Salmon Classic (0.92 g), irrespective of environments. Combined effect depicted that maximum weight of bulblets recorded in Bright Diamond (1.15 g) under protected condition. Diameter of bulb varied from 37.17 to 40.73 mm. The maximum and minimum recorded in Bright Diamond (40.73 mm) and Red Alert (37.17 mm) respectively, irrespective of environments. Interaction effect showed that maximum bulb diameter registered in Bright Diamond (47.94 mm) in protected environment. Among the cultivars of Oriental lily, weight of bulb varied from 25.63 to 52.27 gm. The maximum and minimum recorded in Avocado (52.87 g) and Canberra (25.63 g) respectively, regardless of environments. Weight of bulblets varied from 1.54 to 0.91 g. The maximum and minimum recorded in Avocado (1.58 g) and Canberra (0.91 g) respectively, irrespective of environments. Combined effect depicted that maximum weight of bulblets recorded in Avocado (1.74 g) under protected condition. Diameter of bulb varied from 40.79 to 49.88 mm. The maximum and minimum recorded in Avocado (49.88 mm) and Canberra (40.79 mm) respectively, irrespective of environments. Interaction effect showed that maximum bulb diameter registered in Avocado (50.80 mm) under open condition. Interaction effect showed that maximum diameter of bulblets registered with Rialto (14.71 mm) under protected condition. This could be due to variation in genetic makeup of the cultivar of LA hybrid and Oriental lily. Similar results were also reported by Kumar *et al*. (2017) [11], Jhon *et al*. (2006) [9], Ahmed and Khurshid (2004) [2] in tulip and Kumar *et al*. (2014) [10], Ahlawat *et al*. (2012) [1] in gerbera.

Conclusion

Based on the results, the growers are advised to grow Bright Diamond and Pavia from LA hybrids, and Rialto and Avocado from Oriental lilies, under protected condition to obtain quality cut flower and bulb production.

References

1. Ahlawat TR, Barad AV, Jat G. Evaluation of Gerbera cultivars under naturally ventilated polyhouse. Indian J. Hort. 2012; 69:606-608.
2. Ahmed MJ, Khurshid S. Performance of tulip (*Tulipa gesneriana*) genotypes under Rawalkot conditions. Asian J. Plant Sci. 2004; 3:170-173.
3. Anonymous. Cut Flowers, Facts and Figures, Flora Holland. 2014, 4.
4. De Jong PC. Some notes on the evolution of lilies. Lily yearbook, North Am. Lily Soc. 1974; 27:23-28.
5. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research (2nd Edn.), John Wiley and Sons. Inc. New York, 1984.
6. Grassotti A, Gimelli F. Bulb and cut flower production in the genus *Lilium*: Current status and the future. Acta Hort. 2011; 900:21-36.
7. Hlatshwayo MS, Wahome PK. Effects of shading on growth, flowering and cut flower quality in carnation (*Dianthus caryohyllus*). J. Agric. Soc. Sci. 2010; 6:34-38.
8. Jhon AQ, Khan FU. Evaluation of exotic tulip genotypes under Kashmir valley conditions. Orissa J. Hort. 2002; 5:27-30.
9. Jhon AQ, Khan FU, Rather ZA. Genetic variability studies in tulip. Appl. Biol. Res. 2006; 8:37-39.
10. Kumar R, Ahmed N, Lal S, Mahendiran G. Evaluation of Gerbera genotypes for cut flower production under different growing conditions of Kashmir. Indian J. Hort. 2014; 71**:**138-141.
11. Kumar R, Sharma OC, Singh DB. Screening of tulip (*Tulipa gesneriana* L.) germplasm for quality cut flower and bulb production. Indian J. Hort. 2017; 74:251-257.
12. Nangare DD, Singh J, Meena VS, Bhushan B, Bhatnagar PR. Effect of green shade nets on yield and quality of tomato (*Lycopersicon esculentum* Mill) in semi-arid region of Punjab. Asian J. Advances Basic Applied Sci. 2015; 1:1-8.