Journal of Advances in Biology & Biotechnology

Volume 27, Issue 12, Page 873-883, 2024; Article no.JABB.128162
ISSN: 2394-1081

Floral Biology and Pollination Behaviour in Bottle Gourd under Hilly Condition of Uttarakhand

Varsha [a*], S. S. Bisht [b], S. C. Pant [a], Pankaj Bahuguna [b], Nasir Ahmad Qazizadah [c] and Mamta Khaiper [c]

[a] Department of Vegetable Science, College of Horticulture, Veer Chandra Singh Garhwali, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, 246123, India.
[b] Department of Basic and Social Sciences, College of Horticulture, Veer Chandra Singh Garhwali, Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, 246123, India.
[c] School of Agriculture, OM Sterling Global University, Hisar, 125005, Haryana, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jabb/2024/v27i121834

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/128162

Original Research Article

Received: 12/10/2024
Accepted: 14/12/2024
Published: 29/12/2024

ABSTRACT

An experiment was conducted at College of Horticulture, Uttarakhand University of Horticulture and Forestry Bharsar Pauri Gharwal to observe the floral biology and Pollination behaviour in ten genotypes (G1 to G10) of bottle gourd March 2022 - August 2022. The flower has five petals. The different parameters for floral biology and pollination behavior were recorded on the basis of time

**Corresponding author: E-mail: Singhvarsha6395@gmail.com;*

Cite as: *Varsha, S. S. Bisht, S. C. Pant, Pankaj Bahuguna, Nasir Ahmad Qazizadah, and Mamta Khaiper. 2024. "Floral Biology and Pollination Behaviour in Bottle Gourd under Hilly Condition of Uttarakhand". Journal of Advances in Biology & Biotechnology 27 (12):873-83. https://doi.org/10.9734/jabb/2024/v27i121834.*

period. The experiment was laid out in field conditions is RCBD with three replications for ten genotypes and lab experiment was laid out in CRD with nine treatments. The genotype Pusa Summer Prolific Long (PSPL) took a minimum of 38.333days for first male flowering, and for female flowering, it took 40.667 days. The genotype L. C. Meerut has given better in terms of a maximum 7.100cm male flower length; for female flower length, it was 7.500cm. The genotype Pusa Summer Prolific Long (PSPL) had maximum (81.000mm) diameter of male flower. Arka Bahar had maximum (86.000mm) diameter of female flower. The best result for sex ratio was seen in L. C. Tehri (105.000). Anthesis in different genotypes of bottle gourd started from 5.00 am, and flower continued to open till 11.00 am. The peak period for anthesis in all the genotypes was recorded in between 6.00 am to 8.00 am. Anther dehiscence is increased gradually from 6.00 am to 11.00 am. The peak period of anther dehiscence was recorded between 6.00 am to 8.00 am. The maximum percentage of stigma receptivity was observed during full bloom stage followed by bud and withering stages in all genotypes. The fruit set by hand pollination was maximum (80.000%) in PSPL and by open pollination maximum (86.000%) fruit set was recorded in genotype Arka Bahar.

Keywords: Floral biology; anthesis; anther dehiscence; pollination; pollen viability.

1. INTRODUCTION

Bottle gourd (*Lagenaria siceraria* L.) belongs to the family Cucurbitaceae, and is an important and popular vegetable. High genotypic coefficient of variation values for yield/plant, number of fruits/plant, fruit length and fruit breadth and wider range of variation indicate more opportunity for selection of better genotypes (Rajesh et al., 1999; Ram et al., 2005). In nature, bottle gourd exhibits great morphological and genetic variability and could wide environmental adaptation (Koffi, 2009). Bangladeshi farmers used different local cultivars and released (from different organization) bottle gourd variety. But their yield is not in satisfactory level. Varietal performance might be helpful to overcome this problem. Considering these circumstances the present study was undertaken with a view to evaluate the growth and yield performance of eleven bottle gourd lines.

2. MATERIALS AND METHODS

The general climatic condition of Bharsar is represented as mild summer, high precipitation and colder to severely cold prolonged winter. The South-East monsoon commences towards the end of June while the North-East monsoon causes occasional winter showers during November to February. The area receives frequent snowfall during winter (Bisht and Sharma 2014).

Bottle gourd thrives well under sandy loam to clay soils with the pH value of 5.4 to 7.0. Well drained soils with good organic matter are best by bottle gourd cultivation perform better in well drained and organic matter rich soil. Pits of (30 x 30 x 30) cm^3 size were prepared in each plot with a spacing of 2.5 m x 2 m. In Nursery seeds were sown in polybags on 15/ March/2022 inside the polyhouse.

Seedlings of different genotypes were transplanted in the experimental plot on 21/April/2022 at a spacing of 2.5 m x 2 m. Mechanical support through Oak (*Quercus*) sticks was provided for better growth and yield.

Fully opened staminate and pistillate flowers were collected from the field and brought to the laboratory. The flowers were dissected under a stereo-binocular microscope to study the detailed structure.

Longevity of flowers is the time taken by a particular flower from anthesis till it sets into fruit or till it withers and drops off. Thirty (30) buds of staminate and pistillate flowers were serially numbered using tags and were observed daily to record the day of anthesis. The opened flowers were further monitored till they set fruit or dropped.

Flower lengths of both male and female flowers were measured using scale when the flowers were freshly opened and bloomed. Flower length was measured from five male and five female buds of each of both the plants from each treatment and averaged over replications.

Flower diameter of both male and female flowers was measured by using digital Vernier caliper when the flowers were freshly opened and bloomed. Flower diameter was measured from five male and five female buds of each of both the plants from each treatment and averaged over replications.

The stigmatic receptivity of different treatments was determined by using fruit set method. 10 buds from 2 plants of each genotype were selected at different ages (bud stage, full bloom and withering stage). All the buds of different ages were pollinated and bagged.

Number of fruit sets will be recorded by counting male and female flowers on ten (10) days different nodes and internodes of each plant from each treatment and averaged over replications.

Data was collected consecutively for 10 days from 14/06/2022 till 24/06/2022. Each day 20 flowers buds (both male and female), 10 each of 2 selected plants from each replication was selected and tagged. Flowers expected to open next day were tagged in the evening hours and observations were recorded at hourly intervals from 5:00AM to 11:00AM onwards till complete opening of all flowers. The opened flowers were removed every time at an interval of hour. Time of complete opening of flowers was noted and percentage was determined by computing the mean frequency of flower opening over various time slots.

Hence, observations were recorded for anther dehiscence at different times of the day by tagging 10 randomly selected staminate flower buds from 2 selected plant of each genotype at hourly intervals for 10 consecutive days. Observations were recorded in the freshly opened flowers with the help of hand lens at hourly intervals from 5:00 AM to 11:00AM onward still complete dehiscence. The anther dehiscence (release/appearance of powdery mass) in flowers was observed visually. Time of anther bursting and release of pollen from pollen sac were noted to determine the peak period of dehiscence in various cultivars under study.

3. RESULTS AND DISCUSSION

Bottle gourd being a monoecious crop, male and female flowers are borne separately on the same plant but at different internodes. For transfer of pollen from a staminate flower to the stigma of a pistillate flower an external agent is essential for successful pollination and fruit set. The possibility of wind pollination is ruled out since the pollen grains are sticky. The flowers are a rich source of nectar and pollen, and attract a number of insect visitors, of which a few may be effective pollinators for perpetuation of the plant.

Bottle gourd is a monoecious, annual vine pubescent herb with five angled stems, which are profusely branched. The flowers are large, unisexual, white, solitary and showy. The flower has five petals. The staminate flower has longer pedicels than female and hermaphrodite flowers and exceeds the foliage. Ovary may be round, ovate long or cylindrical. There are three stamens, two as compound and one as single.

Thamburaj and Singh (2000) observed that the pumpkin plant bears 2-3 branches with thick stem, flowers are unisexual, solitary and are lemon yellow-deep orange in colour.

The flowers lasted for less than a day. In summer the flowers closed much earlier probably because of temperature while, in post monsoon season they seldom closed. Low temperature might be the reason for some of the flower not closing during post monsoon season because opening and closing of flowers is regulated by relative humidity and light intensity.

The variations observed in the number of days taken to male flowering were found to be significant in the genotypes under study. The cultivar PSPL took a minimum of 38.333 days to flowering (Table 1). Similar result was reported by Kumari et al*.* (2017) while working on genetic diversity of bitter gourd (*Momordica charanita* L.). The present findings are in conformity with Pal et al*.* (1976) where they reported that bitter gourd vines started flowering 40 days after sowing, and the blooming period varied from 68 to 76 days.

The time of anthesis was recorded on an hourly interval in July 2022. The peak period of anthesis was recorded from 6 to 8am in both male and female flower. In genotype first maximum anthesis percentage was recorded in male flower is 90% and minimum is 10% (Table 4).

Hawthorn and Pollard (1954) found that anthesis in watermelon and muskmelon occurs from one to two hours after sun-shine and the flowers closed before evening. The results of present study are in accordance with the study of Kalloo (1988), Chand et al. (1990), Ram (1997), Ramirez et al. (2002) and Thu (2012) in cucumber. They reported that anthesis started from 4:00am to 7:30am and flowers became fully open from 6:00am to 9:55am and completed anthesis in about 4 to 7 hours on the same day. Flower closure in both the sexes is initiated at about 9:00am of the same day. Final closure takes place between 11:00am and 12:00pm in the male and about 10:00am in the female. Flower once closed doesn't open again.

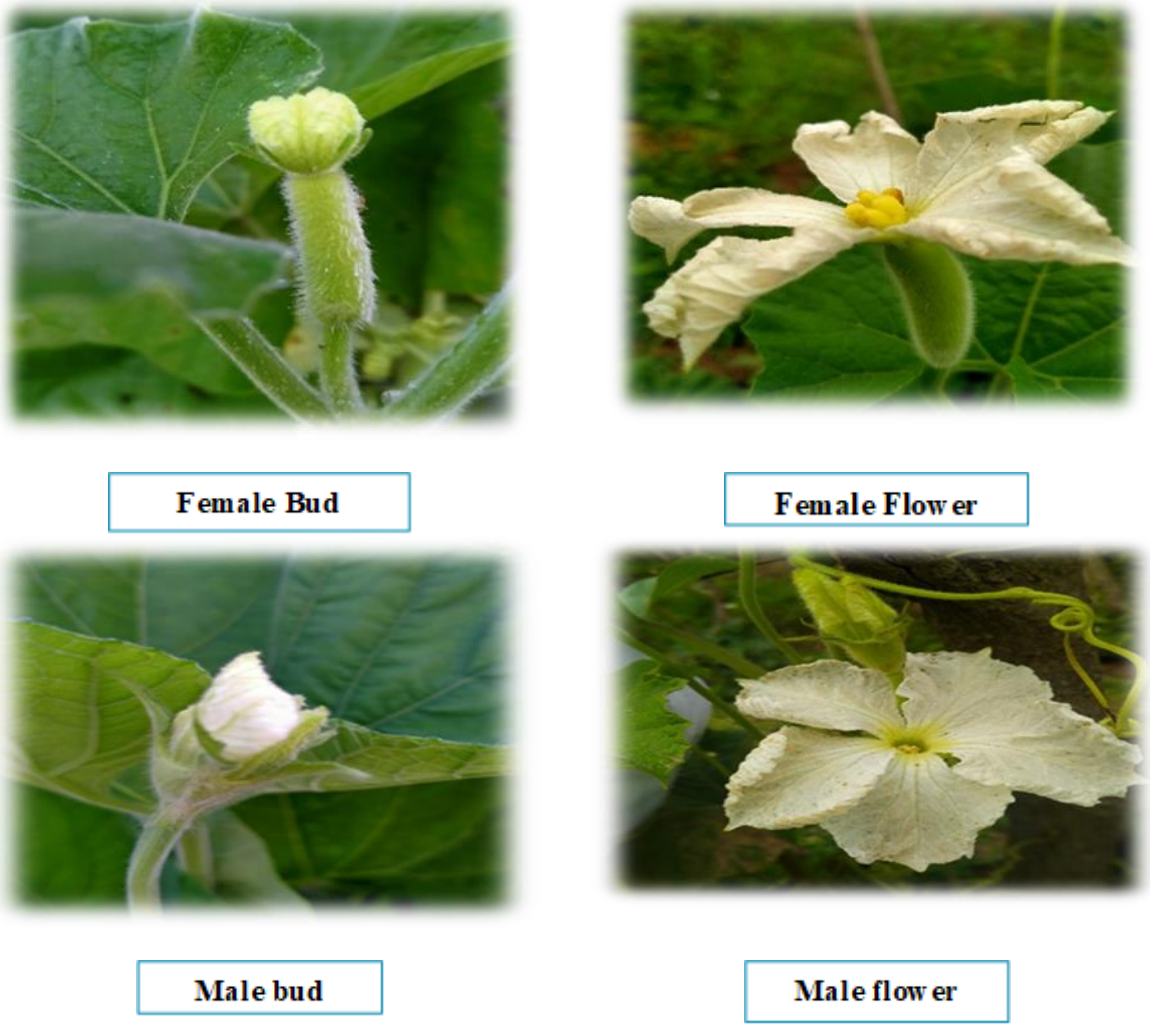

Fig. 1. Male and Female flowers of *Lagenaria siceraria* (Mol.) Standl

Table 1. Mean performance for days to first male and female flowering in different genotypes of *Lagenaria siceraria* (Mol.) Standl

SR. No.	Genotypes	Days to first male and female flowering ± SE(m)	
		Male	Female
1.	G_1 (Arka Bahar)	44.000±2.000	44.667±1.453
2.	G_2 (PSPL)	38.333±1.202	40.667±0.667
3.	G_3 (L. C. Tehri)	46.333±1.453	47.667±1.453
4.	G_4 (L. C. Saharanpur)	46.000±2.309	47.000±1.732
5.	G_5 (L. C. Meerut)	44.333±2.028	48.000±1.528
6.	G_6 (L.C. Rishikesh)	45.333±0.667	48.000±1.155
7.	G_7 (L.C. Dehradun)	41.667± 2.186	50.667±0.333
8.	G_8 (L.C. Karnal)	48.333±1.202	50.667±0.667
9.	G_9 (Kashi Ganga)	41.000±1.528	44.667±1.764
10.	G_{10} (L.C. Bharsar)	43.333±1.202	46.000±2.309
	Grand mean	43.866	51.800
	SE(d)	2.280	1.693
	C.D.$_{(0.05)}$	4.828	3.585

Table 2. Mean performance for flower length (male and female) in different genotypes of *Lagenaria siceraria* (Mol.) Standl

Sr. No.	Genotypes	Flower length male ± SE	Flower length female ±SE
1.	G_1 (Arka Bahar)	6.233±0.696	5.467±0.203
2.	G_2 (PSPL)	5.033±0.742	7.500±0.577
3.	G_3 (L. C. Tehri)	5.567±0.657	5.500±0.577
4.	G_4 (L. C. Saharanpur)	6.367±0.467	5.300±0.200
5.	G_5 (L. C. Meerut)	7.100±0.306	5.767±0.371
6.	G_6 (L.C. Rishikesh)	4.500±0.529	5.167±0.333
7.	G_7 (L.C. Dehradun)	4.700 ±0.643	6.833±0.333
8.	G_8 (L.C. Karnal)	4.500±0.416	4.833±0.333
9.	G_9 (Kashi Ganga)	6.500±0.577	5.500±0.577
10.	G_{10} (L.C. Bharsar)	4.767±0.267	6.033±0.291
	Grand mean	5.526	5.790
	SE(d)	0.735	0.504
	C.D.$_{(0.05)}$	1.555	1.068

Table 3. Mean performance for sex ratio (male/female) in different genotypes of *Lagenaria siceraria* (Mol.) Standl

Sr. No.	Genotypes	Sex ratio ± S.E.(m)
1.	G_1 (Arka Bahar)	149.000 ±2.082
2.	G_2 (PSPL)	147.333 ±13.860
3.	G_3 (L. C. Tehri)	105.000 ±7.638
4.	G_4 (L. C. Saharanpur)	115.000 ±5.774
5.	G_5 (L. C. Meerut)	105.667 ±4.702
6.	G_6 (L.C. Rishikesh)	113.333 ±4.410
7.	G_7 (L.C. Dehradun)	165.000 ±2.887
8.	G_8 (L.C. Karnal)	120.000 ±5.774
9.	G_9 (Kashi Ganga)	129.000± 5.859
10.	G_{10} (L.C. Bharsar)	169.000± 2.082
	Grand mean	131.833
	SE(d)	7.469
	C.D. $_{(0.05)}$	15.813

Anther dehiscence is the final function of anther that causes the release of pollen grains. This process is coordinated precisely with pollen differentiation, floral development and flower opening. In bottle gourd, anther split longitudinally along a definite stomium. In this study observations on time of anther dehiscence were recorded for ten days. Observation regarding the time of anther dehiscence was also recorded at one-hour interval between 5-11 am. The peak period of anther dehiscence we recorded between 6-8am. Maximum anther dehiscence is in cultivar Arka Bahar, PSPL, L. C. Tehri, L. C. Saharanpur, L. C. Meerut and L. C. Bharsar maximum during 6- 8am (90%), and minimum anther dehiscence is 10% in all the cultivars (Table 4). Time of anther dehiscence helps in carrying out crossing activities as well as it helps in understanding the synchronicity in monoecious flowers. The present findings are in conformity with Choudhury and Pathak (1961) in cucumber, Pal and Singh (1972) in bitter gourd; Chand et al. (1990), Poal (1995) and Ram (1997) in cucumber**.** Rubina (2010) observed that the anther dehiscence initiated at 07.30 am, immediately after the opening of flower.

Male flower buds took on an average 17 to 19 days, whereas female buds took 21 to 22 days for their complete development.

The cultivar PSPL took minimum days (40.667) for female flowering and this variation due to different genetic constitution or when diverse genotypes is subjected to a particular environment condition they act accordingly. The difference in flowering time in bottle gourd genotypes is also reported by Kappal et al. (2015).

Table 4. Variation in anthesis and dehiscence per cent among different genotypes of *Lagenaria siceraria* (Mol.) Standl

		Time of anthesis and dehiscence												Temperature(°C)		Humidity
			Male							Female						
Days	No. buds	of5-6am	6-7am	7-8am	8-9am	9-10am	10-11am	5-6am	6-7am	7-8am	8-9am	9-10am	10-11am	Max.	Mini.	%
G_1 (Arka Bahar)																
1.	**20**	60	70	70	60	0	0	20	40	40	0	0	0	29	16	75
2.	**20**	50	60	40	30	0	0	30	60	40	20	10	0	28	16	74
3.	**20**	80	90	90	80	50	50	10	30	30	30	30	20	24	15	72
4.	**20**	30	50	30	30	10	0	20	40	40	30	20	10	21	13	77
5.	**20**	50	60	40	20	0	0	10	30	30	20	10	0	26	19	63
6.	**20**	50	70	70	50	30	10	30	40	40	0	0	0	21	12	70
7.	**20**	50	80	80	40	20	0	40	50	10	0	0	0	20	14	74
8.	**20**	40	60	40	20	10	0	30	20	20	10	10	0	21	13	69
9.	**20**	30	70	60	40	20	10	20	40	20	10	0	0	22	14	72
10.	**20**	40	70	50	30	10	0	20	40	30	20	10	0	23	19	71
Mean	**20**	**48**	**68**	**57**	**40**	**15**	**7**	**23**	**39**	**30**	**14**	**9**	**3**			
G_2 (PSPL)																
1.	**20**	40	70	60	0	0	0	20	40	40	20	20	0	29	16	75
2.	**20**	60	60	80	40	40	0	10	40	30	30	0	0	28	16	74
3.	**20**	30	90	90	40	40	0	30	60	40	30	10	0	24	15	72
4.	**20**	40	70	90	50	50	20	60	80	50	40	0	0	21	13	77
5.	**20**	50	80	60	30	30	0	10	30	20	20	10	0	26	19	63
6.	**20**	30	50	70	40	30	10	20	40	40	30	20	10	21	12	70
7.	**20**	20	50	80	30	20	0	10	30	30	20	10	0	20	14	74
8.	**20**	40	53	80	50	30	0	20	30	20	10	0	0	21	13	69
9.	**20**	50	80	60	40	20	10	30	50	40	30	20	10	22	14	72
10.	**20**	30	50	30	20	10	10	40	70	60	40	30	10	23	19	71
Mean	**20**	**39**	**66**	**70**	**34**	**27**	**5**	**25**	**47**	**37**	**27**	**12**	**3**			
G_3 (L. C. Tehri)																
1.	**20**	20	50	60	60	40	20	10	20	20	10	0	0	29	16	75
2.	**20**	10	30	80	60	30	10	20	50	50	30	20	10	28	16	74
3.	**20**	20	60	90	60	20	10	20	60	60	40	20	20	24	15	72
4.	**20**	30	50	90	70	40	20	10	40	50	30	20	10	21	13	77

	Time of anthesis and dehiscence													Temperature(°C)		Humidity
			Male						Female							
Days	**No. buds**	**of5-6am**	**6-7am**	**7-8am**	**8-9am**	**9-10am**	**10-11am**	**5-6am**	**6-7am**	**7-8am**	**8-9am**	**9-10am**	**10-11am**	**Max.**	**Mini.**	**%**
5.	**20**	40	70	60	50	30	10	10	20	20	20	0	0	26	19	63
6.	**20**	30	40	40	30	10	0	30	40	40	30	10	0	21	12	70
7.	**20**	20	30	50	40	20	0	20	40	40	30	10	0	20	14	74
8.	**20**	30	60	60	30	10	0	10	20	30	20	10	0	21	13	69
9.	**20**	10	30	40	20	10	0	30	60	60	50	40	10	22	14	72
10.	20	20	10	30	10	10	0	10	40	40	30	20	10	23	19	71
Mean	**20**	**23**	**43**	**60**	**43**	**22**	**7**	**17**	**39**	**41**	**29**	**15**	**6**			
G_4 (L. C. Saharanpur)																
1.	**20**	10	40	40	20	0	0	20	40	40	30	10	0	29	16	75
2.	**20**	30	50	50	40	0	0	10	30	30	20	0	0	28	16	74
3.	**20**	20	40	30	30	10	10	20	50	50	40	20	0	24	15	72
4.	**20**	30	90	70	70	60	0	10	20	20	10	0	0	21	13	77
5.	**20**	40	70	60	40	30	0	10	30	30	20	0	0	26	19	63
6.	**20**	30	60	70	50	20	10	20	40	40	50	30	10	21	12	70
7.	**20**	20	70	70	60	30	10	20	30	30	20	10	0	20	14	74
8.	**20**	30	80	80	40	20	0	10	30	30	20	10	0	21	13	69
9.	**20**	10	50	50	20	10	0	10	20	20	10	10	0	22	14	72
10.	**20**	30	60	60	50	30	10	10	40	40	30	20	0	23	19	71
Mean	**20**	**25**	**61**	**58**	**42**	**21**	**4**	**14**	**33**	**33**	**25**	**11**	**1**			
G_5 (L. C. Meerut)																
1.	**20**	30	60	60	50	30	20	20	30	40	30	10	10	29	16	75
2.	**20**	20	50	50	30	10	0	10	30	50	30	10	10	28	16	74
3.	**20**	40	70	70	60	50	0	10	20	40	20	20	20	24	15	72
4.	**20**	30	70	70	50	30	10	30	50	50	20	10	0	21	13	77
5.	**20**	70	90	90	20	0	0	10	30	30	20	10	0	26	19	63
6.	**20**	20	60	60	50	40	0	20	30	30	30	20	10	21	12	70
7.	**20**	40	70	50	50	30	10	10	20	40	30	20	10	20	14	74
8.	**20**	30	50	30	30	20	10	10	40	50	30	10	0	21	13	69
9.	**20**	50	60	50	50	30	10	20	30	40	20	10	0	22	14	72
10.	**20**	30	40	40	30	20	10	10	20	30	10	0	0	23	19	71
Mean	**20**	**36**	**62**	**57**	**42**	**26**	**7**	**15**	**30**	**40**	**24**	**12**	**6**			

	Time of anthesis and dehiscence													Temperature(°C)		Humidity
			Male						Female							
Days	No. buds	of5-6am	6-7am	7-8am	8-9am	9-10am	10-11am	5-6am	6-7am	7-8am	8-9am	9-10am	10-11am	Max.	Mini.	%
G_6 (L. C. Rishikesh)																
1.	**20**	20	30	30	20	10	0	20	30	30	20	10	0	29	16	75
2.	**20**	30	60	70	50	30	20	30	40	30	10	0	0	28	16	74
3.	**20**	30	40	50	30	20	10	10	30	20	20	10	10	24	15	72
4.	**20**	40	60	50	30	10	0	10	20	20	10	10	10	21	13	77
5.	**20**	20	30	50	20	10	10	20	50	30	20	20	10	26	19	63
6.	**20**	30	40	40	30	20	20	20	40	40	30	10	0	21	12	70
7.	**20**	30	50	60	30	20	10	10	30	30	20	10	0	20	14	74
8.	**20**	20	40	50	30	10	0	20	50	30	20	10	0	21	13	69
9.	**20**	10	40	40	30	20	10	10	40	20	10	0	0	22	14	72
10.	**20**	20	50	30	30	20	10	20	20	30	20	0	0	23	19	71
Mean	**20**	**25**	**44**	**47**	**30**	**17**	**9**	**17**	**35**	**28**	**18**	**8**	**3**			
G_7 (L. C. Dehradun)																
1.	**20**	40	60	60	40	30	0	30	40	40	30	20	10	29	16	75
2.	**20**	30	80	80	60	50	20	20	30	50	40	30	20	28	16	74
3.	**20**	40	60	60	20	20	0	40	50	50	30	10	0	24	15	72
4.	**20**	20	50	50	40	20	10	20	40	50	20	0	0	21	13	77
5.	**20**	30	80	80	60	40	20	40	60	60	30	10	0	26	19	63
6.	**20**	20	60	60	40	20	0	20	50	50	30	0	0	21	12	70
7.	**20**	30	50	50	30	20	0	20	40	50	40	20	10	20	14	74
8.	**20**	40	60	50	30	10	0	30	50	60	50	30	20	21	13	69
9.	**20**	50	70	70	40	20	0	20	30	40	30	20	0	22	14	72
10.	**20**	30	60	0	30	20	0	30	50	70	40	30	10	23	19	71
Mean	**20**	**33**	**63**	**56**	**39**	**25**	**5**	**27**	**44**	**52**	**34**	**17**	**7**			
G_8 (L. C. Karnal)																
1.	**20**	60	90	80	70	50	20	20	40	40	30	20	0	29	16	75
2.	**20**	50	70	60	30	20	10	30	30	30	10	0	0	28	16	74
3.	**20**	30	50	30	30	10	0	30	50	40	40	40	20	24	15	72
4.	**20**	40	60	60	50	20	0	20	30	30	20	10	0	21	13	77
5.	**20**	30	60	70	60	30	0	10	20	30	10	10	0	26	19	63
6.	**20**	60	80	80	70	40	20	30	60	60	50	30	10	21	12	70

	Time of anthesis and dehiscence													Temperature(°C)		Humidity
			Male						Female							
Days	**No. buds**	**of5-6am**	**6-7am**	**7-8am**	**8-9am**	**9-10am**	**10-11am**	**5-6am**	**6-7am**	**7-8am**	**8-9am**	**9-10am**	**10-11am**	**Max.**	**Mini.**	**%**
7.	**20**	40	70	60	40	20	10	40	50	50	30	20	0	20	14	74
8.	**20**	30	50	50	30	20	10	20	30	30	20	10	0	21	13	69
9.	**20**	50	60	50	20	10	0	20	40	40	20	10	0	22	14	72
10.	**20**	20	70	70	50	30	10	30	50	50	30	20	10	23	19	71
Mean	**20**	**41**	**66**	**61**	**45**	**25**	**8**	**25**	**40**	**40**	**26**	**17**	**4**			
G_9 (Kashi Ganga)																
1.	**20**	40	70	60	0	0	0	30	50	50	30	20	10	29	16	75
2.	**20**	20	40	30	30	0	0	40	60	50	30	10	0	28	16	74
3.	**20**	10	50	40	40	40	20	20	40	40	20	10	0	24	15	72
4.	**20**	30	50	50	40	20	10	20	50	50	30	10	0	21	13	77
5.	**20**	20	60	60	40	0	0	30	30	30	20	20	10	26	19	63
6.	**20**	30	50	40	30	30	10	30	50	60	30	20	10	21	12	70
7.	**20**	40	70	60	40	20	10	20	40	30	20	10	0	20	14	74
8.	**20**	**20**	**60**	**60**	**30**	**20**	**10**	**10**	**30**	**30**	**20**	**10**	**0**	21	13	69
9.	**20**	10	60	60	30	10	0	30	50	30	30	20	10	22	14	72
10.	**20**	30	50	50	20	10	0	40	50	40	30	20	10	23	19	71
Mean	**20**	**25**	**56**	**51**	**30**	**15**	**6**	**27**	**45**	**41**	**26**	**15**	**5**			
G_{10} (L. C. Bharsar)																
1.	20	20	80	80	70	50	30	30	50	50	0	0	0	29	16	75
2.	20	40	50	70	80	60	20	20	60	50	30	0	0	28	16	74
3.	20	30	90	60	50	30	10	30	40	40	30	20	10	24	15	72
4.	20	40	90	70	40	20	10	20	50	40	20	10	10	21	13	77
5.	20	50	80	60	40	20	0	30	60	60	30	20	10	26	19	63
6.	20	60	70	50	30	10	0	30	60	50	40	30	20	21	12	70
7.	20	40	60	40	20	0	0	20	70	70	40	20	10	20	14	74
8.	20	30	80	80	70	20	10	10	50	50	30	10	0	21	13	69
9.	20	50	90	60	40	30	10	30	40	30	20	0	0	22	14	72
10.	20	30	80	50	30	20	10	20	30	20	10	10	0	23	19	71
Mean	**20**	**39**	**77**	**62**	**47**	**26**	**10**	**24**	**51**	**46**	**25**	**12**	**6**			

The genotype L. C. Meerut (7.100cm) had maximum length in male flower, where as in female flower maximum flower length was (7.500cm). This report is supported by the Deyto and Cervancia, 2009, according to him female flowers bear large sized petals and their sepals are short and strong scented than the male flowers.

Maximum sex ratio was observed in L. C. Bharsar that was 169.000 (Table 3). Variation in sex ratio may be due to the adaptability of different genotypes was also reported by Munshi and Acharya (2005) and Samadia (2002) in bottle gourd. The staminate to pistillate flower ratio varied greatly between species of cucurbits 3:1 in pumpkin, 6:1 in cucumber (Rubina, 2010), 2:1 in bottle gourd (Srikanth, 2012), 13:1 in bitter gourd (Mary et al*.,* 2012) and 18:1 in case of musk melon (Sidda, 2015). In study staminate to pistillate flower ratio in ridge gourd was relatively high (23:1). This higher ratio clearly indicates that it is highly male biased and that the plants are adapted to get maximum pollen deposition on stigma after sufficient pollen gathering by foraging bees. Pumpkin plant produces more of male flowers than female flowers (Akoroda et al., 1990; Suzanne et al., 2000).

4. CONCLUSION

Days to first flowering were recorded for both male and female flowers by counting the days from transplanting until the day on which the first flower opened on the selected plants of each treatment and averaged over replications. The selected plants were observed daily to record the date of first flowering. Day to first male and female flowering will be recorded from day of transplanting plant in the field. In each replication visually seen the first flower is male or female flower.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of this manuscript. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

Details of the AI usage are given below:

1. Research pap
2. M. Sc. and PhD Thesis
3. MS Office

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Akoroda, M. O., Ogbechie-Odiaka, N. I., Adebayo, M. L., Ugwo, O. E., & Fuwa, B. (1990). Flowering, pollination and fruiting in fluted pumpkin (*Telfairia occidentalis*). *Scientia Horticulturae, 43*(3–4), 197–206.

Bisht, A. S., & Sharma, K. D. (2014). Plant utilization by the communities of Bharsar and adjoining area of Pauri Garhwal District, Uttarakhand, India. *Biodiversitas Journal of Biological Diversity, 15*(1), 94–100.

Chand, S., Kumar, J., & Arya, P. S. (1990). Pollination and seed setting studies in cucumber. *Vegetable Science, 17*, 99–101. Choudhury, B., & Phatak, S. C. (1961). Studies on floral biology in cucumber (*Cucumis sativus L.*). *Indian Journal of Horticulture,18*(3), 212–221.

Deyto, R. C., & Cervancia, C. L. (2009). Floral biology and pollination of *Ampalaya* (*Momordica charantia L.*). *Philippine Agricultural Scientist, 92*(1), 8–18.

Hawthorn, L. R., & Pollard, L. H. (1954). Vegetable and flower seed production. *Journal of New Seeds, 1*(3–4), 626.

Kalloo. (1988). *Vegetable breeding.* CRC Press, Florida.

Kappal, S. B., Chawan, B., Rathod, R. H., & Shantappa, T. (2015). Variability and characters, association studies in ridge gourd (*Luffa acutangula* Robx) reference to yield attributes. *Journal of Global Bioscience, 4*(5), 2332–2342.

Koffi, K. K., Anzara, G. K., Malice, M., Dje, Y., Bertin, P., Baudoin, J., & Zoro, Bi, I. A. (2009). Morphological and allozyme variation in a collection of *Lagenaria siceraria* (*Molina*) Standl. from Cote d'Ivoire.

Kumari, P., Kumari, R., Rani, N., Verma, R. B., & Verma, R. (2017). Genetic divergence of bitter gourd (*Momordica charantia L.*) for sixteen important yield attributing traits. *Current Journal of Applied Science and Technology, 23*(2), 1–11.

Mary, G., Muo, K., & Kraemer, M. (2012). Pollinator diversity, behaviour and limitation on yield of *karela* (*Momordica charantia L., Cucurbitaceae*) in Mary Lucy Oronje, Melanie Hagen Western Kenya.

African Journal of Agricultural Research, 7(11), 1629–1638.

Munshi, R., & Acharyya, P. (2005). Varietal evaluation in bottle gourd genotypes. *Indian Agriculture, 49*(3–4), 213–221.

Pal, U. R., Singh, U. R., & Maury, R. A. (1972).

Floral biology of bitter gourd. *Indian Journal of Horticulture, 29*(1), 73–76.

Poal, D. K. (1995). Pollination and seed setting studies in some genetic stocks of cucumber (*Cucumis sativus L.*) (Master's thesis). Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP).

Rajesh, K., Singh, D. K., Ram, H. H., & Kumar, R. (1999). Manifestation of heterosis in bottle gourd (*Lagenaria siceraria* (*Mol*) Stand L.). *Annals of Agricultural Research, 20*(2), 177–179.

Ram, H. H. (1997). *Vegetable breeding: Principles and practices.* Kalyani Publishers, Ludhiana, New Delhi-Noida.

Rubina, K. S. (2010). Pollinators diversity with special reference to the role of honeybees in quantitative and qualitative improvement of cucumber (*Cucumis sativus L.*) (Master's thesis). University of Agricultural Sciences, Bangalore.

Samadia, D. K. (2002). Performance of bottle gourd genotypes under hot arid environment. *Indian Journal of Horticulture, 59*(2), 167–170.

Sidda, R. (2015). Role of flower visitors in pollination and fruit set of muskmelon (*Cucumis melo L.*) (Master's thesis). University of Agricultural Sciences, Bangalore.

Srikanth, C. D. (2012). Insect pollinators diversity with special reference to the role of attractants in insect pollination for increasing the productivity of bottle gourd (*Lagenaria siceraria* Mol. Standl.) (Master's thesis). University of Agricultural Sciences, Bangalore.

Suzanne, C. S., Chris, H. W., & Roger, A. M. (2000). Flowering and fruit set of pumpkin cultivars under field conditions. *Horticulture Science, 35*(6), 1074–1077.

Thamburaj, S., & Singh, N. (2000). *Textbook of vegetables, tuber crops and spices.* Directorate of Information and Publication of Agriculture, ICAR, New Delhi.

Thu, M. K. (2012). Pollination biology of *Cucumis sativus L.* (Cucumber) in Hmawbi Township. *Universities Research Journal, 5*, 189–199.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/128162