HortFlora Research Spectrum
Vol. 5, Issue 1; 39-42 (March 2016)
www.hortflorajournal.com
ISSN: 2250-2823

VARIATION IN FLOWERING CHARACTERS OF BOTTLE GOURD

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ABSTRACT : Selection for early maturing and high yielding genotypes is desirable which in monoecious crops depend on expression of flowering characters. A study was undertaken to understand flowering behaviour of 27 genotypes of bottle gourd that would help to assume the conversion of flowers into fruits. The field experiment was carried out late in rainy season of 2013 at Horticulture Farm of Visva-Bharati University and observations were recorded for various flowering characters. Analysis of variance revealed highly significant differences among genotypes for node number of first male and female flower, days to first male and female flower opening, number of male flowers per vine, number of female flowers per vine and sex ratio. The values of flowering characters ranged for node number of first male flower (5.67-13.20), node number of first female flower (7.80-14.87), first male flower opening (50.30-82.00 days), first female flower opening (53.33-87.50 days), sex ratio (4.73-14.87), number of male flowers (38.30-90.17) and number of female flowers (3.00-14.70) Out of 27 genotypes, APBG-3 was identified as an early bearer genotype which produced male and female flower at earlier nodes on about 50 and 53 days after sowing, respectively. Surabhi recorded the lowest sex ratio but maximum female flowers in number were recorded with Kundan that can be expected to produce higher yields than others.

Keywords : *Bottle gourd, earliness, fruit yield, genotypes.*

Bottle gourd [*Lagenaria siceraria* (Mol.) Stndl.] is an important fruit vegetable of the family Cucurbitaceae. In India, it is grown in kitchen garden and commercial field also. Beside India, it is found growing in Ethiopia, Africa, Central America and other warm region of the world. The bottle gourd is characterized by minimal agro technical requirements and well adapted to extremely divergent agro ecosystems. As a valuable plant has its multiple uses; tender leaves and fruits as vegetable whereas the dried fruits for making water jugs, domestic utensils, musical instruments and floats for fishing nets (Yetisir *et al.,* 10). In many cases of ailments, it is a preferred vegetable because of its cooling effects and easy digestibility. It is also used for preparation of different kinds of sweet. Being monoecious, annual herbaceous vine bears solitary flowering with long pedicel. Sex expression in cucurbits is influenced by genetic, environmental and chemical factors (Tiedjens, 8). There is need of the farmers to develop early maturing and high yielding variety/hybrid. Preliminary identification of such genotypes can be done based on flowering behaviour of plant.

Article's History:
Received : 05-02-2016 ***Accepted : 21-02-2016***

MATERIALS AND METHODS

The experiment was conducted at the Horticulture Farm of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan. The location represents sub-humid, sub-tropical climate and lateritic soil of West Bengal, India. The field was divided by the irrigation channels into plots of 5.0 m x 2.5 m size each. The 27 genotypes were laid out in randomized block design with three replications. The plant to plant spacing was given 50 cm. Sowing of pre-soaked seed was done on 14th September, 2013. Standard agronomic package of practices were adopted to raise a good crop. Observations were recorded on 10 randomly selected plants from each replication at blooming stage of the crop for seven flower characters. Sex ratio was calculated dividing total male flowers by female flowers borne in first month from beginning of flower. The data were analyzed to test the variance in characters due to genotypes (Gomez and Gomez, 1).

Table 1: Analysis of variance for flower characters in bottle gourd.

Source	D.F	Mean Sum of Squares						
		Node number of first male flower	Node number of first female flower	Days to first male flower opening	Days to first female flower opening	Sex ratio	Number of male flowers/ vine	Number of female flowers/ vine
Replication	2	1.98	0.16	1.59	9.59**	2.96	77.76**	11.46**
Genotype	26	13.75**	13.10**	225.81**	196.30**	21.34**	416.90**	25.91**
Error	52	0.99	1.44	6.79	3.45	0.11	0.48	0.23

Table 2: Performance of bottle gourd genotypes for flower characters.

Genotype	Node number of first male flower	Node number of first female flower	Days to first male flower opening	Days to first female flower opening	Sex ratio	Number of male flowers/vine	Number of female flowers/vine
Aditi	8.43^{efgh}	10.13^{bcdef}	58.53^{deg}	63.27^{def}	5.60^{bcd}	50.77^{i}	9.03^{d}
Arka Bahar	7.77^{bcdefg}	9.00^{abc}	54.77^{bcd}	62.00^{de}	5.73^{cd}	65.30^{c}	11.47^{c}
APBG-1	11.50^{jk}	13.00^{ijkl}	82.00^{l}	87.50^{n}	7.93^{i}	47.50^{jk}	6.00^{ij}
APBG-2	11.63^{jkl}	13.60^{kl}	78.07^{l}	81.83^{m}	10.37^{k}	38.30^{q}	3.70^{mn}
APBG-3	6.33^{ab}	9.10^{abcd}	50.30^{a}	53.33^{a}	7.13^{fgh}	50.00^{i}	7.00^{h}
DBG-2	6.40^{abc}	7.80^{a}	59.93^{gh}	63.50^{def}	6.60^{ef}	60.63^{e}	9.20^{d}
DBG-3	8.20^{defgh}	10.33^{cdefgh}	70.00^{ijk}	73.43^{ij}	6.10^{de}	47.07^{k}	7.83^{g}
Gola Lattoo	6.33^{ab}	12.17^{ghijk}	53.67^{abc}	64.23^{f}	7.10^{fg}	90.17^{a}	12.80^{b}
Joda Bonta	12.90^{kl}	14.57^{l}	72.77^{jk}	76.50^{kl}	14.87^{n}	44.57^{lm}	3.00^{n}
Kundan	7.33^{bcdef}	8.63^{abc}	57.83^{cdeg}	61.07^{cde}	5.37^{bc}	78.17^{b}	14.70^{a}
Mayur Dharidar	7.00^{abcdef}	11.10^{efghi}	51.77^{ab}	57.63^{b}	7.70^{hi}	60.03^{e}	7.80^{g}
OBG-1	9.73^{hi}	11.50^{fghij}	70.30^{ijk}	76.50^{kl}	10.43^{k}	52.00^{h}	5.00^{kl}
OBG-2	11.13^{ij}	14.87^{l}	71.97^{ijk}	79.13^{lm}	8.93^{j}	46.80^{k}	5.30^{jk}
PSPL	7.13^{abcdef}	10.20^{bcdefg}	53.43^{ab}	58.53^{bc}	5.33^{bc}	43.57^{mn}	8.23^{efg}
Pusa Samridhi	9.27^{gh}	12.50^{ijk}	55.50^{bcde}	66.00^{fg}	5.20^{abc}	46.67^{k}	9.00^{de}
Pusa Santushti	8.53^{fgh}	12.17^{ghijk}	63.93^{h}	73.70^{ijk}	6.63^{ef}	62.77^{d}	9.43^{d}
Surabhi	8.43^{efgh}	12.27^{hijk}	59.67^{egh}	65.83^{fg}	4.73^{a}	44.63l^{m}	9.47^{d}
UKBG-1	7.40^{bcdef}	9.57^{abcdef}	55.87^{bcde}	58.83^{bc}	5.07^{ab}	58.63^{f}	11.63^{c}
UKBG-2	8.00^{cdefg}	11.03^{defghi}	59.37^{eg}	68.67^{gh}	7.67^{ghi}	47.60^{jk}	6.23^{hi}
UKBG-3	5.67^{a}	9.63^{abcdef}	59.77^{egh}	74.17^{ijk}	13.30^{m}	57.33^{g}	4.30^{lm}
UPBG-2	6.60^{abcd}	8.27^{ab}	63.87^{h}	65.83^{fg}	5.57^{bcd}	48.53^{j}	8.77^{def}
UPBG-9	6.77^{abcd}	9.43^{abcde}	68.73^{ij}	71.23^{hi}	5.40^{bc}	42.77^{no}	8.00^{fg}
WBG-1	6.50^{abc}	8.50^{abc}	60.77^{gh}	67.67^{g}	7.77^{i}	62.00^{d}	8.00^{fg}
WBG-2	8.53^{fgh}	9.57^{abcdef}	68.30^{i}	71.37^{hi}	8.90^{j}	39.80^{p}	4.53^{kl}
WBG-3	11.17^{ij}	13.47^{jkl}	73.70^{k}	75.67^{jk}	12.16^{l}	45.33^{l}	3.73^{mn}
WBG-4	6.83^{abcde}	9.57^{abcdef}	54.03^{abc}	65.80^{fg}	5.30^{abc}	49.77^{i}	9.40^{d}
WBG-6	13.20^{l}	14.57^{l}	72.83^{jk}	74.50^{jk}	9.23^{j}	42.40^{o}	4.60^{kl}
Grand Mean	8.47	10.98	63.03	68.81	7.64	52.71	7.71
Range	5.67 – 13.20	7.80 – 14.87	50.30 – 82.00	53.33 – 87.50	4.73 – 14.87	38.30 – 90.17	3.00 – 14.70
C.D. (P=0.05)	1.63	1.97	4.27	3.04	0.57	1.14	0.80
C.V. (%)	11.75	10.96	4.14	2.70	4.53	1.32	6.32

RESULTS AND DISCUSSION

The analysis of variance of twenty seven genotypes with respect of different flower characters is presented in Table 1. The mean sum of squares due to genotypes were highly significant for node number of first male and female flower, days to first male and female flower opening, number of male flowers per vine, number of female flowers per vine and sex ratio. This indicates the presence of considerable amount of variation among genotypes to carry out further genetic studies. Similar variations for flowering characters were reported by Husna *et al.* (3), Mandal *et al.* (4) and Sharma and Sengupta (6). Earliness is highly desirable for horticultural crops. The early and late female flower appearance help in the occurrence of early or late flush of the yield which is advantageous for market to fetch the higher price in bottle gourd (Sharma and Dhankar, 7 and Ram *et al.,* 5). The mean values of node number of first male flower ranged from 5.67-13.20 among genotypes. Comparison of genotypes revealed that UKBG-3, APBG-3 and Gola Lattoo, DBG-2, WBG-1, UPBG-2, UPBG-9, WBG-4, Mayur Dharidhar and PSPL were in same bar which produced first male flower at lowest node (Table 2). The range of genetic variation for node number to first male flowering had been reported by Yadav and Kumar (9), Harika *et al.,* (2) and Sharma and Sengupta, (6). The mean values of node number of first female flower ranged from 7.80-14.87 among genotypes. The genotypes DBG-2, UPBG-2, WBG-1, Kundan, Arka Bahar, APBG-3, UPBG-9, UKBG-1, WBG-2 and WBG-4 and UKBG-3 were in same bar which produced first female flower at lowest node (Table 2). The range of variation for node number to first female flowering had also been by Harika *et al.,* (2), and Sharma and Sengupta, (6). The first male flower opening ranged from 50.30-82.00 days among genotypes. The genotypes APBG-3 was early for first male flower appearance on about 50 days which closely followed by Mayur Dharidhar (51.77 days), PSPL (53.43 days), Gola Lattoo (53.67 days) and WBG-4 (54.03 days). The genotype APBG-1 was late taken 82 days after sowing for initiation of first male flower. Similar variation for first male flower anthesis had been reported by Yadav and Kumar (9), Harika *et al.* (2) and Sharma and Sengupta, (6); The first female flower opening ranged from 53.33-87.50 days among genotypes. APBG-3 was significantly early genotype for days to first female flower appearance on about 53 days. The genotype APBG-1 was late taken 87.50 days after sowing initiation of first female flower. Noticeable variation for first female flower anthesis had been reported by Yadav and Kumar (9), Harika *et al.* (2) and Sharma and Sengupta, (6).

Sex ratio is proportion of male and female flower which intend bearing habit of the plant. Low sex ratio is considered desirable which can be expected for more fruits per vine. The mean values for sex ratio ranged from 4.73-14.87 among genotypes. A range of variation for sex ratio (11.87-24.40) was reported by Harika *et al.* (2). The genotype Surabhi had lowest sex ratio and closely followed by UKBG-1 (5.07), Pusa Samridhi (5.20) and WBG-4 (5.30). Profuse male flowering can reduce sites for female flowers on vine thereby resulting low yields. Of 27 genotypes, number of male flowers significantly ranged from 38.30 in APBG-2 to 90.17 in Gola Lattoo. Not only sex ratio and lowest number of male flowers may be good indicator for assumption of number of fruits per vine but also number of female flowers must be considered since this character has direct relation with number of fruits per vine. The mean values for number of female flowers per vine ranged from 3.00-14.70 among genotypes. The genotype Kundan had produced maximum female flowers per vine. These results agree with Husna *et al.* (3) who recorded significant genetic variations for number of male and female flowers in bottle gourd.

CONCLUSION

The findings of present study indicate that the indigenous materials had sufficient amount of variation for most of the traits and effective selection can be practiced in available germplasm. The genotypes with high mean value can directly be used for adaptation or as parents in hybridization. Based on mean performance, APBG-3 was identified as an early bearer genotype and Kundan can be expected to produce high yields. These two genotypes may be tested for assessing its potential to harvest early and high yield, respectively.

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Citation : Tirumalesh M., Mandal J. and Dhangrah V.K. (2016). Variation in flowering characters of bottle gourd *HortFlora Res. Spectrum,* **5**(1) : 39-42.