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## DIVERSITY OF REPRODUCTIVE CHARACTERS OF BER (*ZIZIPHUS MAURITIANA* LAMK.) IN NEW ALLUVIAL ZONE OF WEST BENGAL

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## ABSTRACT

The reproductive character of fourteen ber varieties (Apple Kul, Banarasi Karaka, BAU-1 Kul, Chhuhara, Dandan, Gola, Illaichi, Jogia, Kaithali, Madhavpur, Mundia, Sanur-2, Topa and Umran) was studied at HRS, Mondouri of Bidhan Chandra Krishi Viswavidyalaya during 2014-15. An appreciable variation of cyme emergence (1<sup>st</sup> August - 23<sup>rd</sup> August), flower bud development (17.0 - 22.3 days), duration of flowering (44-70 days) and duration of peak flowering (23-35 days) was observed among different ber varieties. The duration of flowering was longest in Mundia (70 days) but duration of longest peak flowering was found in Illaichi (35 days). Dandan and Kaithali took least time and Jogia took maximum time for flower bud development. A prominent variation of flower morphology like pedicel length (5.84-8.89 mm), flower diameter (8.68-5.60 mm), length/breadth ratio of sepal (0.88-1.30), length/breadth ratio of petal (1.48-2.25), anther length (0.30-0.47 mm), filament length (0.97-1.50 mm), disc diameter (2.90 - 4.23 mm) was noted among fourteen varieties. It is concluded that wide diversity of reproductive characters are existing among ber varieties and this knowledge of reproductive characters will be useful in ber breeding programme.

## INTRODUCTION

Ber (*Ziziphus mauritiana* Lamk.) is one of the ancient and indigenous fruits of India. Ber is previously recognized as poor man's fruit, also designated as "King of Arid fruits" owing to fact that it can be grown in unproductive, waste, marginal or inferior soil with pH as high as 9.0 in arid and semi-arid regions which are characterized by extreme variations of diurnal annual temperatures and high evaporations coupled with sparse and highly variable precipitations (Kumari *et al.*, 2015). The potency of the rich food received from the juicy ber fruits seems to have greatly contributed to the sound health, longevity, thinking and high imagery (Kumar *et al.*, 2014). Fruits are excellent source of ascorbic acid and carotenoids. The different parts of ber trees are used in different uses. Considering its importance and different uses, India has already included ber in its national programme on underutilized crops (Pareek, 2001). But commercial varieties of Indian ber are not performing up to their standard in new alluvial zone of West Bengal. High humidity along with infestation of powdery mildew and fruit fly seem to be major factors responsible for restricting its cultivation. The knowledge of reproductive biology of the parents is the essential pre-requisite for a successful hybridization programme. So far only a few attempts have been made to study the reproductive biology of ber (Neeraja *et al.*, 1991; Babu and Kumar, 1988; Pareek, 2001 Gupta *et al.*, 2004). In West Bengal little or no work of reproductive biology of ber was carried out. The main objective of the present work is to generate knowledge of reproductive characters which will be useful for efficient and purposeful hybridization programme in order to combine maximum desirable traits in a cultivar. Keeping these in view, the present investigation was undertaken to study the flowering behaviour, flower morphology and biology of different ber varieties.

## MATERIALS AND METHODS

The investigation was carried out in varietal block of ber at Horticultural Research Station, Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during the year 2014-15. The ber orchard is situated at the eastern side of this research station having 22.43 °N latitude and 88.34 °E longitude, with an altitude of 9.75 m above the mean sea level. The experiment was laid out with 14 varieties (Apple Kul, Banarasi Karaka, BAU-1Kul, Chhuhara, Dandan, Gola, Illaichi, Jogia, Kaithali, Madhavpur, Mundia, Sanur-2, Topa and Umran) in a randomized block design. Each variety was replicated thrice. To determine period of flower bud development, four branchlets (arising from branches) were tagged in all directions for each plant during peak flowering season. All the developed flower buds and opened flowers were cut from each cyme of tagged branchlet by scissors retaining only tiny flower buds (pin headed) in a branchlet for recording this observation.

Four branches consisting of multiple branchlets were tagged in all directions as suggested by Sharma *et al.* (1990) for recording flowering habit, cyme emergence, flowering time and duration, peak flowering time and duration and flower morphology like pedicel length, flower diameter, size of sepal and petal, anther length, filament length and diameter of disc. Emergence of cyme or inflorescence is

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determined on the appearance of at least first 10 cymes at a time. Similarly, opening of at least first 15 flowers and last 15 flowers at a time were considered as start and end of flowering, respectively. Branchlets consisting of cymes were collected in the transparent polythene packet early in the morning and brought immediately in the laboratory for recording observations on different floral parts. Flower and different floral parts were separated and observed under binocular microscope over a slide filled with millimetre graph paper for accurate and easy recording of data. The data was statistically analyzed by analysis of variance method as suggested by Panse and Sukhatme (1998).

## RESULTS AND DISCUSSION

### Flowering behaviour

The flowers of all the cultivars were borne in cluster in the axil of leaves *i.e.* inflorescence was axillary cyme. Ber possessed mixed buds and gave rise to both flowering and vegetative buds simultaneously. The flowers on lower portion of branch were first to open and progressed onwards to apex. The central flowers within the cluster opened earlier than those on edges.

The flowers of most of the cultivars were borne in current season growth except Banarasi Karaka, Gola, Jogia and Mundia in which flowers were borne both in current and previous season growth. Desai *et al.*, 1986 also found that inflorescence of ber was an axillary cyme and Jonsanet *al.* (1980) reported that the flower buds of ber were borne both in mature as well as current season's growth.

There was an appreciable variation of cyme emergence (1<sup>st</sup> August - 23<sup>rd</sup> August), flower bud development (17.0 – 22.3 days), duration of flowering (44-70 days) and duration of peak flowering (23-35 days) among different ber varieties (Table 1 & 2). Here, Umran took lesstime (17.3 days) and Sanur-2 took more time (21.3 days) to flower bud development (Table 1) which is in contrast of the findings of Jonsanet *al.*(1980) where Umran took longest time (22 days) and Sanur-2 took least time for flower bud development in Punjab condition. This might be due to differences in agro-climatic condition. Ber flowered from late August to early November. Pareek *et al.* (2007) reported that the flowering period of ber varied from early June to late November indifferent varieties under different agro climatic condition of India. Nehra *et al.* (1984) also opined that the trees growing under unirrigated condition due to water

**Table 1: Cyme emergence and flower bud development of ber varieties**

Variety	Emergence of cyme	Period for flower bud to anthesis (days)
Apple Kul	20.08.2015	21.0
Banarasi Karaka	22.08.2015	18.0
BAU Kul-1	21.08.2015	21.3
Chhuhara	01.08.2015	21.0
Dandan	19.08.2015	17.0
Gola	05.08.2015	19.0
Illaichi	01.08.2015	20.3
Jogia	02.08.2015	22.3
Kaithali	10.08.2015	17.0
Madhavpur	23.08.2015	21.3
Mundia	04.08.2015	21.3
Sanur-2	02.08.2015	21.7
Topa	18.08.2015	19.0
Umran	19.08.2015	17.3
SEm( ±)	-	0.49
LSD (0.05)	-	1.417

**Table 2: Flowering of different ber varieties**

Variety	Flowering time and duration		Duration of flowering (Days)	Peak flowering time and duration		Duration of peak flowering (Days)
	Start of Flowering	End of Flowering		Start of Peak Flowering	End of Peak Flowering	
Apple Kul	09.09.2015	05.11.2015	58	24.09.2015	24.10.2015	31
Banarasi Karaka	05.09.2015	18.10.2015	58	17.09.2015	09.10.2015	23
BAU Kul-1	07.09.2015	27.10.2015	51	19.09.2015	20.10.2015	32
Chhuhara	20.08.2015	16.10.2015	57	04.09.2015	06.10.2015	33
Dandan	08.09.2015	29.10.2015	53	21.09.2015	17.10.2015	27
Gola	25.08.2015	21.10.2015	58	08.09.2015	10.10.2015	33
Illaichi	20.08.2015	19.10.2015	61	04.09.2015	08.10.2015	35
Jogia	22.08.2015	20.10.2015	60	09.09.2015	10.10.2015	32
Kaithali	25.08.2015	22.10.2015	59	12.09.2015	13.10.2015	32
Madhavpur	10.09.2015	05.11.2015	57	26.09.2015	25.10.2015	30
Mundia	21.08.2015	30.10.2015	70	12.09.2015	15.10.2015	34
Sanur-2	23.08.2015	20.10.2015	58	10.09.2015	09.10.2015	30
Topa	10.09.2015	05.11.2015	57	24.09.2015	26.10.2015	33
Umran	07.09.2015	20.10.2015	44	19.09.2015	12.10.2015	24

**Table 3: Size of flower, pedicel, stamen and disc of different Varieties of ber**

Variety	Pedicel length (mm)	Flower diameter (mm)	Stamen Anther length (mm)	Filament length (mm)	Diameter of disc (mm)
Apple Kul	6.40	5.98	0.37	1.30	2.90
Banarasi Karaka	8.89	6.20	0.33	1.37	3.30
BAU Kul-1	7.65	6.78	0.43	1.50	3.93
Chhuhara	6.64	5.60	0.40	1.10	3.80
Dandan	6.87	8.68	0.30	0.97	3.12
Gola	6.81	6.59	0.37	1.47	4.07
Illaichi	7.32	6.46	0.37	1.23	4.23
Jogia	6.49	7.27	0.33	1.50	3.30
Kaithali	6.10	6.96	0.40	1.30	3.43
Madhavpur	6.88	6.96	0.47	1.13	3.30
Mundia	5.84	6.69	0.47	1.20	3.53
Sanur-2	7.63	5.81	0.37	1.50	3.20
Topa	7.27	7.55	0.33	1.13	3.13
Umrans	6.40	8.50	0.40	1.40	3.60
SEm ( $\pm$ )	0.192	0.306	0.042	0.095	0.071
LSD (0.05)	0.561	0.893	N.S	0.278	0.209

**Table 4: Dimension of sepal and petal of different ber varieties**

Variety	Length of Sepal (mm)	Breadth of Sepal (mm)	Length / breadth ratio	Length of Petal (mm)	Breadth of Petal (mm)	Length / Breadth ratio
Apple Kul	1.93	1.93	1.00	1.83	0.90	2.03
Banarasi Karaka	2.43	2.43	1.00	1.73	0.77	2.25
BAU Kul-1	2.43	2.70	0.90	1.70	0.90	1.80
Chhuhara	2.30	2.37	0.97	1.53	0.90	1.70
Dandan	2.37	2.17	1.09	1.33	0.87	1.53
Gola	2.57	1.30	1.30	1.90	0.93	2.03
Illaichi	2.47	2.50	0.98	1.63	0.90	1.81
Jogia	2.37	2.67	0.88	1.70	0.90	1.88
Kaithali	2.60	2.40	1.08	2.00	1.20	1.66
Madhavpur	2.63	2.27	1.16	1.63	0.90	1.81
Mundia	2.33	2.47	0.94	1.57	0.87	1.80
Sanur-2	2.57	2.37	1.08	1.33	0.90	1.48
Topa	2.80	2.80	1.00	1.67	0.97	1.71
Umrans	2.87	2.33	1.22	1.47	0.87	1.69
SEm ( $\pm$ )	0.135	0.117	-	0.032	0.028	-
LSD (0.05)	0.394	0.341	-	0.092	0.081	-

stress came into flowering much earlier than those growing under irrigated condition. The delay in flowering in new alluvial zone of West Bengal was probably due to continuous availability of water due to monsoon. In the present studies varieties like Chhuhara, Illaichi, Mundia, Jogia, Sanur-2, Gola and Kaithali started flowering early (2<sup>nd</sup> fortnight of August) with long flowering duration. The commencement of flowering was late (1<sup>st</sup> fortnight of September) in varieties like Dandan, Apple Kul, Madhavpur and Topa. The duration of flowering was longest in Mundia (70 days) but duration of longest peak flowering was found in Illaichi (35 days). Long flowering season of berwas also observed by Neeraja *et al.* (1991). In all the studied varieties peak period of flowering was observed in September - October (Table 2). Similarly, Sharma *et al.* (1990) noticed peak flowering in September whereas Godara *et al.* (1981) and Singh and Jindal (1982) noticed in October.

#### Flower morphology

A prominent variation of flower morphology like pedicel length (5.84-8.89 mm), flower diameter (8.68-5.60 mm), length/breadth ratio of sepal (0.88-1.30), length/breadth ratio of petal

(1.48 - 2.25), anther length (0.30 - 0.47 mm), filament length (0.97-1.50 mm), disc diameter (2.90 - 4.23 mm) was noted among fourteen varieties (Table 3 and 4). Flower size was higher in Jogia, Topa, Umrans and Dandan. These results are in close agreement with those of Jonsan *et al.* (1980). Pedicel was longer in Banarasi Karaka and shorter in Mundia. The variation of anther length was not significant among different studied varieties. Filament length was higher in BAU Kul-1, Jogia and Sanur-2. Both anther length and filament length were lowest in Dandan but diameter of disc was much higher in Illaichi and Gola (Table 3). The length/breadth ratio of sepal was exactly 1.0 in Apple Kul, Banarasi Karaka and Topa which indicated equal length and breadth of sepal in these varieties. Higher length/breadth ratio of sepal (more than 1) in Gola (1.30) and Umrans (1.22) revealed much higher length than their corresponding breadth. Similarly, length/breadth (sepal) of less than 1 in BAU Kul-1, Chhuhara, Illaichi, Jogia and Mundia indicated higher breadth of sepal than their corresponding length. All the varieties had more than 1 value of length/breadth ratio of petal. The length/breadth ratio of

petal was more than 2 in Apple kul, Banarasi Karaka and Gola which indicated that the length of petal was more than double than the breadth. However, the size of sepal was higher in BAU Kul-1 (2.43 x 2.70 mm), Kaithali (2.60 x 2.40 mm), Topa (2.80 x 2.80 mm) and Umran (2.87 x 2.33 mm) whereas the size of petal was higher in Apple Kul, (1.83 x 0.90 mm), Gola (1.90 x 0.93 mm) and Kaithali (2.00 x 1.20 mm) (Table 4). Variation of morphological characters among different varieties was also reported earlier (Nehera et al., 1984 and Gupta et al., 2004).

## REFERENCES

- Babu, R. H. and Kumar, P. S. 1988.** Studies on the growth and flowering of certain cultivars of ber (*Zizyphus mauritiana* Lamk.) of Hyderabad. *Haryana J. Hort. Sci.* **17(1-2)**: 24-27.
- Desai, U. T., Ranawade, D. B. and Wavhal, K. N. 1986.** Floral biology of ber. *J. Maharashtra Agric. Univ.* **11(1)**: 76-78.
- Gupta, R.B., Sharma, J. A. and Panwar, R. D. 2004.** Study on flowering behaviour in some cultivated and wild forms of ber (*Zizyphus mauritiana* Lamk.). *Haryana J. Hort. Sci.* **33(1&2)**: 11-14.
- Godora, N. R. 1980.** Studies on Floral Biology and compatibility behaviour in ber (*Zizyphus mauritiana* Lamk.) *Ph. D. Thesis*, Haryana Agric. Univ, Hisar, India.
- Jonsan, J. S. Jawanda, J. S., Bal, J. S. and Singh, R. 1980.** I: Studies on floral biology of ber II: Pollen Studies receptivity of stigma and mode of pollination. *The Punjab Hort. J.* **21**: 61-64.
- Kumar, H., Katiyar, P. N., Singh, A. K. and Rajkumar, B. V. 2014.** Effects of different pruning severity on physicochemical properties of ber (*Zizyphus mauritiana* Lamk.) cv. Banarasi Karaka. *The Ecoscan.* **8(3&4)**: 203-206.
- Kumari, S., Bhat, D. J., Wali, V. K., Bakshi, P. and Jasrotia, A. 2015.** Physico-chemical studies of different ber (*Zizyphus mauritiana* Lamk.) Germplasm under rainfed conditions of jammu. *The Bioscan.* **10(3)**: 1427-1430.
- Nehra, N. S., Chitkara, S. D. and Singh, K. 1984.** Studies of morphological characters of some wild ber forms and cultivated varieties of ber. *Punjab Hort. J.* **24(1-4)**: 49-59.
- Neeraja, G., Reddy, S. A. and Babu, R. S. H. 1995.** Fruit set, fruit drop and fruiting behaviour in certain ber (*Zizyphus mauritiana* Lamk.) cultivars. *J. Res.* **23(3/4)**: 17-21.
- Panse, V. G. and Sukhatme, P. V. 1998.** *Statistical Methods for Agricultural Workers*. Publication Information Division, ICAR, New Delhi. p. 361.
- Pareek, O. P. 2001.** *Fruits for the Future 2: Ber*. International Centre for Underutilised Crops, University of Southampton, Southampton, UK.
- Pareek, S., Mukherjee, S. and Paliwal, R. 2007.** Floral Biology of ber-A Review. *Agric. Rev.* **28(4)**: 277-282.
- Sharma, V. P., Raja, P. V. and Kore, V. N. 1990.** Flowering, fruit set and fruit drop in some ber (*Zizyphus mauritiana* Lamk.) varieties. *Annals Agric. Res. Inst.* **11(1)**: 14-20.
- Singh, D. and Jindal, P. C. 1982.** Studies on flowering and sex ratio in some ber (*Zizyphus mauritiana* Lamk.) cultivars. *Haryana Agric. Univ. J. Res.* **12(2)**: 292-294.

