



Original Research Article

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## Studies on the Pattern of Changes Biochemical Constitutes of Ber (*Zizyphus mauritiana* Lamk.) Fruits cv. Narendra Ber Selection-1

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The biochemical changes occurs during growth and development of ber fruit cv. Narendra ber selection-1 in term of total sugars, ascorbic acid, reducing sugars, non-reducing sugar and total sugars increased continuously from fruit set till maturity whereas titrable acidity exhibited decreasing trend throughout the growth and development of fruits.

### Introduction

Ber (*Zizyphus mauritiana* Lamk.) is an ancient fruit tree of India and China. In fact it was one of the prominent fruits on which sages in ancient India lived during Vedic ages. There is a reference to ber in "Yajurved", written not later than 1000 B.C. Ber (*Zizyphus mauritiana* Lamk.) is also known as Chinese date, Chinee/Chinkee apple, jujube, Indian plum, Regi pandu, Indian jujube and masau, belongs to the family Rhamnaceae and genus *Zizyphus*. It is a tetraploid (2n=48) in nature. It is grown in countries like Iran, Syria, Australia, USA, France and certain parts of Italy, Spain and Africa. Precisely it is seen to be growing under tropical and sub-tropical as

well as Mediterranean regions of the world. The center of origin for this fruit crop is Central Asia. This includes north-west India, Afghanistan, regions of Tajikistan, Uzbekistan and China. It is found growing wild, semi-wild and in cultivated form in almost all parts of India (De Candolle, 1886). The medicinal values of various parts of the tree and fruits of *Ziziphus spp.* are many and yet not fully exploited (Sin ko, 1976). The maturity plays an important role in quality and shelf life of ber fruit. It grows even on the marginal soil and various kinds of waste land situation such as sodic saline soil, ravines, arid, semi-arid region including plated area of Bundelkhand and South India. Regarding its distribution it grows most widely in Punjab plains, U.P.,

Haryana, Rajasthan, M.P., Bihar, Maharashtra, Assam, A.P., Tamil Nadu and West Bengal. In U.P. ber orchards are found around Varanasi, Aligarh, Saharanpur, Faizabad, Agra and Raibareilly districts. However, scattered planting is common in plains. It is hardy and flourishes well under little care in wide range of soils and climatic conditions. It grows even on the marginal soil and various kinds of waste land situation such as sodic saline soil, ravines, arid, semi-arid region including plateau area of Bundelkhand and South India.

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It is hardy and flourishes well under little care in wide range of soils and climatic conditions. The studies on changes during growth and development are essential requirement to determine the maturity, harvesting time and method. The present investigations were therefore, aimed to generate basic information on the namely studies on the pattern of changes biochemical constituents of ber.

## Materials and Methods

The present investigation was carried out at Main Experiment Station of the Department of Horticulture, Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Faizabad 224229 (U.P.) India during the years 2016-17. The experiment was conducted on 24 years old uniform vigorous ber trees (Nrendra Ber Selection-1) which received uniform cultural operation throughout the experimental period. The details of the materials used, the trial was laid out in a randomized block design having six treatments with four replications.

Samples from randomly selected fruit from each treatment were taken and macerated in pestle and mortar for juice extraction. Total soluble solid (T.S.S.) of the juice was determined by using a hand Refractometer of 0-32 per cent range. The values were corrected at 20 °C and expressed as (°Brix) T.S.S. of the fruit pulp. By using ERMA hand refractometer and expressed as °Brix (Ranganna,). The acidity quality of fruit pulp (5 g) was macerated and diluted in small amount of distilled water and filtered through muslin cloth. The volume was made up to 100 ml; 5 ml aliquot was taken for titration against 0.1% N sodium hydroxide (NaOH) solution using phenolphthalein as indicator. The appearance of light pink colour was marked as the end point. Ascorbic acid content was estimated by grinding 5 g fruit pulp with 3.0 per cent metaphosphoric acid as buffer. The extract was filtered with muslin cloth and volume was made to 50 ml aliquot was titrated against 2, 6- dichlorophenol indophenol dye solution till the light pink color appeared. The result were calculated with the help of following formula and expressed as mg ascorbic acid per 100g of fruit pulp (A.O.A.C., 1975). The total reducing sugar was estimated by Fehling solution as advocated by Lane and Eynon (1923). To determine the reducing

sugar 5g pulp was crushed with distilled water, filtered with muslin cloth and volume was maintained up to 100 ml after that 5 ml aliquot was taken with Fehling solution ‘A’ and ‘B’(5 ml each) in conical flask. This mixture was titrated against 1 per cent glucose solution using methylene blue as indicator at boiling stage. The end point was marked by the appearance of brick red colour. The result was expressed as per cent of reducing sugar. Non-reducing sugars was estimated by deducting quantity of reducing sugar from total invert sugar and multiplied by factors 0.95. The result was expressed as per cent non-reducing sugar. Total sugars were estimated by adding reducing and non-reducing sugar per cent and expressed as per cent of total sugars.

## Results and Discussion

The observation on the following attributes was started to record since first week of October (Table 1). Total soluble solids content of ber fruit increased continuously with growth period which might be due to hydrolysis of polysaccharides in to sugar and synthesis of other water solubles. Jawanda and Bal, (1980) also reported rapid increase in T.S.S. towards ripening in different ber cultivars. Similar observation were recorded by Yadav, S. S. (2009) during studies on growth and development of pevendi ber (*Ziziphus mauritiana* Lamk.) in Jhansi Uttar Pradesh and showed that total soluble solids, increased towards maturity. Acidity content of ber fruit was decrease after fruit setting which indicate the accumulation of acid during the initial period at rapid rate. The results are in conformity to those reported by Teaotia *et al.*, (1974) in fruits of ber cv. Bansasi Karka. Bal (1981) and Bal and Chaunhan (1981) also found that ber (*Ziziphus mauritiana* Lamk.) cv. Sanaura-2 and Umran acidity content decreased gradually during growth and development. Similar observations have been

reported by Bhatia and Gupta (1985) in ber cv. Gola, Kaithali and Umran. The present findings show continuous increasing trend in ascorbic acid content of ber during growth and development. The increasing teand of ascorbic acid content during growth and development of fruits might be due to accumulation and greater synthesis of glucose-6-phosphate which reserved as a precursor of ascorbic acid synthesis in fruit. The present finding are in conformity to earlier reporte of Bal *et al.*, (1995) who noted the increase in vitamin C content as the maturity advanced in ‘Umran’ ber fruits. The changes in ascorbic acid content of fruit pulp were studied in ber cultivars Mehrun-Khedi, Mehrun and M.P.K.V., during growth and maturity of ber fruits at 20 days interval from 20 days after fruit set up to 120 days. The ascorbic acid content of ber fruits in all the three cultivars at different developmental stages of fruit development indicated an increasing trend up to the maturity stage (Pathare *et al.*, 2016).

The reducing sugar content in ber fruit was increased during growth and development. The increasing in reducing sugar content in ber fruit might be due to conversion of polysaccharides and non-reducing sugar in to reducing sugars during growth and development. Similar observation was recorded on increasing in reducing sugars during growth and development of fruit by (Bal, 1981; and Bal and Chauhan, 1981; Bal and Singh, 1978 Gupta *et al.*, 1983). Non-reducing sugar content in ber fruit continuously increased through entire period of growth and development. The increasing non-reducing sugar during growth and development might be due to hydrolysis of starch in to sucrose when fruit proceeded to words maturity and ripening. The findings are of agreement with (Pandey *et al.*, 1990). Total sugars content of ber fruit was significantly increased continuously during growth and development.

**Table.1** Changes in biochemical attributes during growth and development of ber cv. NBS-1

Interval (days)		Total soluble solids (%)	Acidity (%)	Ascorbic acid content(mg/100g)	Reducing sugar (%)	Non- reducing sugar (%)	Total sugars (%)
21	October	1.04	0.41	3.31	0.24	0.12	0.37
28		1.05	0.39	3.38	0.26	0.19	0.45
35		1.08	0.37	3.46	0.29	0.33	0.62
42		1.55	0.34	3.85	0.31	0.49	0.71
49	November	1.65	0.31	4.05	0.33	0.67	1.01
56		2.52	0.31	4.07	0.38	0.76	1.14
63		2.56	0.29	5.65	0.48	0.97	1.36
70		3.11	0.26	5.88	0.51	1.06	1.56
77	December	3.21	0.25	5.93	0.89	1.07	2.06
84		4.33	0.24	8.81	0.91	1.38	2.41
91		4.61	0.21	9.11	1.31	1.46	2.77
98		5.09	0.19	18.35	1.43	1.51	2.94
105	January	8.37	0.18	19.38	1.69	1.63	3.34
112		11.12	0.17	23.55	1.71	1.86	3.58
119		15.09	0.17	24.26	1.78	2.13	3.69
126		16.30	0.16	33.26	2.58	2.79	5.39
133	February	16.82	0.15	46.38	2.87	2.96	5.85
140		17.51	0.13	53.23	3.42	3.75	7.15
147		19.45	0.13	67.48	3.62	3.98	7.58
154		20.73	0.11	74.05	3.83	3.96	7.79
161	March	21.81	0.09	85.88	4.25	5.43	9.68
168		22.24	0.07	94.00	4.81	5.78	11.00
SEM±		0.75	0.02	3.71	0.25	0.23	0.35
CD at 5%		2.21	0.11	11.14	0.71	0.67	1.01

The increasing in total sugar might be because of increasing in total soluble solids and reducing sugar resulting from the conversion of polysaccharides in to sugars. Gupta *et al.*, (1983) also found that total sugar continued to increase throughout the development of fruit in ber cv. Umran and Gola. Same trend also reported by Pathare *et al.*, (2016) in ber cultivars Mehrun-Khedi, Mehrun and M.P.K.V., during growth and maturity of ber fruits at 20 days interval from 20 days after fruit set up to 120 days. Fruits growth might be associated with rapid increase in total sugars in the fruit pulp of all the three

cultivars in the later stage of the development of fruits. Marked variations in sugar content have been observed in different fruit during their growth and development. It has been found varying from 9.65 to 32.6 per cent in (*Zizyphus Mauritiana* Lamk) (Bartov, 1975).

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