



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2016; 2(2): 757-761
www.allresearchjournal.com
Received: 18-12-2015
Accepted: 20-01-2016

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Physical fruit characteristics assessment of selected Ber (*Zizyphus mauritiana* Lamk.) Genotypes

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Abstract

The present investigation of physical characteristics of fruits was carried out at Instructional-cum-Research Orchard of Arid Zone Fruit Project, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri during the year 2012 to 2014 on nineteen different genotypes of ber which were grafted on the local rootstock. The results showed much variation among the different ber genotypes. The maximum number of fruits per cluster (6-8) was registered by Kadaka followed by Kala Gola (5-6) and it was observed minimum in remaining genotypes (2-4). The early fruit maturity was observed in genotypes Chuhara, Umran and Kala Gola While it was late in Kopargaon Selection Mehrun-1, Jalgaon and Rahuri 1, 2 and 3. Much variation in respect of fruit shape and colour was observed in all the genotypes. The highest fruit weight (71.71g) was recorded by genotype Kopargaon Selection while it was found minimum in Rahuri-3 (6.49g). The largest fruit size was registered by Kopargaon selection. The maximum pulp weight was noticed in genotype Kopargaon Selection (68.71g) and it was found lowest in Rahuri-3 (5.47g).

Keywords: Ber, maturity group, fruit, stone, pulp characters

Introduction

India is bestowed with a varied agro-climate, which is highly favourable for growing a large number of horticultural crops. It has large range of varieties of fruits in its basket and account for 10% of world's total fruit production (Anonymous, 2013) [4]. The Indian arid regions having high temperature, low and variable precipitations are spread over about 31.7 million hectares limiting the scope for high horticultural productivity. However these conditions greatly favour development of high quality in number of fruits. Among them King of Arid Zone Fruits Ber or Indian jujube (*Zizyphus mauritiana* Lamk.) is one of the ancient and common fruit in India (Rai and Gupta, 1999) [21] relished for its sweet and sour fruits. It belongs to Buckthorn family Rhamnaceae. At present, nearly 90 per cent of its production is consumed as fresh fruit. Although there seems to be good potential for use of fruits in processing industry and different parts of tree in pharmacology, these have still not been exploited. Fruits are used for preparation of candy, pickles, preserve, canned ber chutney, murabba, ber powder and chuhara (Singh, 1995) pulp is used for making jam, bases for squash nectar and ready to serve beverage (Neog *et al.*, 1993). Hard stones, serious infestation of fruit fly and powdery mildew seem to be main bottlenecks restricting its wide spread cultivation. Reviewing the merits there is considerable scope for improvement by thoroughly screening some genotypes for their growth behaviour to select or recommend superior varieties to the farmers. Variation in yield as well as physical properties of fruits of different ber varieties has been reported by several workers. Pareek and Vashishtha (1983) [18], Saran *et al.* (2006) [24], Thanmay Kumar Koley *et al.* (2011) [27] have evaluated different ber varieties and have recommended particular one for commercial cultivation in different agro climatic conditions.

Though Chuhara and Gola are the most popular varieties presently, there is a scope for further development and it is still a felt need. Chuhara has its own downfalls *viz.* less fruit yield per tree, small fruit size and poor keeping quality etc. A variety with, good size and shape will be greatly appreciated by the consumers. An attempt is being made in the present study to critically evaluate the varieties with an intension to judge whether there are any other better varieties than Chuhara ber regarding the characters such as attractive shape, best pulp to stone ratio and economic importance.

Materials and Methods

The experiment was conducted in orchard selecting 57 plants, which were screened for various morphological characters during 2012-2014. The nineteen cultivars of Ber (i.e. Umran, Chhuhara, Gola, Kaithili, CIAH Selection-1, CIAH Hybrid-1, Goma Kirti, Narendra Ber-1, Narendra Ber-2, Seb, Kala Gola, Kadaka, Mehrun-1, Jalgaon, Chemeli, Rahuri-1, Rahuri-2, Rahuri-3 and Kopargaon Selection.) were assessed for the present studies. The experiment was carried out in a randomized block design (RBD) and the statistical analysis was done as per the procedures given by Panse and Sukhatme (1985) [17]. Means over replication for each genotype and character were calculated and used for statistical analysis. Also some data was analysed by using basic statistics.

Results and Discussion

Evaluation of the germplasm is a pre-requisite to collect basic information before initiating any breeding programme for crop improvement. Knowledge of the inter relationship of quantitative traits of economic importance with yield and among themselves is important for the improvement in a complex character like yield and quality through selection. In the present study of evaluation of some ber genotypes for physical characteristics of fruits, the findings are discussed in relation to the various characters of commercial importance.

Fruit Characters

Sharon *et al.* (2006) [24] classified Umran and Chhuhara as late bearing genotype while Gola is early bearing genotype and Kaithli is a mid-season genotype. These observations collaborate with the findings of Chadha *et al.* (1972) [7]. The present investigation states the genotypes Umran, Chhuhara, Gola, Goma Kirti, Narendra Ber-1, Narendra Ber-2, Kadaka and Chameli falls under early maturity group, and the genotypes Kaithili, CIAH Selection-1, CIAH Hybrid-1, Seb, Kala Gola and Kopargaon Selection are mid maturing genotype and all the remaining genotype are late maturing genotype. These variations in flowering and fruit maturity relates to climatic variation like temperature and rainfall and genetic constitution.

Bearing habit of almost all the genotypes was in cluster except in Goma Kirti which had solitary bearing habit. Most of the genotypes had 2-4 fruits per cluster on an average, while it was maximum in Kadaka having 6-8 fruits per cluster followed by Kala Gola having 5-6 fruits per cluster.

Pareek (2001) [19] reported that fruit shape varied from round, oval, ovate, obovate, oblong to oblate. The fruit shape of Umran, CIAH Selection-1, CIAH Hybrid-1, Chameli, Rahuri-2 and Rahuri-3 were found to be ovate oblong, Chhuhara and Seb have oblong oval shape, Kaithili, Kala Gola, Jalgaon, Rahuri-1 have oblong shape, Gola and Kopargaon Selection have round shape Goma Kirti have oval shape, Kadaka have ovate shape with beaked apex.

Fruit cracking was observed to be absent in almost all the genotypes under investigation except in Chhuhara which was found to be at the rate of 2 per cent.

Immature fruit colour was observed to be Dark green in CIAH Selection-1, Light green in Kadaka and Green with purplish blush in Kala Gola all the remaining genotype were found to have green colour.

Singh and Singh (1973) [25] noticed that Umran are golden yellow with chocolate flecks when ripe, and those of the other genotype are greenish yellow. The present

investigation also reveals the similar results as cultivars Gola and Chameli have Golden yellow colour Chhuhara have chocolate brown colour and Kala Gola was observed to have green with purplish tinge. However all the remaining genotype were found to be greenish yellow when mature.

Umran, Kaithili, Goma Kirti, Narendra Ber-1, Jalgaon, Chameli, Rahuri-1 and Rahuri-3 have broadly pointed apex. Chhuhara, Gola, Seb, Rahuri-2 and Kopargaon Selection have round apex. CIAH Selection-1 CIAH Hybrid-1, Narendra Ber-2 have pointed apex whereas Kadaka have beaked apex. Depressed shallow fruit base was found in Seb, Kala Gola, Kadaka and Rahuri-2. Round grooved and broad base were found in Gola, Goma Kirti and Chameli respectively, whereas all the remaining genotypes have depressed fruit base.

Pulp colour of almost all the genotype is creamy white. Kala Gola and Chameli have soft texture, Kopargaon Selection had granular texture. However, all the remaining genotypes are medium in texture.

Pareek (2001) [19], Kumar *et al.* (1987) [13], Kundi *et al.* (1989) [14], Faroda (1996) [10], Akhundova and Agaev (1989) [2], Reddy *et al.* (1998) [23], Ram *et al.* (2008) [22], Dhanumjaya Rao and Subramanyam (2010) [8], Jan Brindza *et al.* (2011) [12], Ganesh Shukla *et al.* (2012) [11], Muhammad *et al.*, (2013) [16] and Mohsin Abbas *et al.*, (2012) [15] recorded observations on Fruit length, Fruit width, Fruit weight which are in line with the present investigation where Kopargaon Selection have highest fruit length (5.90 cm), fruit width (4.90 cm) and Fruit weight(71.71g). The minimum fruit length was observed in the genotype Rahuri-1 (1.80 cm), and minimum fruit width was observed in Rahuri-2 (1.70 cm) and minimum weight was observed in Rahuri-3 (6.49 g). Significantly maximum pulp weight was recorded in the genotype Kopargaon Selection (68.71 g) and significantly minimum pulp weight was recorded in the Rahuri-3 (5.47g).

Stone Characters

Dhingra *et al.* (1973) [9] and Akhundova and Agaev (1989) [2] reported the ratio of pulp to stone in Gola was 0.14 and in Mundia 0.23. Mohsin Abbas (2012) [5] recorded highest stone size (2.09 cm²) and stone weight (2.31g) in Foladi. However, maximum flesh ratio (10.59%) was in Gorh genotype. Similar observations were also recorded by Jan Brindza *et al.* (2011). Ram *et al.* (2008) [22], Ganesh Shukla *et al.* (2012) [11], Singh Rajesh and Misra (2012) [26] and the present investigation reveals that maximum stone length, stone width and stone weight was recoded in Kadaka (2.80 cm), (1.20 cm) Kala Gola, (3.86 g) respectively. And minimum stone length, stone width and stone weight were recorded in Rahuri-3 (1.30 cm), Rahuri-3 (0.30 cm), Chhuhara (0.50 g), respectively.

CIAH Selection-1, Narendra Ber-2, Kadaka have apiculate apex Kala Gola, Rahuri-3, and Kopargaon Selection have round stone apex. However all the remaining genotype have acute apex. Stone base is acute in genotype Chhuhara, CIAH Hybrid-1, Narendra Ber-2 and Mehrun-1. Apiculate in Gola, Narendra Ber-1, Kadaka and Rahuri-1 whereas obtuse in all the remaining genotype. The stone shape of Umran and CIAH selection-1 was found to be oval, Chhuhara and Seb have Elliptical stone shape. Gola, Kaithili, Goma Kirti, Narendra Ber-2, Chameli Rahuri-1 have obovate stone shape, Kala Gola had oval broad shape and Mehrun-1 have elliptical mucronate shape and Rahuri-3 had Round shape. The stone

surface was found to be smooth in Kaithili, furrowed in Umran, Chhuhara and Kadaka and warty in all the remaining genotype.

Pulp Stone Ratio

Ram *et al.* (2008) [22] found that pulp/stone ratio to be in the range of 5.03-36.98. Similar reports were given by Dhingra *et al.* (1973) [9], Akhundova and Agaev (1989) [2], Jan Brindza *et al.* (2011), Ganesh Shukla *et al.* (2012) [11], Singh Rajesh and Misra (2012) [26] and Mohsin Abbas (2012) [15]. In the present investigation among the nineteen genotype significant differences were noticed for this trait the maximum pulp stone ratio was recorded in Umran (23.10)

followed by Kopargaon Selection (22.90). The genotype CIAH Selection-1 (4.22) had minimum pulp stone ratio followed by Rahuri-1 (6.80).

All these fruit and stone characters are the yield contributing characters for improvement of pulp yield in ber. Similar associations between traits studies have been reported by Thimmappaiah *et al.* (1985) [28] and Kurni (1992) in guava, Attri *et al.* (1999) [5] in mango and Patil and Patil (1995) [20] in grapes. The variation in the traits may be due to change in cultural practices, climatic conditions and other biotic and abiotic factors, yet they provide a reliable basis for cultivar identification in jujube. These results confirmed variations in early findings of Bisla *et al.* (1998) and Pareek (2001) [19].

Table 1: Observations for Fruit characters

Sr. No.	Genotypes	Number of fruits per cluster	Date of 50% maturity	Fruit maturity group	Fruit shape	Fruit cracking
1	Umran	2-3	4.10.2013	Early	Ovate oblong	Absent
2	Chhuhara	4-5	1.10.2013	Early	Oblong oval	Present (2%)
3	Gola	4	8.10.2013	Early	Round	Absent
4	Kaithili	3-2	20.10.2013	Mid	Oblong	Absent
5	CIAH Selection1	2	18.10.2013	Mid	Ovate oblong	Absent
6	CIAH Hybrid-1	2	18.10.2013	Mid	Ovate oblong	Absent
7	Goma Kirti	1	4.10.2013	Early	Oval	Absent
8	Narendra Ber-1	4-5	6.10.2013	Early	Obovate	Absent
9	Narendra Ber-2	3-5	6.10.2013	Early	Obovate	Absent
10	Seb	2-3	16.10.2013	Mid	Oblong oval	Absent
11	Kala Gola	5-6	21.10.2013	Mid	Oblong	Absent
12	Kadaka	6-8	5.10.2013	Early	Ovate oblong with beaked apex	Absent
13	Mehrun-1	2-3	7.11.2013	Late	Oblong oval	Absent
14	Jalgaon	4	10.11.2013	Late	Oblong	Absent
15	Chameli	2-3	30.9.2013	Early	Ovate oblong	Absent
16	Rahuri-1	3-4	15.11.2013	Late	Oblong	Absent
17	Rahuri-2	2-4	12.11.2013	Late	Ovate oblong	Absent
18	Rahuri-3	4-5	12.11.2013	Late	Ovate oblong	Absent
19	Kopargaon Selection	2-3	22.10.2013	Mid	Round	Absent

Table 1: contd.....

Sr. No.	Genotypes	Immature fruit colour	Mature fruit colour	Fruit surface	Fruit apex	Fruit base
1	Umran	Green	Greenish yellow chocolate colour flakes	Smooth	Broadly pointed	Depressed shallow
2	Chhuhara	Green	Chocolate brown	Smooth	Round	Depressed shallow
3	Gola	Green	Golden yellow	Smooth	Round	Round
4	Kaithili	Green	Greenish yellow	Smooth	Broadly Pointed	Depressed shallow
5	CIAH Selection1	Dark Green	Greenish yellow	Rigid	Pointed	Depressed shallow
6	CIAH Hybrid	Green	Greenish yellow	Smooth	Pointed	Depressed shallow
7	Goma Kirti	Green	Greenish yellow	Rigid	Broadly pointed	Grooved
8	NarendraBer-1	Green	Greenish yellow	Smooth	Broadly pointed	Depressed shallow
9	NarendraBer-2	Green	Greenish yellow	Rigid	Pointed	Depressed shallow
10	Seb	Green	Greenish yellow	Smooth	Round	Depressed shallow
11	Kala Gola	Green with Puplish blush	Green with pinkish tinge	Smooth	Broad	Depressed shallow
12	Kadaka	Light Green	Greenish yellow	Smooth	Beaked	Depressed shallow
13	Mehrun-1	Green	Greenish yellow	Smooth	Broad	Depressed shallow
14	Jalgaon	Green	Greenish yellow	Smooth	Broadly pointed	Depressed shallow
15	Chameli	Green	Golden yellow	Smooth	Broadly Pointed	Broad
16	Rahuri-1	Green	Greenish yellow	Smooth	Broadly Pointed	Depressed shallow
17	Rahuri-2	Green	Greenish yellow	Smooth	Round	Depressed shallow
18	Rahuri-3	Green	Greenish yellow	Smooth	Broadly pointed	Depressed shallow
19	Kopargaon Selection	Green	Greenish yellow	Smooth	Round	Depressed shallow

Table 1: contd.....

Sr. No.	Genotypes	Pulp colour	Pulp texture	Fruit length(cm)	Fruit width(cm)	Fruit weight(g)	Pulp weight(g)
1	Umran	Creamy white	Medium	4.50	3.00	26.76	25.65
2	Chuhara	Creamy white	Medium	2.40	2.10	13.43	12.63
3	Gola	Creamy white	Medium	4.20	3.50	30.61	29.11
4	Kaithili	Creamy white	Medium	4.20	3.10	27.97	26.19
5	CIAH Selection-1	Creamy white	Medium	4.00	2.60	17.75	14.35
6	CIAH Hybrid	Creamy white	Medium	4.00	2.30	22.87	20.4
7	Goma Kirti	Creamy white	Medium	3.60	2.90	17.61	16.59
8	NarendraBer-1	Creamy white	Medium	4.90	3.10	43.61	39.63
9	NarendraBer-2	Creamy white	Medium	3.30	2.80	30.44	28.49
10	Seb	Creamy white	Medium	3.95	3.20	24.43	20.57
11	Kala Gola	Creamy white	Soft	3.80	3.30	22.87	20.4
12	Kadaka	Creamy white	Medium	4.00	2.80	11.31	9.68
13	Mehrun-1	Creamy white	Medium	2.50	1.80	10.32	9.44
14	Jalgaon	Creamy white	Medium	2.10	2.00	07.42	6.5
15	Chameli	Creamy white	Soft	2.50	2.70	07.32	6.48
16	Rahuri-1	Creamy white	Medium	1.80	1.80	07.73	6.74
17	Rahuri-2	Creamy white	Medium	2.60	2.00	06.57	5.62
18	Rahuri-3	Creamy white	Medium	1.90	1.70	06.49	5.47
19	Kopargoan Selection	Creamy white	Granular	5.90	4.80	71.71	68.71
	S.E _±			0.43	0.41	0.48	0.75
	CD at 5%			1.28	1.24	1.43	2.29

Table 2: Observations for Stone characters

Sr. No.	Genotypes	Stone apex	Stone base	Stone Shape	Stone surface
1	Umran	Acute	Oval	Obtuse	Furrowed
2	Chuhara	Acute	Elliptic	Acute	Furrowed
3	Gola	Acute	Obviate	Apiculate	Warty
4	Kaithili	Acute	Obviate	Obtuse	Smooth
5	CIAH Selection-1	Apiculate	Oval	Obtuse	Warty
6	CIAH Hybrid	Acute	Elliptic	Acute	Warty
7	Goma Kirti	Acute	Obviate	Obtuse	Warty
8	NarendraBer-1	Acute	Obviate	Apiculate	Warty
9	NarendraBer-2	Apiculate	Obviate	Acute	Warty
10	Seb	Acute	Elliptic	Obtuse	Warty
11	Kala Gola	Round	Oval broad small	Obtuse	Warty
12	Kadaka	Apiculate	Elliptic	Apiculate	Furrowed
13	Mehrun-1	Acute	Elliptical mucronate	Acute	Warty
14	Jalgaon	Acute	Oblong oval	Obtuse	Warty
15	Chameli	Acute	Obviate	Obtuse	Warty
16	Rahuri-1	Acute	Obviate	Apiculate	Warty
17	Rahuri-2	Acute	Oblong oval	Obtuse	Warty
18	Rahuri-3	Round	Round	Obtuse	Warty
19	Kopargoan Selection	Round	Oblong	Obtuse	Warty

Table 2: contd....

Sr. No.	Genotypes	Stone length (cm)	Stone width (cm)	Stone weight (g)	Pulp stone ratio
1	Umran	2.30	1.00	1.11	23.1
2	Chuhara	1.40	0.70	0.50	15.78
3	Gola	2.40	1.00	1.50	19.4
4	Kaithili	2.40	1.00	1.78	14.71
5	CIAH Selection-1	2.70	1.00	3.40	4.22
6	CIAH Hybrid-1	2.40	0.80	2.47	8.26
7	Goma Kirti	1.90	0.90	1.02	16.26
8	NarendraBer-1	2.70	1.00	1.98	20.01
9	NarendraBer-2	2.10	0.80	1.92	14.83
10	Seb	2.10	1.00	3.86	5.32
11	Kala Gola	2.10	1.20	2.47	8.26
12	Kadaka	2.80	0.90	1.63	5.93
13	Mehrun-1	1.80	0.70	0.88	10.72
14	Jalgaon	1.80	1.00	0.92	7.06
15	Chameli	1.30	0.80	0.84	7.71
16	Rahuri-1	1.40	0.90	0.99	6.8
17	Rahuri-2	1.80	0.60	0.95	5.91
18	Rahuri-3	1.30	0.30	1.02	5.36
19	Kopargoan Selection	2.30	1.10	3.00	22.9
	S.E _±	0.13	0.12	0.28	0.35
	CD at 5%	0.39	0.35	0.84	1.04

Conclusion

The genotypes Rahuri-1, Rahuri-2, Rahuri-3, Kopargaon selection and Kala Gola can be utilized for further breeding programme on the basis of physical characters of fruits.

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