Studies on Carpological Traits in Ber (*Ziziphus mauritiana* Lamk.) Genotypes

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Thirty five ber genotypes were studied for their fruit and stone characters. Different types of fruit shapes were observed such as oblong , oval , ovate, round and obovate. The shape of fruit apex and base were found from round , broad and beaked. The skin colour of unripe and ripe fruit also showed considerable variation, as light green (Kaithli), green (Dandan), dark green (Desi Alwar and ZG-3), green with pinkish purple colour (Kathpal) in unripe, while in ripe fruit greenish yellow (Kaithli), pinkish yellow (Katha Rajasthan), chocolate smooth brown (Chhuhara), and yellowish with red brown blush (Kathaphal) were observed. Fruit surface in majority of genotypes was smooth (Gola, Dandan etc.) and warty (Illachi, Mirchia, Banarsi Karaka and Chonchal). In most of the genotypes oblong stone shape was observed but some were oval to ovate. The carpological traits can be used for improvement programme of ber.

Key words: Ber Genotypes, Carpological traits, Diversity, Fruit and Stone characters, *Ziziphus mauritiana*

Ber (*Ziziphus mauritiana* Lamk.) is one of the most common fruit indigenous to India which belongs to family *Rhamnaceae*. It is growing throughout the tropical, subtropical and arid region and is quite popular due to its low cost of cultivation, wide adaptability, ability to withstand drought and good economic returns. A large number of genotypes are available in India but many of them are still unidentified due to lack of systematic information with respect to morphological traits. The identification of genotypes through carpological traits is useful to the horticulturists, breeders and fruit growers. A wide variation is available for fruit and stone characters in ber and helpful in identification of best combiners for use in breeding programmes as well as for getting rid of cultivar synonymity. The description of fruit and stone character will help in distinguishing ber genotypes at different stages of development and will aid in selection and popularization of good varieties for wider commercial cultivation.

Material and Methods

The present investigations were made on 35 genotypes grafted on *Ziziphus rotundifolia* rootstock at the Experimental Orchard of CCS Haryana Agricultural University, Hisar, Haryana, India. The selected genotypes constituted plants of twenty five years age, planted at 8 x 8m spacing having uniform training and pruning. The identification of ber genotypes was made using fruit and stone characters as described in Table 1. The fruit description by Zielinski (1955) served as a guide. For recording various observations on fruit characters a random sample of twenty fruits were collected from three trees of each genotype.

Table 1. Fruit and stone characters and their states

Character	Character state
Fruit shape	Ovate, oblong, oval, round, obovate, beaked
Colour of unripe fruit	Light green, green, dark green, green with purple blush
Skin colour of ripe fruit	Light green, green, yellow, yellowish green, golden yellow, yellow with purple blush, pinkish yellow, chocolate brown
Fruit surface	Smooth, smooth with glossiness, ridged warty, slightly coarse
Fruit apex	Broad, round, round with ridge, shallow, shoulder with slight ridge, flate with depression
Fruit base	Broad, round, flat, flat with ridges, depressed, pointed, beaked
Flesh colour	Creamy white, white, light yellow
Cavity at stem end	Presence, absence
Cavity at styler end	Presence, absence
Stone surface	Smooth, rough
Stone shape	Oval, oblong, obovate
Stone apex	Acute, pointed, round, obtuse
Stone base	Acute round, oblong, obtuse.

Results and Discussion

The characters like fruit shape, fruit colour, fruit base, apex, cavity at both end, fruit surface and flesh colour (see Fig 1 to 5) were taken into account for characterization of germplasm. The observation recorded in the present investigation suggested that the different germplasm varied markedly with respect to fruit shape and colour etc., obviously due to their differential genetical behaviour (Table 2). Oblong, oval, ovate, round and obovate type fruit shape was observed in different genotypes. The results obtained in the present investigation were different

Table 2. Fruit characters of ber germplasm

Name of Germplasm	Fruit shape	Skin colour (unripe fruit)	Skin colour (ripe fruit)	Fruit surface	Fruit apex at stylar end	Fruit base	Flesh colour	Cavity at stem end	Cavity at stylar end
Kaithli	Oblong	Light green	Greenish yellow	Smooth	Round	Distinctly pointed	Creamy white	Present	Absent
Umran	Oval	Green	Golden yellow	Ridged	Round with clear ridges	Round with slight depression	White	Present	Absent
Safeda Rohtak	Oval	Green	Light yellow	Smooth	Round	Round	White	Present	Absent
Katha Bombay	Oval	Green	Yellowish green	Ridged	Round with ridges	Round with depression	White	Present	Very small
Seo	Round	Green	Greenish yellow	Depression present	Round (slight ridges)	Round	White	Present	Absent
Chonchal	Oblong	Green	Light yellow	Smooth with stricked	Round	Beaked	White	Present	Absent
Noki	Oblong	Green	Yellowish	Rough and warty	Shoulder rising	Clear beaked	White	Present	Absent
Katha Rajasthan	Oval to oblong	Light green	Pinkish yellow colour	Smooth	Round with slight depression	Round	White	Present	Very small
Laddu	Round	Green	Golden yellow with light brown blush	Smooth with glossyness	Round with slight depression	Round	Light creamy colour	Present	Absent
Chhuhara	Ovate	Green	Chocolate smooth brown	Smooth	Round with slight ridges	Distinct beaked	White	Present	Absent
Sandura Narnual	Ovate	Green	Yellowish green	Warty Slightly coarse	Showed prominent	Slight beaked	White	Present	Absent
Illaichi	Ovate	Green	Golden yellow	Ridged	Flattened ridged	Flat with ridge	Creamy white	Present	Present (very small)
Dandan	Oblong	Green	Golden yellow	Smooth	Round (slight ridged)	Round	White	Present	Absent
ZG-3	Obovate	Dark Green	Greenish yellow	Smooth (ridge on stem end)	Round (ridged)	Round	White	Present	Absent
Kathaphal	Obovate	Green with Pinkish purple colour	Yellowish green with red brown blush	Smooth	Shallow	Round	White	Present	Present (very small)
Akhrota	Oblong	Green	Yellowish	Smooth and glossy	Round	Round	White	Absent	Absent
Bhadurgarhia	Oblong	Green	Yellowish	Smooth	Shoulder with slight ridge	Slight beaked	Creamy white	Present	Absent
Govindgarh Selection	Oblong	Green	Yellowish	Smooth with warty	Round with ridge	Beaked	White	Present	Absent
Thornless	Oblong	Green	Yellow green	Smooth	Round	Round	White	Present	Absent
Gola Gurgaon No. 3	Round	Green	Yellow	Smooth	Flat with depression	Round	Creamy white	Present	Present
Gola Gurgaon No. 2	Round	Green	Yellow	Smooth	Round	Round	Creamy white	Present	Present
Desi Alwar	Oblong	Dark Green	Yellowish green	Smooth	Distinctly ridged (necked)	Clear beaked	Creamy white	Present	Absent
Sanori No. 5	Oval	Green with slight purple colour	Golden yellow with purple colour	Slightly coarse	Round (slight ridged)	Clear beaked	Creamy white	Present	Absent
Sanori No. 1	Beaked (oval)	Green with slight pinkish colour	Golden yellow with purple colour	Slightly coarse	Round (slight ridged)	Clear beaked	Creamy white	Present	Absent
Seo Bhadurgarh	Round	Green	Greenish yellow	Depression present	Round with depression	Round	White	Present	Absent

Contd.

Table 2. Contd.

Name of Germplasm	Fruit shape	Skin colour (unripe fruit)	Skin colour (ripe fruit)	Fruit surface	Fruit apex at stylar end	Fruit base	Flesh colour	Cavity at stem end	Cavity at stylar end
Sua	Ovate	Green	Yellow green	Smooth	Round with more depression	Round	White	Present	Absent
Kishmish	Oblong	Green	Reddish yellow	Smooth	Roundish	Slight beaked	White	Present	Absent
Popular Gola	Round	Green	Yellowish	Smooth	Round with depression	Round	White	Present	Absent
Mirchia	Beaked (oblong)	Green	Golden yellow	Warty	Bluntly tapering	Clear beaked	Cream white	Present	Absent
Jogia	Oblong	Reddish pigmentation in green colour	Light brown	Coarse with ridge	Round ridged	Round	White	Present	Absent
Mundia Murhara	Oblong	Green red spot	Yellow with some	Smooth with smooth with depression	Tapering shallow notch	Roundish	White	Present	Absent
Ponda	Round	Dark green yellow	Greenish	Smooth depression	Flat with	Round white	Creamy	Present	Absent
BS-2	Oblong	Green	Yellow	Smooth with glossyness	Round with slight ridges	Round	White	Present	Absent
Gola	Round	Green	Bright yellow	Smooth with glossyness	Round	Round	White	Present	Present
Banarsi Karaka	Oval to oblong (slight beaked)	Green	Light yellow	Smooth glossy and warty	Round smooth with slight ridge	Slight beaked	Creamy white	Present	Absent

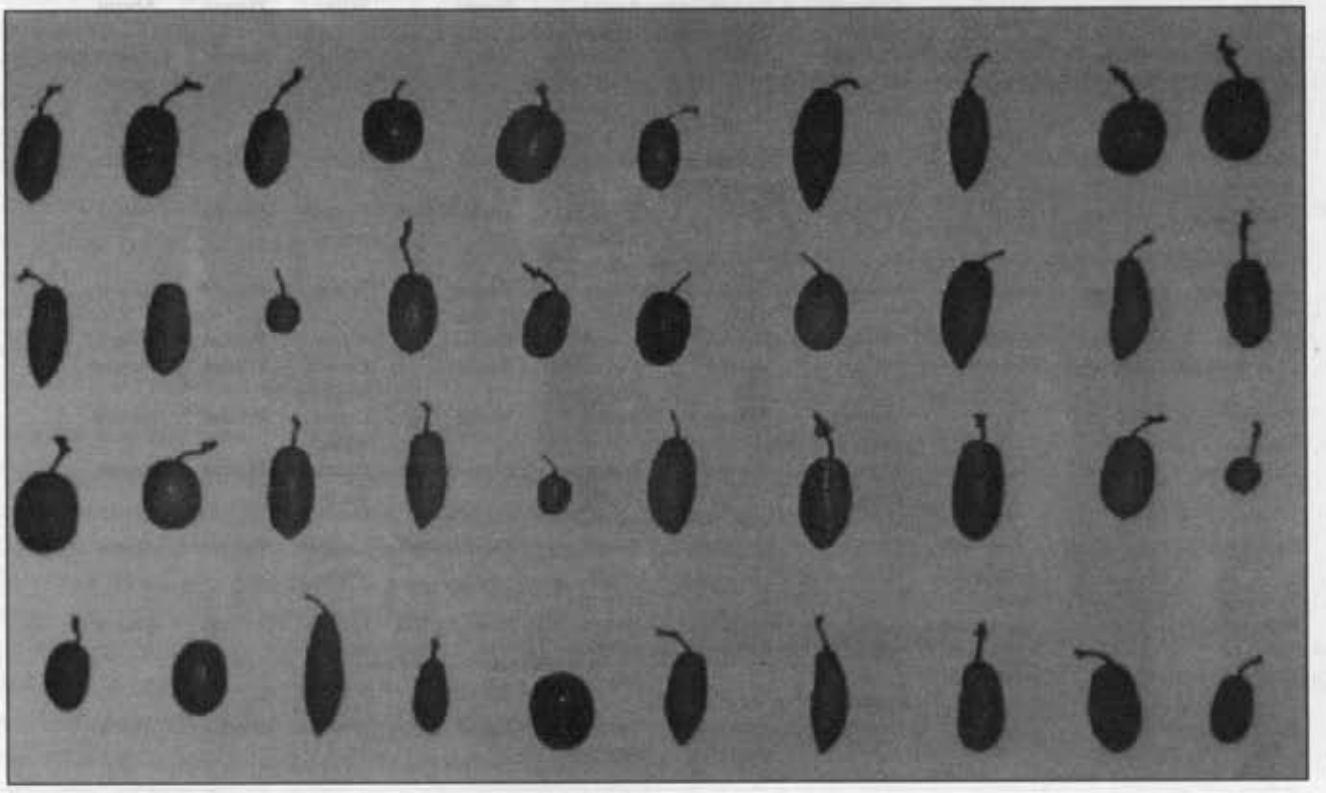

Fig. 1: Ber showing variability for shape, surface and size of fruits

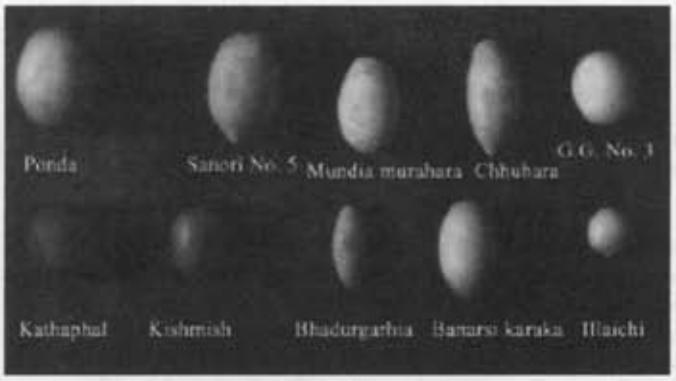

Fig. 2: Morphological variability of fruits

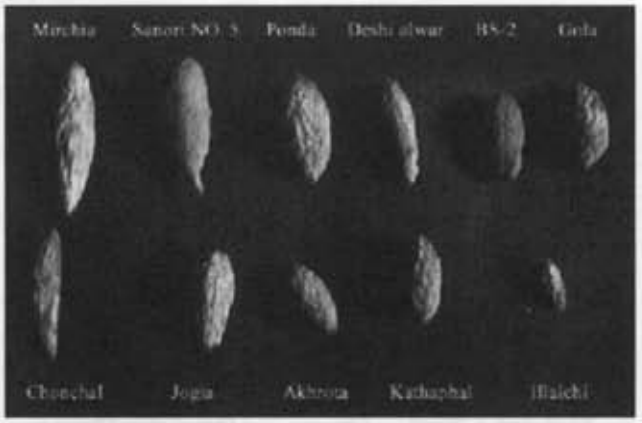

Fig. 3: Morphological variability of stones

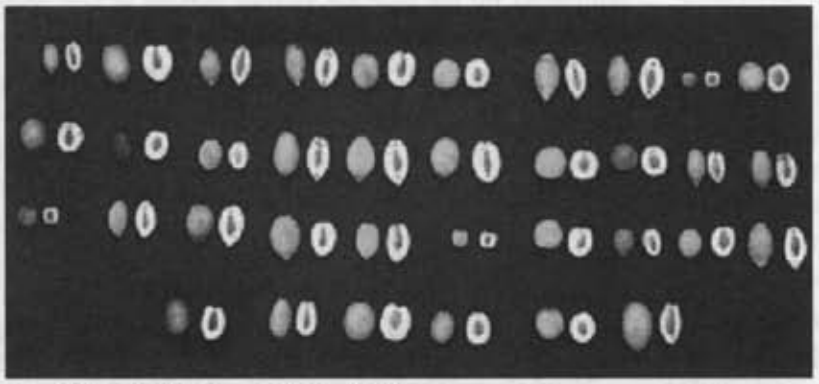

Fig. 4: Morphological variability of fruits

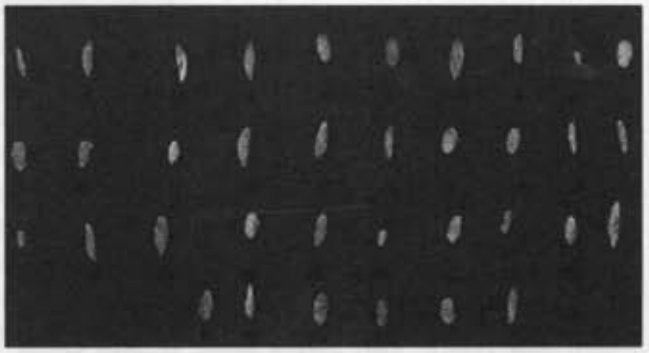

Fig. 5: Morphological variability of stones

Table 3. Stone characters of ber germplasm

Name of germplasm	Stone surface	Stone shape	Stone apex	Stone base
Kaithli	Rough	Oblong	Obtuse	Obtuse
Umran	Rough	Oblong	Obtuse	Obtuse
Safeda Rohtak	Rough	Oblong	Obtuse	Obtuse
Katha Bombay	Rough	Oblong	Obtuse	Obtuse
Seo	Rough	Oval	Obtuse	Obtuse
Chonchal	Rough	Oblong	Acute	Acute
Noki	Rough	Oval	Acute	Acute
Katha Rajasthan	Rough	Oblong	Obtuse	Obtuse
Laddu	Rough	Oval	Obtuse	Obtuse
Chhuhara	Rough	Oblong	Obtuse (pointed)	Acute
Sandura Narnual	Rough	Ovate	Obtuse	Obtuse
Illaichi	Rough	Obovate	Obtuse	Obtuse
Dandan	Rough	Oval	Obtuse	Obtuse
ZG-3	Rough	Oblong	Round	Round
Kathaphal	Rough	Oblong	Round	Obtuse
Akhrota	Rough	Obovate	Obtuse	Obtuse
Bhadurgarhia	Rough	Oblong	Acute	Acute
Govindgarh Selection	Rough	Oval	Acute	Acute
Thornless	Rough	Oval	Oblong	Oblong
Gola Gurgaon No. 3	Rough	Oblong	Obtuse	Obtuse
Gola Gurgaon No. 2	Rough	Oblong	Obtuse	Obtuse
Desi Alwar	Rough	Oblong	Oblong	Obtuse
Sanori No. 5	Rough	Ovate	Obtuse	Acute
Sanori No. 1	Rough	Ovate	Obtuse	Obtuse
Seo Bhadurgarh	Rough	Oblong	Obtuse	Obtuse to Acute
Sua	Rough	Oblong	Oblong	Obtuse
Kishmish	Rough	Oval	Obtuse	Obtuse
Popular Gola	Rough	Oblong	Obtuse	Acute
Mirchia	Rough	Oblong	Obtuse	Obtuse
Jogia	Rough	Oval	Obtuse	Round
Mundia Murhara	Rough	Ovate	Obtuse	Round
Ponda	Rough	Oval	Obtuse	Round
BS-2	Rough	Ovate	Obtuse	Round
Gola	Rough	Oval	Obtuse	Round
Banarsi Karaka	Rough	Ovate	Obtuse	Round

from those of earlier workers. However, some results are in conformity with the findings of Singh *et al.*, 1971; Kundi *et al.*, 1989; Bal 1992; Sobha *et al.*, 2001 at different places. The difference in the findings may be due to environmental factors, location, age of trees and cultural practices adopted in ber cultivars and wild forms. Shape of fruit apex and base was observed from round, broad, ridged and beaked in different genotypes. The variation were also reported by Gupta (2001) in four varieties of ber. Skin colour of unripe fruit showed considerable variation as, green, light green and green with purple blush, green yellow, bright yellow, greenish yellow and yellow with purple blush in skin colour of ripe fruit. Fruit surface of majority of genotypes was smooth (with or without glossiness) while few genotypes had warty with ridged surface.

Presence of cavity at stem end was observed in all the genotypes except Akhrota. Presence of cavity at stylar end was observed in Katha Bombay, Katha Rajasthan, Illaichi and Kathaphal while in rest of the genotypes it was absent. The variation for this character were also recorded by Raja (2004) in 12 genotypes of ber.

Flesh colour showed variation which was observed from creamy to light yellow. Similar results with respect to this character was recorded by Gupta, 2001 and Raja, 2004.

It is evident from the Table 3 the genotypes possessed grooved stone surface. In majority of genotypes, oblong stone shape was observed but some genotypes had oval to ovate stone shape. The stone apex was observed to be round in ZG-3 and Kathaphal. The genotypes like Bahadurgarhia and Govindgarh Selection had acute type stone apex. Obtuse type stone apex was observed in remaining genotypes. The stone base also showed pronounced variability like round, acute, pointed and obtuse. Although variation in stone morphology is a varietal character but upto a certain limit it can be influenced by the climatic factors as well as size and growth of the fruit. Similar observations were also noticed by Gupta (2001) in four cultivars and two species of ber.

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