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Morphological descriptor for DUS testing of Indian jujube (*Ziziphus mauritiana*)

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ABSTRACT

A total of 24 varieties of Indian jujube or *ber* (*Ziziphus mauritiana* Lamk.) were characterized based on morphological characters, viz. growth habit, foliage, thorn, fruit and stone. The erect growth habit was noticed in two varieties, viz. Dharki No. 1 and Tikadi, while semi-erect growth habit was noticed in majority of the varieties. Three types of leaf shapes were recorded, i.e. ovate, oval and cordate. Dharki No.1 and Safeda Rohtak had ovate leaf shape and Chhuhara Bawal, Jogia, Kaithali, Kala Gola, Katha Phal, Mehrun, Sanaur-5, Seb and Tikadi had cordate shape. While rest of the varieties showed oval shape. *Ber* varieties could also be categorized based on leaf pubescence on lower side, viz. smooth, sparsely-tomentose and densely-tomentose. Of which, only Tikadi exhibited smooth surface on lower leaf side. Also, Tikadi recorded high branch thorniness. On the basis of fruit maturity, varieties were grouped into early, mid and late. High variability was recorded for the character fruit shape (oblong, oval, ovate, oblate, round and falcate). Eleven varieties showed yellow, 12 varieties depicted greenish-yellow and one variety Tikadi, showed chocolate brown fruit colour at maturity. The varieties were also classified into five groups, on the basis of stone shape, viz. oblong, oval, spindle, club and falcate. The varieties depicted wide variability for various morphological traits, perhaps owing to such differences in the species from which these cultivars have evolved.

Key words: *Ber*, DUS, Example variety, Genotypes, *Ziziphus mauritiana*

The Indian jujube or *ber* (*Ziziphus mauritiana* Lamk.) is one of the ancient and indigenous fruits of India, which belongs to the family Rhamnaceae. The tree is an example of extremely drought hardy species, which can be grown in dry land areas and in degraded, eroded, gravelly, saline and sodic wastelands. The jujube tree has commercial importance owing to the usefulness of almost all its parts. Berries are richer than apple in protein, phosphorus, calcium, carotene and Vitamin C (Azam-Ali *et al*. 2006, Krishna *et al*. 2014) and oranges in phosphorus, iron, vitamin C and carbohydrates. It is also a good source of antioxidants (Krishna and Parashar 2013). Most of the present day commercial cultivars were developed through selection. Also, seedlings growing in nature were selected by the farmers based on economic characters and further propagated vegetatively to maintain their genetic identity. Major focus in *ber* breeding has been on clonal selection for early maturing clones. The most of the common cultivars are the result of selection in different regions. A wide range of variability exists in *ber* in India for all important characters suggesting substantial scope for improvement. However, morphological descriptions of many cultivars are vague. Varietal identification has attained critical importance in view of the intellectual property rights (IPR) regime enforced in the country as per Trade related aspects of intellectual property rights (TRIPS) agreement under WTO to protect plant breeders and farmers rights. The UPOV Convention provides DUS testing of crop varieties and is in operation in large number of countries (Dixit *et al*. 2010). The testing for distinctness, uniformity and stability (DUS) is the basis for grant of protection of new plant varieties under the protection of Plant Varieties and Farmer's Right Act, 2001 (PPV&FR Act) in India. The act has provision to compare the candidate variety with the varieties of common knowledge on a set of relevant characteristics prescribed in the Draft National Test Guidelines for DUS testing of *ber* (Anonymous 2013). Therefore, the present study was undertaken with the objective to characterize 24 *ber* varieties on the basis of morphological characters and to establish distinctness of the candidate variety from all other varieties available in India.

MATERIALS AND METHODS

A total of 24 *ber* varieties, viz. Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Dharki No.1, Gola, Gularvasi, Illaichi, Jogia, Kaithali, Kala Gola, Kathaphal, Lakhan, Mehrun, Mundia, Narma, Reshmi,

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Table 1 Characterization of *ber* varieties based on DUS descriptor

Genotype	Growth habit	Shoot surface	Leaf: Apex	Leaf: Base	Leaf: Shape	Leaf: Curving	Leaf: Pubescence	Branch:Thorniness	Thorn: Shape	Thorns persistence: Cauducous	Fruit maturity group	Bearing habit: Bunching	Immature fruit: Anthocyanin blush	Fruit shape: apex	Fruit shape	Mature fruit colour	Fruit surface	Pulp cavity	Pulp cavity: Stylar end	Pulp cavity: Stem end	Pulp texture	Pulp: stone ratio	Stone shape: Apex	Stone shape
Banarasi Karaka	3	5	2	3	2	9	3	5	2	1	5	1	1	3	2	3	2	9	1	9	3	9	4	2
Banarasi Pewandi	3	5	2	4	2	9	5	5	2	9	5	1	1	7	3	3	2	9	9	9	5	7	2	1
Chhuhara	3	5	2	2	2	9	5	5	2	1	5	1	1	3	2	3	1	9	9	9	5	7	2	4
Chhuhara Bawal	3	5	1	2	3	9	3	3	2	9	5	1	1	7	2	3	2	9	1	9	5	3	2	5
Dharki No.1	1	5	1	1	1	1	5	5	2	1	7	1	1	3	2	5	2	1	1	1	7	1	1	2
Gola	3	5	2	4	2	9	5	5	2	1	3	1	1	3	5	3	1	9	1	9	3	3	2	1
Gularvasi	3	5	2	3	2	9	3	5	2	9	7	1	1	3	2	5	2	9	9	9	3	7	2	4
Illaichi	3	5	2	4	2	9	3	3	2	9	5	9	1	3	4	3	2	9	1	9	5	3	1	2
Jogia	3	5	1	2	3	1	3	5	1	1	7	1	1	3	2	3	2	9	1	9	5	5	2	1
Kaithali	3	5	2	4	3	9	5	3	2	1	5	1	1	3	2	5	2	9	9	9	3	5	2	1
Kala Gola	3	5	2	2	3	1	5	5	1	1	7	1	1	3	2	5	2	9	1	9	3	9	1	2
Kathaphal	3	5	2	2	3	9	5	5	2	1	7	1	9	3	5	5	1	9	1	9	5	3	1	2
Lakhan	3	5	2	2	2	1	3	5	2	1	7	1	1	3	2	5	2	9	9	9	5	3	2	4
Mehrun	5	5	1	2	3	9	5	5	2	1	7	1	1	3	1	5	2	9	9	9	5	1	1	1
Mundia	3	5	2	3	2	9	5	5	2	9	5	1	1	3	2	5	2	9	1	9	3	9	2	4
Narma	3	5	2	4	2	9	3	5	2	1	5	1	1	7	6	3	2	9	1	9	5	5	2	1
Reshmi	3	5	2	2	2	9	3	3	1	9	5	1	1	3	1	3	2	9	1	9	3	3	2	1
Safeda Rohtak	5	5	1	4	1	1	5	5	1	1	7	1	1	3	1	5	1	9	1	9	5	3	2	2
Safeda Selection	3	5	2	2	2	9	5	5	2	1	5	1	1	3	5	5	2	1	1	1	3	3	2	2
Sanaur-5	5	5	1	2	3	1	3	5	2	1	7	1	9	7	3	3	2	1	1	9	5	3	2	3
Seb	3	5	2	2	3	1	5	5	2	9	5	1	1	3	5	5	1	9	1	9	7	7	1	2
Tikadi	1	3	2	2	3	1	1	7	2	1	7	1	1	7	3	7	1	1	1	1	7	1	1	2
Umran	3	5	2	2	2	9	3	3	2	1	7	1	1	3	1	3	2	9	1	9	5	3	2	1
ZG-3	3	5	2	2	2	1	3	5	2	1	7	1	1	7	3	5	2	9	9	9	5	3	2	3

Safeda Rohtak, Safeda Selection, Sanaur-5, Seb, Tikadi, Umran and ZG-3 were evaluated at ICAR-Central Institute for Arid Horticulture, Bikaner, Rajasthan in a Randomized Block Design with three replications over two years (2011-12 and 2012-13). The spacing adopted was 6 × 6 m. The cultivars were evaluated for 24 characters at specified stage of crop growth when characteristics had full expression. To establish distinctiveness among cultivars, the descriptor of essential characters (Table 1 and 2) were used in sequential manner as per the National Test Guideline for the conduct of test for distinctiveness, uniformity and stability on *ber* (Anonymous 2013). Accordingly, observations were made on five plants or parts taken from each of five plants. In the case of parts of plants, the number taken from each of the plants was two. Observation on growth habit, shoot surface, thorn and leaf characters were recorded three months after pruning, when canopy attained its characteristic shape specific to a variety. Fully mature leaves, not showing the sign of active growth, in the middle of tertiary branches were selected for the observations on the leaf. Similarly, observations on thorn were recorded in the middle of tertiary branches. Further, observation on immature fruit were recorded when fruit has not attained its full size and is predominantly green and quite hard in texture, i.e. 60-75 days after fruit set. On the other hand, observations on the mature fruit and stone were recorded when fruit was ready for harvesting. All colour characteristics were assessed using the Royal Horticultural Society (RHS) colour chart.

RESULTS AND DISCUSSION

Considerable variations were recorded among 24 *ber* varieties for various morphological characters. However, for bearing habit and shoot surface, one variety exhibited variation for each characteristics, respectively. The chief characteristics of different *ber* varieties under study are presented in Table 1. The frequency distribution of each character along with the example varieties are given in Table 3. In the present study, the erect growth habit was noted in two varieties, viz. Dharki No. 1 and Tikadi, while semi-erect growth habit was noticed in 19 varieties. Three varieties showed spreading growth habit. For commercial cultivation of *ber*, semi-spreading growth habit is preferred. Since, commercial *ber* cultivars are the result of selection; therefore, most of the common cultivars exhibited semi-spreading growth habit. Branching habit, which determines the growth habit of *ber* is one of the most appropriate vegetative characters for classification (Bal 1992, Azam-Ali *et al*. 2006). Substantial variation was observed for shape of leaf blade. Three types of leaf shapes were recorded in *ber*. Dharki No.1 and Safeda Rohtak had ovate leaf shape, while Chhuhara Bawal, Jogia, Kaithali, Kala Gola, Katha Phal, Mehrun, Sanaur-5, Seb, Tikadi had cordate shape. Rest of the varieties showed oval shape. There were two groups of varieties based on leaf apex such as acute and obtuse. In the former group, 06, while in latter 18 varieties fell. In the present study, four types of leaf bases were registered, viz. Acute, Cordate, Round and Oblique. Acute leaf base was recorded only in Dharki No.1. *Ber* varieties could also be categorized on the basis of pubescence on lower surface. These were smooth, sparsely- tomentose and densely- tomentose. Of which, only Tikadi exhibited smooth surface on lower side of leaf. Likewise amongst 24 example varieties, only Tikadi recorded high branch thorniness. There were only two types of thorn shape, viz. all curved and alternate curved.

On the basis of fruit maturity group, varieties were categorized into early, mid and late. cv. Gola was early, while Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Illaichi, Kaithali, Mundia, Narma, Reshmi, Safeda Selection, Seb were mid season and Dharki No.1, Gularivasi, Jogia, Kala Gola, Katha Phal, Lakhan, Mehrun, Safeda Rohtak, Sanaur-5, Tikadi, Umran, ZG-3 were late maturing varieties. Two cultivars belong to the group, which have anthocyanin blush on immature fruits e.g. Katha Phal and Sanaur-5, while other 22 varieties had no blush on developing fruits. In respect of shape of fruit apex, 06 varieties Banarasi Pewandi, Chhuhara Bawal, Narma, Sanaur-5, Tikadi, ZG-3 depicted pointed apex, while other 18 varieties showed round apex. The cultivars are normally distinguished by their fruit characters such as shape, form of stylar and basal ends, pulp texture, colour of peel, etc. and therefore, some such prominent characters have often been used in their nomenclatures also, e.g. Gola, Illaichi, Tikadi, Narma, Banarasi Karaka *etc*. (Vashishtha 2001). In relation of fruit shape, huge variability was noticed. Safeda Rohtak, Reshmi, Mehrun, Umran depicted oblong fruit shape, Banarasi Karaka, Chhuhara, Chhuhara Bawal, Dharki No.1, Gularvasi,

Table 2 Status of characteristics according to national descriptors of *ber*

1. Oblong 2. Oval 3. Spindle 4. Club 5. Falcate
1. Obtuse 2. Acute
1. Very Low 3. Low 5. Medium 7. High 9. Very High
3. Soft 5. Medium 7. Hard
1. Absent 9. Present
1. Absent 9. Present
1. Absent 9. Present
1. Plain 2. Ridged & Wart
3. Yellow 5. Greenish Yellow 7. Chocolate Brown
1. Oblong 2. Oval 3. Ovate 4. Oblate 5. Round 6. Falcate
3. Round 7. Pointed
1. Absent 9. Present
1. Absent 9. Present
3. Early 5. Mid 7. Late
1. No 9. Yes
1. All Curved 2. Alternate Curved
3. Less 5. Medium 7. High
1. Smooth 3. Sparsely tomentose 5. Densely tomentose
1. Absent 9. Present
1. Ovate 2. Oval 3. Cordate
1. Acute 2. Cordate 3. Round 4.Oblique
1. Acute 2. Obtuse
3. Smooth 5. Tomentose
1. Erect 3. Semi-erect 5. Spreading

Table 3 Frequency distribution and example varieties of some important attributes of 24 *ber* genotypes

Plant descriptor	Range in expression	No. of genotype	Genotype
Growth habit	Erect	2	Dharki No.1, Tikadi
	Semi-erect	19	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Gola, Gularvasi, Illaichi, Jogia, Kaithali, Kala Gola, Katha Phal, Lakhan, Mundia, Narma, Reshmi, Safeda Selection, Seb, Umran, ZG-3
	Spreading	3	Mehrun, Safeda Rohtak, Sanaur-5
Shoot surface	Smooth	1	Tikadi
	Tomentose	23	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Dharki No. 1, Gola, Gularvasi, Illaichi, Jogia, Kaithali, Kala Gola, Kathaphal, Lakhan, Mehrun, Mundia, Narma, Reshmi, Safeda Rohtak, Safeda Selection, Sanaur-5, Seb, Umran, ZG-3
Leaf: Apex	Acute	6	Chhuhara Bawal, Dharki No.1, Jogia, Mehrun, Safeda Rohtak, Sanaur-5
	Obtuse	18	Gola, Gularvasi, Illaichi, Banarasi Karaka, Banarasi Pewandi, Chhuhara, Kaithali, Kala Gola, Kathaphal, Lakhan, Mundia, Narma, Reshmi, Safeda Selection, Seb, Tikadi, Umran, ZG-3
Leaf: Base	Acute	1	Dharki No.1
	Cordate	14	Chhuhara, Chhuhara Bawal, Jogia, Kala Gola, Katha Phal, Lakhan, Mehrun, Reshmi, Safeda Selection, Sanaur-5, Seb, Tikadi, Umran, ZG-3
	Round	3	Banarasi Karaka, Gularvasi, Mundia
	Oblique	6	Banarasi Pewandi, Gola, Illaichi, Kaithali, Narma, Safeda Rohtak
Leaf: Shape	Ovate	2	Dharki No.1, Safeda Rohtak
	Oval	13	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Gola, Gularvasi, Illaichi, Lakhan, Mundia, Narma, Reshmi, Safeda Selection, Umran, ZG-3
	Cordate	9	Chhuhara Bawal, Jogia, Kaithali, Kala Gola, Katha Phal, Mehrun, Sanaur-5, Seb, Tikadi
Leaf: Curving	Absent	9	Dharki No.1, Jogia, Kala Gola, Lakhan, Safeda Rohtak, Sanaur-5, Seb, Tikadi, ZG-3
	Present	15	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Gularvasi, Illaichi, Gola, Kaithali, Katha Pahal, Mehrun, Mundia, Narma, Reshmi, Safeda Selection, Umran
Leaf: Pubescence on lower surface	Smooth	1	Tikadi
	Sparsely- tomentose	11	Banarasi Karaka, Chhuhara Bawal, Gularvasi, Illaichi, Jogia, Lakhan, Sanaur-5, Narma, Reshmi, Umran, ZG-3
	Densely- tomentose	12	Safeda Rohtak, Safeda Selection, Banarasi Pewandi, Chhuhara, Dharki No.1, Gola, Kaithali, Kala Gola, Katha Phal, Mehrun, Mundia, Seb
Branch: Thorniness	Less	5	Chhuhara Bawal, Illaichi, Kaithali, Reshmi, Umran
	Medium	18	Banarasi Karaka, Banarasi Pewandi, Dharki No.1, Gola, Gularvasi, Jogia, Kala Gola, Katha Phal, Lakhan, Mehrun, Mundia, Narma, Safeda Rohtak, Safeda Selection, Sanaur-5, Seb, ZG-3
	High	1	Tikadi
Thorn: Shape	All Curved	4	Jogia, Kala Gola, Reshmi, Safeda Rohtak
	Alternative Curved	20	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Dharki No.1, Gola, Gularvasi, Illaichi, Kaithali, Katha Phal, Lakhan, Mehrun, Mundia, Narma, Safeda Selection, Sanaur-5, Seb, Tikadi, Umran, ZG-3
Thorns persistence: Cauducous	No	17	Banarasi Karaka, Chhuhara, Dharki No.1, Gola, Jogia, Kaithali, Kala Gola, Katha Phal, Lakhan, Mehrun, Narma, Safeda Rohtak, Safeda Selection, Sanaur-5, Tikadi, Umran, ZG-3
	Yes	7	Banarasi Pewandi, Chhuhara Bawal, Gularvasi, Illaichi, Mundia, Reshmi, Seb
Fruit maturity group	Early	1	Gola
	Mid	11	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Illaichi, Kaithali, Mundia, Narma, Reshmi, Safeda Selection, Seb
	Late	12	Dharki No.1,Gularivasi, Jogia, Kala Gola, Katha Phal, Lakhan, Mehrun, Safeda Rohtak, Sanaur-5, Tikadi, Umran, ZG-3

Contd.

Table 3 (*Continued*)

Plant descriptor	Range in expression	No. of genotype	Genotype
Immature fruit: Anthocyanin blush	Absent	22	Dharki No.1, Chhuhara, Chhuhara Bawal, Jogia, Kala Gola, Lakhan, Mehrun, Reshmi, Safeda Selection, Seb, Tikadi, BanarasiKaraka, Gularvasi, Mundia, Banarasi Pewandi, Gola, Illaichi, Kaithali, Narma, Safeda Rohtak, Umran, ZG-3
	Present	2	Katha Phal, Sanaur-5
Bearing habit: Bunching	Absent	1	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Dharki No. 1, Gola,Gularvasi, Tikadi, Jogia, Kaithali, Kala Gola, Kathaphal, Lakhan, Mehrun, Mundia, Narma, Reshmi, Safeda Rohtak, Safeda Selection, Sanaur-5, Seb, Tikadi, Umran, ZG-3
	Present	23	Illaichi
Fruit Shape: apex	Round	18	Dharki No.1, Chhuhara, Jogia, Kala Gola, Lakhan, Mehrun, Reshmi, Safeda Selection, Seb, Banarasi Karaka, Gularvasi, Mundia, Gola, Illaichi, Kaithali, Safeda Rohtak, Katha Phal,Umran
	Pointed	6	Banarasi Pewandi, Chhuhara Bawal, Narma, Sanaur-5, Tikadi, ZG-3
Fruit shape	Oblong	4	Safeda Rohtak, Reshmi, Mehrun,Umran
	Oval	10	Banarasi Karaka, Chhuhara, Chhuhara Bawal, Dharki No.1, Gularvasi, Jogia, Kaithali, Kala Gola, Lakhan, Mundia
	Ovate	4	Banarasi Pewandi, Sanaur-5, Tikadi, ZG-3
	Oblate	1	Illaichi
	Round	4	Gola, Katha Phal, Safeda Selection, Seb
	Falcate	1	Narma
Mature fruit colour	Yellow	11	Banarasi Karaka, Banarasi Pewandi, Chhuhara, Chhuhara Bawal, Gola, Illaichi, Jogia, Narma, Reshmi, Sanaur -5,Umran
	Greenish Yellow	12	Dharki No.1, Gularvasi, Kaithali, Kala Gola, Katha Phal, Lakhan,Mehrun, Mundia, Safeda Rohtak, Safeda Selection, Seb, ZG-3
	Chocolate Brown	1	Tikadi
Fruit Surface	Plain	6	Chhuhara, Gola, Katha Phal, Safeda Rohtak, Seb, Tikadi
	Ridged and Wart	18	Banarasi Karaka, Banarasi Pewandi, Chhuhara Bawal, Dharki No.1, Gularvasi, Illaichi, Jogia, Kaithali, Kala Gola, Lakhan, Mehrun, Mundia, Narma, Reshmi, Safeda Selection, Sanaur-5, Umran, ZG-3
Pulp Cavity	Absent	4	Dharki No.1 , Safeda Selection, Sanaur-5, Tikadi
	Present	20	Chhuhara, Chhuhara Bawal, Jogia, Kala Gola, Lakhan, Mehrun, Reshmi, Seb, Banarasi Karaka, Gularvasi, Mundia, Banarasi Pewandi, Gola, Illaichi, Kaithali, Narma, Safeda Rohtak, Katha Phal, Umran, ZG-3
Pulp cavity: Stylar end	Absent	5	Dharki No.1, Safeda Selection, Sanaur-5, Tikadi, Umran
	Present	19	Chhuhara Bawal, Jogia, Kala Gola, Reshmi, Seb, Banarasi Karaka, Mundia, Gola, Illaichi, Narma, Safeda Rohtak, Katha Phal, Banarasi Pewandi, Chhuhara, Gularvasi, Kaithali, Lakhan, Mehrun, ZG-3
Pulp Cavity: Stem end	Absent	3	Dharki No.1, Safeda Selection, Tikadi
	Present	21	Sanaur-5, Chhuhara Bawal, Jogia, Kala Gola, Reshmi, Seb, Banarasi Karaka, Mundia, Gola, Illaichi, Narma, Safeda Rohtak, Katha Phal, Banarasi Pewandi, Chhuhara, Gularvasi, Kaithali, Lakhan, Mehrun, ZG-3, Umran
Pulp texture	Soft	10	Banarasi Pawandi, Chhuhara, Chhuhara Bawal, Gola, Gularvasi, Kaithali, Kala Gola, Mundia, Reshmi, Safeda Selection
	Medium	11	Banarasi Karaka, Illaichi, Jogia, Katha Phal, Lakhan, Mehrun, Narma, Safeda Rohatak, Sanur-5, ZG-3, Seb
	Hard	3	Dharki No.1, Umran, Tikadi
Pulp: stone ration	Very Low (<5)	3	Tikadi, Dharki No. 1, Mehrun
	Low (5-10)	11	Chhuhara Bawal, Sanur-5, Katha Phal, Safeda Selection, Lakhan, Umran, Safeda Rohatak, Illaichi, Reshmi, ZG-3, Gola
	Medium (11-15)	3	Jogia, Narma, Kaithali
	High (16-20)	4	Seb, Banarasi Pawandi, Chhuhara, Gularvasi
	Very High (>20)	3	Kala Gola, Mundia, Banarasi Karaka

Contd.

Table 3 (*Concluded*)

Plant descriptor	Range in expression	No. of genotype	Genotype
Stone shape: Apex	Obtuse	7	Dharki No.1, Illaichi, Kala Gola, Katha Phal, Mehrun, Seb, Tikadi
	Acute	17	Safeda Selection, Sanaur-5, Chhuhara Bawal, Jogia, Reshmi, Mundia, Gola, Narma, Safeda Rohtak, Banarasi Pewandi, Chhuhara, Gularvasi, Kaithali, Lakhan, Banarasi Karaka, ZG-3, Umran
Stone shape	Oblong	7	Banarasi Pewandi, Gola, Jogia, Kaithali, Mehrun, Narma, Reshmi
	Oval	9	Dharki No.1, Illaichi, Katha Phal, Seb, Tikadi, Safeda Selection, Gola, Safeda Rohtak, Banarasi Karaka
	Spindle	2	Sanaur-5, ZG-3
	Club	5	Chhuhara, Gularvasi, Lakhan, Mundia, Umran
	Falcate	1	Chhuhara Bawal

Jogia, Kaithali, Kala Gola, Lakhan, Mundia showed oval, while Banarasi Pewandi, Sanaur-5, Tikadi, ZG-3 had ovate fruit shape. Likewise, Illaichi exhibited oblate, Gola, Katha Phal, Safeda Selection, Seb showed round and Narma depicted falcate fruit shape, respectively. In the present study, 11 varieties showed yellow, 12 varieties depicted greenish-yellow and only one variety Tikadi, noticed chocolate brown fruit colour at their horticultural maturity. Plain fruit surface was recorded in Chhuhara, Gola, Katha Phal, Safeda Rohtak, Seb and Tikadi, while 18 varieties had Ridges & Warts on the fruit surface. In four varieties, viz. Dharki No.1, Safeda Selection, Sanaur-5 and Tikadi, pulp cavity was found to be absent. On the other hand, Chhuhara, Chhuhara Bawal, Jogia, Kala Gola, Lakhan, Mehrun, Reshmi, Seb, Banarasi Karaka, Gularvasi, Mundia, Banarasi Pewandi, Gola, Illaichi, Kaithali, Narma, Safeda Rohtak, Katha Phal, Umran and ZG-3 depicted fruit cavity either on stylar end or both on stylar and stem end of fruits. Amongst fruit characters, apex type, stylar and stem end cavities and fruit shape are the most dependable characters for classification (Bal 1992, Azam-Ali *et al*. 2006). Pulp: stone ratio is an important character as it indicates towards the edible portion in the fruit (Saran *et al*. 2006). Highest pulp: stone ratio was noted in Kala Gola, Mundia and Banarasi Karaka, while the least was recorded in Tikadi followed by Dharki No.1 amongst the studied varieties. The varieties were also classified on the basis of stone shape into five groups like oblong, oval, spindle, club and falcate. Each group had 7, 9, 1, 4 and 1 variety(s) as examples, respectively. The varieties depict wide variability with respect to growth habit, shape of thorn, leaf, fruit and stone, leaf and fruit surface, maturity period etc., perhaps owing to such differences in the species from which these cultivars have evolved (Vashishtha 2001). An important commercial cultivar, which has hard and tough texture, Umran, is popular owing to its long storage life. On the contrary, soft pulped Gola has short storage life. Pulp texture is an important character if breeding is aimed for long storage life (Krishna *et al*. 2014).

The descriptor will make access to diversity of a crop by the users of plant genetic resources, who in turn will benefit from their economic and social values (Bioversity International 2007). The testing of DUS characters is useful in four main ways, viz. (i) for genetic resources and identification of varieties, (ii) for registration of varieties and plant variety protection (PVP) Act, (iii) for varietal information system and classification of varieties into different groups, and (iv) for creating data base for plant (Singh *et al*. 2005).

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