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SHORT COMMUNICATION

Evaluation of *Morinda tomentosa* accession under zero irrigation conditions of semi-arid ecosystem

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Morinda sp. belongs to family Rubiaceae and the plant is believed to have originated in India and South East Asia and to be precise in Andaman and Nicobar Islands (Singh, 2009). It is also known by different vernacular names in different parts of world like *nuna*, *ach*, Indian mulberry, *awl*, great *Morinda*, cheese fruit, mouse's pineapple, jumbie breadfruit, hog apple, pain killer, *mengkudu, aledi* and *bilimbi*. It is grown wildly in many places throughout India *viz*. Madhya Pradesh, Gujarat, Rajasthan, Andhra Pradesh etc. It is hardy green small tree bearing flowers and fruits throughout the year under different agro-climatic conditions, but more prominently during rainy season (April to August). Plants of different species of *Morinda* spp. are found to be growing in fragile edephoclimatic conditions and adapted to acidic, alkaline and saline conditions (Cambie and Ash, 1994). *M. tomentosa* is known to various usages by native folklore. Its decoction is used to cure chronic skin infections like boils. Ash of its leaves is also made into paste in oil base and applied on boils. Its fruits after discarding seeds are used as poultice. Its bark and wood are used to make yellow pigment and wood is used as timber for making stakes, pillars and handles of farm implements. Its fragrant flowers are offered to Lord Ganesha. The seeds are triangular reddish to brown in colour have prominent air sac attached to one end which makes the seeds buoyant. The noni is one of the most important botanical, medicinal remedies & food supplements traded on national as well as international market. Looking into the need of it elite cultivar, which are having desirable characters for above said reasons. An attempt was made to study variability in *Morinda* genotypes from Madhya Pradesh for the development of the suitable cultivar.

An extensive survey was made during the year 2010-11 to diversity rich areas of Madhya Pradesh (Berzer, Kathiwada, Dhar, Mandav, Ujjan, Mandsaur, Ratlam, Amarkantak, Jobat, Bhabhara, Jhabua etc.) to identify, earmark and collect the genotypes in the form of shoots, leaves, flowers and fruit for further evaluation. Efforts were made to select regular, prolific bearer genotype with good fruit quality. The method of random sampling from a population and biased sampling after gathering information about particular genotype was selected. A total of sixteen fruits were randomly collected from all the direction of each genotype to record the qualitative and quantitative morphological characters. The extent of variation in physico-chemical traits of fruits from different location was recorded. A total of 20 genotypes were collected which had fairly wide spectrum of variability with respect to growth, flowering, fruiting behaviour and quality attributes. The samples of leaf, bud, flower and fruit were brought to the laboratory for morphological study and fruit quality attributes. The observations on qualitative characteristics like tree habit, and leaf morphology were recorded visually. Observation on the leaf morphology was in terms of leaf shape, leaf apex, leaf margin and leaf colour was taken as illustrated by Wilde et al., 1972 and Simpson, 2006.

The mature fruits of various genotypes differing in shape, size and appearance were collected from disease free plant to study the variability in physico-chemical attributes. Fresh samples in form of leaf, flower, fruit and seeds of selected genotypes of *Morinda* were collected for further study. Total soluble solids and pH of fruits were measured with the help of hand refrectometer and pH meter, respectively and for estimation of acidity and vitamin C, the methods as advocated by A.O.A.C. (1990). The data were statistically analyzed for measurable characters as per method given by Gomez and Gomez (1984).

Leaf

There was significant variability among all the genotypes studied for morphological characters of leaf. There were mainly 2 types of leaf shape observed i.e., elliptical and oval elliptical. Majority (60 %) of the genotypes were elliptical and remaining (40%) were oval elliptical in shape. The color of the leaves observed green in all the genotypes excluding CHESNM-1, CHESNM-7, CHESNM-9, CHESNM-13, CHESNM-15 and CHESNM-17.The leaf apex observed acute in CHESNM-1, CHESNM-5, CHESNM-8, CHESNM-10, CHESNM-11, CHESNM-13, CHESNM-14, CHESNM-16, CHESNM-17, CHESNM-19, CHESNM-20. Acuminate type of leaf apex was observed in CHESNM-2, CHESNM-3, CHESNM-6, CHESNM-9, CHESNM-12, whereas the

genotypes; CHESNM-4, CHESNM-7, CHESNM-18 had acute to acuminate type of leaf apex. The leaf length ranged between 20.40 -25.22 cm. The larger leaves measured in CHESNM-18 (25.22 cm) followed by CHESNM-7 (25.00cm) and smaller leaves in CHESNM-17(20.40 cm) followed by CHESNM-9(20.42 cm) among all the genotypes studied in M.P. The leaf width ranged between 8.00 -16.19 cm. The leaves were observed broader in CHESNM-2 (16.19 cm) and CHESNM-18(16.00 cm) and narrowly broader in CHESNM-12 (8.00cm) and CHESNM-15 (8.70 cm). Value petiole length ranged between 1.20 - 2.10 cm being maximum in CHESNM- 7 (2.10 cm) and CHESNM-16 (2.08 cm) and the same was the minimum in CHESNM-12 (1.20 cm) and CHESNM-6 (1.22 cm).The vain pairs per leaf was varied significantly among all the genotypes which was measured between 7.43- 12.33cm. It was counted maximum in CHESNM-16 (12.33) followed by CHESNM-5(10.95) and CHESNM-2 (10.12), whereas same was calculated minimum in CHESNM-6 (7.43) followed by CHESNM-12(7.70) among all the genotypes (Table 1).

Table 1. Leaf morphomatrix of different *M. tomentosa* genotypes.

Genotypes	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Vain pairs/ leaf	Leaf adexial surface	Leaf abexial surface	Leaf apex	Leaf shape	Leaf colour
CHESNM-1	22.41	13.22	2.05	09.95	Smooth	rough with hairs	Acute	elliptical	dark green
CHESNM-2	24.53	16.19	2.10	10.12	smooth shining	rough with hairs	Acuminate	oval elliptical	green
CHESNM-3	22.17	13.00	1.73	08.75	smooth	rough with hairs	Acuminate	elliptical	Green
CHESNM-4	21.71	12.50	1.50	09.41	smooth shining	rough with hairs	acute to acuminate	elliptical	green
CHESNM-5	23.20	13.27	2.07	10.95	Smooth shining	rough with hairs	acute	elliptical	green
CHESNM-6	21.48	12.74	1.22	07.43	smooth	rough with hairs	Acuminate	elliptical	Green
CHESNM-7	25.00	10.18	2.10	10.00	smooth	rough with hairs	acute to acuminate	elliptical	dark green
CHESNM-8	19.20	09.95	1.38	08.15	smooth	rough with hairs	acute	oval elliptical	green
CHESNM-9	20.42	13.30	1.90	08.70	smooth shining	rough with hairs	acuminate	elliptical	dark green
CHESNM-10	24.40	14.50	1.75	10.00	Smooth shining	rough withless hairs	acute	elliptical	green
CHESNM-11	22.17	14.00	1.80	09.15	smooth	rough with less hairs	acute	elliptical	green
CHESNM-12	15.54	08.00	1.20	07.70	smooth	rough with less hairs	acuminate	elliptical	green
CHESNM-13	22.10	14.20	1.73	09.00	smooth	rough	acute	elliptical	dark green
CHESNM-14	22.38	12.74	1.90	08.12	smooth	rough with hairs	acute	oval elliptical	green
CHESNM-15	16.17	08.70	1.45	09.64	smooth	rough with hairs	acute to acuminate	elliptical	dark green
CHESNM-16	22.43	11.75	2.08	12.33	Smooth shining	rough with hairs	acute	elliptical oval	green
CHESNM-17	20.40	13.05	1.97	08.40	smooth	rough less hairs	acute	elliptical	dark green
CHESNM-18	25.22	16.00	1.62	08.50	smooth	rough with less hairs	e to acuminate	elliptical	green
CHESNM-19	21.19	14.03	1.45	8.79	Smooth shining	rough with hairs	acute	elliptical	green
CHESNM-20	17.19	09.67	2.00	8.32	smooth	rough with hairs	acute	oval elliptical	green
C. D. at 5%	1.91	1.35	0.16	0.95	--	--	--	--	--

Floral traits

Perusal of data from the Table 2 revealed that the colour of flower observed mainly white and greenish white amongst the genotypes studied. The larger number of flowers per head was recorded in CHESNM-4 (29.04) followed by CHESNM-16 (23.13) and CHESNM-11(22.83) whereas it was observed minimum in CHESNM-6 (12.25) followed by CHESNM- 8 (13.21) and CHESNM-20 (13.45).The maximum panicle length (12.00 cm) and diameter (1.20 mm) observed in CHESNM-2 and CHESNM-3, respectively. The bud length ranged between 11.00-13.50 cm and it was observed maximum in both the genotypes CHESNM-1 and CHESNM-11 (13.50 cm) followed by CHESNM-16 (13.24 cm) and CHESNM-9 (13.05 cm). The sepal length ranged between 3.30 -6.53 cm. It was measured maximum in CHESNM-5 (6.53 cm) followed by CHESNM-15 and CHESNM-7 and similar trait was minimum in CHESNM-3 (3.30 mm) followed by CHESNM-19 (3.50 mm).The petal length observed the maximum in CHESNM-19 (9.47 mm) followed by CHESNM-6 (9.34 mm) and same was the minimum in CHESNM-7 (7.12 mm) followed by CHESNM-4 (7.50 mm) and CHESNM-2 (7.54 mm). The number of stamen ranged between 5-6.50 and it was highest in number in CHESNM-1 and CHESNM-7 (6.50) and lowest in CHESNM-5, CHESNM-9, CHESNM-14 and CHESNM-18.The stamen length ranged between 5.12 -7.00 cm, it was maximum in CHESNM-4 (7.00 mm) followed by CHESNM-13 (6.85 mm) and CHESNM-7 (6.80 mm) whereas similar trait was the minimum in CHESNM-3(5.12 mm) followed by CHESNM-17(5.13 mm) and CHESNM-1 (5.15 mm).Style length varied from 14.00-17.15 mm, the maximum style length measured in CHESNM-9(17.15 mm) followed by CHES -12 (17.12 mm) and CHESNM-14 (17.10mm) whereas same was the minimum in CHESNM-5 (14.00 mm) followed by CHESNM-10 (14.12 mm) and CHESNM-15 (14.15 mm). The observation was supported with the finding of cooke (1908).

Fruit quality attributes

Results of study on the physico-chemical characters of different genotypes of *Morinda* spp. revealed that the wide genetic diversity collected from different parts of Madhya Pradesh. Perusal of the data on the genetic diversity of *Morinda* spp. revealed that the different genotypes varied widely in their fruit quality attributes. The physico-chemical attributes of fruits varied significantly among the different genotypes of *Morinda* spp. (Table-3). The fruit weight was recorded the maximum in CHESNM-

Table.2.Variability for flower characters of different *M. tomentosa* genotypes

Genotypes	No of flowers /head	Panicle length (mm)	Panicle diameter (mm)	Bud length (mm)	Sepal length (mm)	Petal length (mm)	Stamen number	Stamen length (mm)	Style length (mm)	Flower colour
CHESNM-1	22.00	21.23	2.00	13.50	4.05	8.50	6.50	5.15	16.00	White
CHESNM-2	14.24	12.00	2.50	12.12	4.50	07.54	6.00	6.24	15.50	White
CHESNM-3	16.47	18.20	1.25	12.23	3.30	09.20	6.00	5.12	14.43	White
CHESNM-4	29.04	17.15	2.57	11.12	4.00	07.50	6.00	7.00	15.80	Greenish white
CHESNM-5	20.25	24.05	2.30	12.00	6.53	08.65	5.00	5.50	14.00	White
CHESNM-6	12.25	25.54	1.50	12.65	5.50	09.34	6.00	6.50	15.00	Greenish white
CHESNM-7	15.17	27.20	2.75	11.46	6.20	07.12	6.50	6.80	18.13	white
CHESNM-8	13.21	30.12	3.00	12.45	5.20	08.00	6.00	6.67	15.17	Greenish white
CHESNM-9	19.84	21.23	2.05	11.00	5.27	08.08	5.00	5.87	17.15	White
CHESNM-10	21.25	24.55	2.40	12.23	5.25	07.53	6.45	5.42	14.12	white
CHESNM-11	22.83	25.00	2.95	13.50	5.22	10.00	6.00	5.50	15.00	Greenish white
CHESNM-12	14.15	25.15	2.65	12.05	5.24	09.27	6.00	6.54	17.12	white
CHESNM-13	15.12	14.82	2.55	13.00	4.83	06.75	6.00	6.85	15.17	white
CHESNM-14	15.15	12.15	1.95	11.15	4.15	08.50	5.00	6.67	17.10	Greenish white
CHESNM-15	16.85	16.65	1.62	12.57	6.42	09.30	6.00	5.87	14.15	White
CHESNM-16	23.13	18.13	1.94	13.24	5.23	07.98	6.00	5.42	16.00	Greenish white
CHESNM-17	18.05	15.12	1.57	10.65	5.47	08.15	6.00	5.13	14.64	white
CHESNM-18	22.21	16.69	2.00	11.95	4.28	09.24	5.00	6.24	15.57	Greenish white
CHESNM-19	20.14	18.07	2.55	13.05	3.50	09.47	6.00	5.18	14.15	white
CHESNM-20	13.45	12.21	2.23	12.22	5.00	08.50	6.00	7.05	15.12	white
C. D. at 5%	1.98	2.32	0.24	1.25	0.48	0.83	0.51	0.67	1.49	--

12 (34.24g) followed by CHESNM-20 (30.50g), CHESNM-14 (30.24g) while the same was recorded the minimum in CHESNM-2 followed by (15.38g), CHESNM-6 (16.76g) and CHESNM-16 (17.38g). The maximum length and breadth of the fruit was recorded 4.00 cm and 4.05 cm in CHESNM-12 while it was recorded the minimum in CHESNM-1 (length- 2.30cm and breadth-2.20cm) among the evaluated genotypes. These findings are in consonance with results as reported by Singh *et al.* (2010) and Gupta *et al.* (2011). The number of pyrines and seed weight varied from 14.00 - 23.14 and from 23.00 to 44 per fruit. Per seed weight was recorded the maximum in CHESNM-12(0.11g) and the lowest in CHESNM-2 (0.07g), while TSS was recorded the maximum in CHESNM-12 (10.50) followed by CHESNM-6 (10.15) and it was minimum in CHESNM-1 (7.00). The P^H of fruit juice was recorded the maximum in CHESNM-14 (6.25) followed CHESNM- 12 (5.50). The acidity of fruit juice and vitamin C varied between 0.49 to 0.72% and 30.00-40.00 mg/100g, respectively among the genotypes collected from Madhya Pradesh. These findings are in agreement with the results as reported by Singh *et al.,* (2010) and Singh *et al.*, (2011).

However, based on the overall performance the genotypes with respect to physico-chemical attributes CHESNM-12 and CHESNM-14 were found to be promising with respect to quality attributes. Though only the genotypes of Madhya Pradesh are reported here, but the general morphology of various genotypes are in accordance with that of reported by earlier workers (Singh *et al.* 2009, Singh *et al.* 2010 and Singh *et. al.*, 2008).

Table.3. Variability f or fruit characters of different *M. tomentosa* genotypes.

Genotypes	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Pyrines / fruit	Number of seed / fruit	Seed weight (g)	TSS (%)	p^H of fruit juice	Acidity (%)	Vitamin C mg/100 g
CHESNM-1	16.72	2.30	2.20	14.00	23.00	0.08	07.00	4.25	0.70	32.12
CHESNM-2	15.38	2.42	2.25	16.12	28.28	0.07	10.00	4.70	0.65	38.00
CHESNM-3	20.76	3.40	3.35	17.17	30.23	0.10	08.00	5.00	0.54	39.15
CHESNM-4	18.12	3.38	3.30	17.19	35.17	0.08	08.00	4.60	0.53	38.45
CHESNM-5	19.43	3.60	3.62	16.34	36.48	0.09	08.00	4.25	0.57	38.00
CHESNM-6	16.76	2.45	2.45	18.27	36.27	0.08	10.15	4.50	0.52	32.15
CHESNM-7	19.97	3.58	3.47	19.10	34.00	0.09	09.00	5.00	0.63	31.65
CHESNM-8	25.73	3.90	3.80	19.00	27.00	0.10	10.20	4.25	0.52	34.00
CHESNM-9	20.65	3.47	3.56	16.00	30.00	0.08	09.21	4.62	0.62	37.13
CHESNM-10	23.92	3.52	3.81	17.75	26.13	0.08	08.50	4.25	0.67	34.20
CHESNM-11	23.77	3.68	3.60	18.80	38.00	0.07	10.00	4.70	0.55	36.00
CHESNM-12	34.24	4.00	4.05	23.14	44.00	0.11	10.50	5.50	0.49	45.00
CHESNM-13	18.76	3.32	3.45	23.00	26.00	0.08	10.0	4.60	0.60	39.00
CHESNM-14	30.24	3.98	3.84	13.00	42.25	0.09	08.50	6.25	0.55	33.00
CHESNM-15	27.68	3.68	3.67	19.25	39.00	0.08	09.00	4.50	0.72	32.00
CHESNM-16	17.38	2.65	2.70	18.11	26.15	0.09	10.00	4.00	0.66	35.00
CHESNM-17	19.08	3.12	3.00	15.17	32.00	0.10	10.00	4.25	0.50	34.12
CHESNM-18	22.77	3.50	3.40	16.13	34.58	0.08	09.50	4.62	0.61	30.00
CHESNM-19	26.70	3.98	3.80	19.00	41.18	0.08	08.00	4.25	0.65	31.00
CHESNM-20	30.50	3.95	3.90	21.00	40.00	0.07	09.50	5.00	0.52	32.15
C. D at 5%	3.21	0.31	0.29	3.10	5.42	NS	2.11	0.30	0.08	1.42

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