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Thar Mahima: an improved cultivar of muskmelon identified for arid region

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ABSTRACT

The 'Thar Mahima' cultivar of muskmelon along with nine genotypes including checks was evaluated at ICAR-CIAH, Bikaner for 3 consecutive summer years (2016, 2017 and 2018) replicated thrice. The experiments were conducted following the recommended package of practices for muskmelon cultivation. From the results, it is evident that 'Thar Mahima' cultivar showed promising performance with respect to first fruit picking (75-80 DAS), high TSS (11.58-11.80%), fruits weighing 780-900 g with 2.8-3.2 cm thick flesh having salmon orange colour, 0.30-0.48 cm thick rind and small seed cavity (2.8-3.2 cm). It produced 4-5 fruits per plant which were round and attractive with netted surface having sutures.

Introduction

Muskmelon (*Cucumis melo* L.) is one of the most important cucurbits throughout the world which is consumed as 'Dessert fruit'. It is an annual and summer season annual crop with climbing, creeping or trailing vines. The fruits of muskmelon are many-seeded called 'pepo'. India being the centre of diversity, many landraces of muskmelon are grown in Rajasthan, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Maharashtra and Andhra Pradesh. A wide range of variation for genetic improvement of muskmelon is present in India (Pandey *et al.*, 2005 and Choudhary *et al.*, 2012). The persistence of large variability in muskmelon ensures better chances to select new genotypes for specific traits. Thus, evaluation of the variability is prerequisite in any crop improvement programme. Cultivars of muskmelon having orange colored flesh, netted rind, high TSS and more shelf life are preferred by the Indian consumers. In this article, we report the identification of 'Thar Mahima', a cultivar with better performance in arid region as compared to other prevalent varieties. While developing this improved cultivar, the selection indices described by Lal and Singh (1997), Choudhary *et al.* (2015) and Haldhar *et al.* (2015) were followed in the selection of superior plants.

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Origin

'Thar Mahima' originated from an open pollinated landrace (AHMM/BR-47) collected in 2013 from Garda, District - Baran of Rajasthan. The collected germplasm was evaluated, maintained and characterized over the years starting from 2014 at ICAR-Central Institute for Arid Horticulture, Bikaner, Rajasthan, India situated at 28°N latitude, 73°18' E longitude at an altitude of 234.84 m above sea level. The soil of experimental field was loamy sand with a pH of 8.7, EC 0.20 dS/m and organic carbon 0.07%. The breeding objective of the investigation comprised to develop early and quality yielding variety of muskmelon adapted to hot arid conditions. The collected material was raised and homogenized through repeated inbreeding for 6 cycles exercising single plant selection based on earliness, fruit weight, salmon orange flesh colour, high TSS, small size seed cavity, more flesh thickness, rind with netting and high marketable fruit yield. While developing

The purified material was evaluated for three consecutive years (2016, 2017 and 2018) during summer season and based on the data the Thar Mahima cultivar has been identified by the IVIC in 2022. It is recommended for cultivation in arid and semi-arid region of the country under open field and tunnel cultivation. The seed has also been deposited to National Bureau of Plant Genetic Resources (NBPGR), New Delhi under the accession no. IC-0624305.

Description

The plants of 'Thar Mahima' have short vine (1.6-2.0 m) with profuse branching and characterized by deep lobing of leaves. Plants are andromonoecious in sex expression. Fruits are round with netting on rind surface (Fig. 1). The rind colour is attractive at marketable stage. The fruit flesh color is salmon orange at edible maturity. The fruit weight ranges between 780 to 900 g and become ready for first harvest in 75-80 days after seed sowing. Total soluble solid (TSS) content is 11.58-11.80% which is higher compared to other commercial cultivars. The salient characteristics of 'Thar Mahima' are presented in Table 1.

Table 1. Salient characteristics of 'Thar Mahima' cultivar

S. No.	Character		Description
1.	Sex form	:	Andromonoecious
2.	Fruit shape	:	Round with fruit diameter of 10.3-11.0 cm
3.	Days to first fruit picking from sowing	:	75-80 days
4.	Flesh thickness	:	2.8-3.2 cm
5.	Width of seed cavity	:	4.27-5.58 cm
6.	Total soluble solids (TSS)	:	11.58-11.80%
7.	Fruit weight	:	780-900 g
8.	Number of marketable fruits/ plant	:	4-5
9.	Flesh colour	:	Salmon orange
10.	Rind traits	:	0.30-0.48 cm thick, netted with sutures and attractive
11.	Leaf traits	:	Characterized by deep lobing of leaves

Performance

The 'Thar Mahima' cultivar along with nine genotypes including checks was evaluated at ICAR-CIAH, Bikaner for 3 consecutive summer years (2016, 2017 and 2018) replicated thrice. The experiments were conducted following the recommended package of practices for muskmelon cultivation. From the results, it is evident that 'Thar Mahima' cultivar showed promising performance with respect to first fruit picking (75-80 DAS), high TSS (11.58-11.80%), fruits weighing 780-900 g with 2.8-3.2 cm thick flesh having salmon orange colour, 0.30-0.48 cm thick rind and small seed cavity (2.8-3.2 cm). It produced 4-5 fruits per plant which were round and attractive with netted surface having sutures. The year wise ancillary characteristics are presented in Table 2, Table 3 and Table 4.

'Thar Mahima' cultivar produced an average marketable fruit yield of 193.7 q/ ha in on-station trials conducted during three consecutive summer years from 2018 to 2020. Recorded the increase in marketable fruit yield of 'Thar Mahima' over rest of the genotypes and checks. The increase in marketable fruit yield was registered 21.90% and 16.27% higher over checks *viz*., RM-50 and Pusa Madhuras, respectively (Table 5).

Also evaluated the 12 genotypes of muskmelon including 'Thar Mahima' cultivar against Fusarium wilt under field conditions during two consecutive years' *viz*., summer season of 2016 and 2017. The results confirmed that the 'Thar Mahima' cultivar showed moderately resistant reactions against Fusarium wilt with PDI of 16.67 and 14.29 during 2016 and 2017, respectively (Table 6 and Table 7).

Table 2. Performance of 'Thar Mahima' cultivar at ICAR-CIAH, Bikaner during summer season of 2016

Genotypes	First fruit picking (DAS)	Fruit weight (kg)	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (cm)	Width of seed cavity (cm)	TSS (%)	No. of marketable fruit/ plant	Flesh colour
AHMM/BR-41	78.7	0.72	10.78	2.18	0.26	6.32	10.30	3.20	Salmon orange
AHMM/BR-42	80.0	0.88	10.80	2.04	0.24	7.06	9.22	3.40	Salmon orange
Thar Mahima	75.0	0.78	10.54	2.90	0.30	5.58	11.58	4.00	Salmon orange
AHMM/BR-49	81.3	0.70	10.16	2.20	0.22	6.54	10.48	3.20	Salmon orange
AHMM/BR-51	86.7	0.75	10.68	2.14	0.24	6.46	11.16	3.40	Greenish white
AHMM/BR-52	76.3	0.55	7.16	2.02	0.14	6.58	11.32	3.00	Greenish white
AHMM/BR-53	76.7	0.69	8.66	2.00	0.24	6.84	11.06	3.40	Whitish green
RM-50 (C)	87.0	0.75	10.06	2.20	0.22	5.63	11.10	3.20	Greenish white
Pusa Madhuras (C)	84.3	0.80	11.70	2.30	0.28	7.20	11.20	3.40	Salmon orange
CD at 5%	1.23	0.12	0.54	0.60	0.03	0.71	1.05	0.52	
CV (%)	10.32	7.51	8.73	7.32	8.04	10.22	6.80	9.71	

Table 3. Performance of 'Thar Mahima' cultivar at ICAR-CIAH, Bikaner during summer season of 2017

Genotypes	First fruit picking (DAS)	Fruit weight (kg)	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (cm)	TSS (%)	Flesh colour
AHMM/BR-41	82.3	0.70	10.20	4.2	0.28	9.52	Salmon orange
AHMM/BR-42	90.7	0.85	13.52	3.4	0.26	11.16	Salmon orange
Thar Mahima	77.0	0.83	10.32	3.2	0.34	11.80	Salmon orange
AHMM/BR-49	88.3	0.76	10.26	1.9	0.23	10.36	Salmon orange
AHMM/BR-51	92.0	0.80	11.02	2.8	0.26	11.64	Greenish white
AHMM/BR-52	83.7	0.78	10.80	2.4	0.18	9.82	Greenish white
AHMM/BR-53	80.0	0.60	8.64	2.8	0.26	10.74	Whitish green
RM-50 (C)	90.7	0.80	10.10	2.1	0.22	11.07	Light green
Pusa Madhuras (C)	86.3	0.82	11.90	2.5	0.32	11.30	Salmon orange
CD at 5%	2.65	0.10	0.60	0.46	0.04	0.82	
CV (%)	9.30	7.16	9.08	8.91	7.00	7.60	

Table 4. Performance of 'Thar Mahima' cultivar at ICAR-CIAH, Bikaner during summer season of 2018

Genotypes	Fruit weight (kg)	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (cm)	TSS (%)	No. of marketable fruits/ plant	Flesh colour	Rind traits
AHMM-BR-41	0.61	10.26	2.03	0.30	11.07	3.27	Salmon orange	10 sutures
AHMM/BR-42	0.97	12.30	2.16	0.39	10.90	2.33	Salmon orange	Netted with sutures
Thar Mahima	0.90	11.00	2.78	0.48	11.76	4.40	Salmon orange	Netted with sutures
AHMM/BR-49	0.90	10.91	2.46	0.35	11.00	2.83	Salmon orange	10 sutures
AHMM/BR-51	0.71	10.63	2.18	0.29	10.19	3.20	Greenish white	10 sutures
AHMM/BR-52	1.01	10.65	2.60	0.37	10.71	2.40	Greenish white	10 sutures

AHMM/BR-53	0.93	11.03	2.53	0.33	11.11	3.00	Whitish green	-
RM-50 (C)	0.78	9.10	2.02	0.25	11.00	3.20	Greenish white	Netted with sutures
Pusa Madhuras (C)	0.80	11.00	2.41	0.30	11.40	3.40	Salmon orange	10 sutures
CD at 5%	0.14	1.00	0.42	0.05	1.19	0.54		
CV (%)	9.65	9.93	10.31	9.62	6.47	9.70		

Table 5. Fruit yield of 'Thar Mahima' cultivar and Check (C) at ICAR-CIAH, Bikaner during summer season (2018-2020)

Entries	Marketable fruit yield (q/ ha)			
	2018	2019	2020	Average
Thar Mahima	180.6	205.8	194.7	193.7
RM-50 (C)	148.2	172.0	156.5	158.9
Pusa Madhuras (C)	170.3	161.4	168.0	166.6
	Average % increase over RM-50 (C)			21.90
	Average % increase over Pusa Madhuras (C)			16.27

Table 6. Screening of muskmelon genotypes against *Fusarium* wilt under field conditions during summer season of 2016

S. No.	Genotypes	PDI*	Disease Reaction
1.	AHMM/BR-1	19.33 (26.04)	Moderately Resistant
2.	AHMM/BR-38	22.67 (28.09)	Moderately Susceptible
3.	AHMM/BR-44	14.67 (22.47)	Moderately Resistant
4.	AHMM/BR-46	19.36 (25.91)	Moderately Resistant
5.	Thar Mahima	16.67 (23.97)	Moderately Resistant
6.	AHMM/BR-48	28.06 (31.95)	Moderately Susceptible
7.	AHMM/BR-49	20.09 (26.52)	Moderately Susceptible
8.	AHMM/BR-53	16.14 (23.59)	Moderately Resistant
9.	AHMM/BR-54	30.64 (33.57)	Susceptible
10.	MHY-3	18.65 (25.56)	Moderately Resistant
11.	RM-43	25.31 (30.12)	Moderately Susceptible
12.	RM-50	29.33 (32.76)	Moderately Susceptible
	CD at 5%	4.58	
	CV (%)	9.76	

* Values in parenthesis are angular transformed value

Table 7. Screening of muskmelon genotypes against *Fusarium* wilt under field conditions during summer season of 2017

S. No.	Genotypes	PDI*	Disease Reaction
1.	AHMM/BR-1	18.35 (25.26)	Moderately Resistant
2.	AHMM/BR-38	24.74 (29.70)	Moderately Susceptible
3.	AHMM/BR-44	15.62 (23.16)	Moderately Resistant
4.	AHMM/BR-46	17.78 (24.44)	Moderately Resistant
5.	Thar Mahima	14.29 (22.14)	Moderately Resistant
6.	AHMM/BR-48	26.67 (30.95)	Moderately Susceptible
7.	AHMM/BR-49	21.48 (27.46)	Moderately Susceptible
8.	AHMM/BR-53	19.23 (25.84)	Moderately Resistant
9.	AHMM/BR-54	35.82 (36.72)	Susceptible

10.	MHY-3	16.12 (23.47)	Moderately Resistant
11.	RM-43	28.34 (32.11)	Moderately Susceptible
12.	RM-50	29.98 (33.11)	Moderately Susceptible
	CD at 5%	6.88	
	CV (%)	14.48	

* Values in parenthesis are angular transformed value

DNA fingerprinting

The DNA fingerprinting of Thar Mahima along with 6 known varieties (RM-50, Durgapura Madhu, Hara Madhu, Kashi Madhu, Pusa Madhuras and MHY-3) as comparative control was done using 15 CAAT-box Derived Polymorphism (CBDP) markers. Four CBDP markers namely CBDP2, CBDP4, CBDP7 and CBDP12 were able to produce Thar Mahima specific bands and could be able to differentiate the Thar Mahima cultivar to related comparative control. The Thar Mahima varietal-specific allele distribution along with size is given in Table 9.

Table 9. Thar Mahima specific DNA fingerprints, their distribution and size

S. No.	CBDP marker	Approximate size of Thar Mahima varietal-specific alleles (bp)	No. of specific alleles
1.	CBDP2	760	1
2.	CBDP4	1100	1
3.	CBDP7	550 and 800	2
4.	CBDP12	450	1

Conclusion

'Thar Mahima' cultivar showed promising results under hot arid conditions of western Rajasthan. It possess quality attributes as per consumer preference *viz*., TSS (11.58-11.80%), flesh colour (salmon orange), small seed cavity (2.8-3.2 cm). thick rind (0.30-0.48 cm) and attractive fruits (round and netted surface with sutures). Therefore, based on performance and other overall attributes it is recommended for commercial cultivation.

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