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Assessment of Heterosis in Intraspecific Hybrids derived from Muskmelon (*Cucumis melo* L.) and Mangalore melon (*Cucumis melo* var. *acidulous*) for Yield and Quality Traits including Shelf Life

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ABSTRACT: Muskmelon is one of the most important and widely grown crop of Cucurbitaceae family, despite having tremendous nutritive and medicinal value it needs to improved genetically in order to overcome the problems like poor shelf life, thinner fruit flesh, and larger seed cavity, late flowering and fruit maturity. An investigation was undertaken to evaluate the extent of heterosis in intraspecific hybrids between selected genotypes of muskmelon and Mangalore melon during *kharif* 2019 and *rabi* 2020. A total of 15 intraspecific hybrids were developed by crossing 4 varieties of muskmelon and 7 accessions of Mangalore melon. Hybrids were developed using hand emasculation and hand pollination technique and the developed hybrids were evaluated using RCBD design with two replications. The results showed that, out of the 15 intraspecific hybrids, 11 intraspecific hybrids showed significant positive heterosis over mid parent and only four intraspecific hybrids were found to be superior to the better parent for fruit yield per vine. The intraspecific hybrids Haramadhu X MS 78 exhibited highest and significant heterosis over both mid parent (53.20%) and better parent (42.02%) followed by Haramadhu X MS 28 (33.71% and 20.33%) and Haramadhu X MS 30 (26.03% and 15.66%). Apart from this the hybrid ArkaSiri X MS 79 was found to be superior for fruit length, fruit diameter, average fruit weight, number of seeds per fruit, flesh thickness, shelf life. The hybrid ArkaSiri X MS 17 found to be superior over the parental lines for the characters flesh thickness, vine length, average fruit weight, shelf life and TSS content. These hybrids can be further evaluated in segregating generation for identification of desirable muskmelon types with enhanced shelf life.

Keywords: Intraspecific hybrids, Muskmelon, Mangalore melon, heterosis, shelf life.

INTRODUCTION

Muskmelon (*Cucumis melo* L.) is one of the most important desert fruits belonging to the family Cucurbitaceae with chromosome number 2n=2x=24. Fruits are juicy, delicious and tasty. They are popular in tropics and subtropics and are grown all over the world for its nutritive as well as its medicinal properties. The fruit juice is nutritive, diuretic, demulcent and aphrodisiac. Juice is also a remedy for skin diseases, tan freckles and in case of dyspepsia. The seed oil is useful in painful discharge and suppression of urine. Every 100g of edible portion of melon gives 16 to 17 calories of energy, 0.3mg calcium, 1.4 g of iron and 14 mg phosphorus (Chakrabarthi, 2001). Muskmelon is an important cultivated cucurbitaceous crop bearing mostly andromonoecious flowers, originated in Tropical Africa especially in the south of the Sahara Desert but its diversification and domestication are reported to have occurred in Asian region. The secondary centers of origin are India, China, Russia and Persia (Chadha and Lal 1993). Despite having tremendous nutritive and medicinal value muskmelon needs to improved genetically, in order to overcome the problems like poor shelf life, thinner fruit flesh, and larger seed cavity, late flowering and fruit maturity and also the higher susceptibility to the disease and pests like Downy mildew, Powdery mildew, cucumber mosaic virus and fruit flies which adversely impact the farmers profitability.

On the contrary, Mangalore melon [*Cucumis melo* Var. *acidulous* (2n = 2x = 24)], popularly known as culinary melons had longer shelf life up to 150 days due to delayed onset of ethylene production in both peel and pulp (Gunnaiah *et al.*, 2021). Mangalore melons are predominantly grown the coastal and Malnad regions of South Indian states; Karnataka, Kerala, Tamil Nadu, Andhra Pradesh and Telangana. Intraspecific hybridization is one of the most important tools for improvement of crop plants and also a potential approach to broaden the genetic base of crop plants by incorporating various genes and alleles from the less exploited or unexploited species, sub-species wild forms and wild relatives of the cultivated species. Since both Muskmelon and Mangalore melon belongs to the same family Cucurbitaceae as well as same species and both of these are having same somatic chromosome number 2n=24. They are cross-compatible and shelf-life genes from Mangalore melon can easily transfer to through intraspecific hybridization. The assessment of different types of heterosis for productivity traits including shelf life is essential for identification of superior intraspecific hybrid for further evaluation with background the current study is aimed at assess the extent of heterosis for productivity traits in the intraspecific hybrids derived from muskmelon and Mangalore melon particularly for the trait shelf life. In the future the present study can help in identified top performing hybrids need to be evaluated in segregating generations to know the genetic pattern of traits including shelf life and Identification of shelf-life trait introgression line in backcross population in muskmelon background.

MATERIALS AND METHODS

A. Development of intraspecific hybrids

The intraspecific hybrids were developed using four muskmelon genotypes (ArkaSiri, ArkaJeet, Madhuras and Haramadhu) as female and seven selected Mangalore melon accessions as male parent during late kharif 2019 at Department of Biotechnology and Crop improvement farm, College of Horticulture, Sirsi. Unopened muskmelon flower buds which were ready to open in next day were selected on previous day for emasculation. After careful emasculation, the flower bud was covered with a butter paper bag. Next morning between 6.30 to 8.30 am crossing was performed using selected accessions of Mangalore melon as male parents. After pollination again the flower bud was covered with a bag and labeled to avoid out crossing. Pollination was performed two days continuously for the same flower to attend a good seed set. The successful hybrid fruits were harvested at full maturity stage and seed was extracted stored and used for evaluation in next season.

B. Evaluation of hybrids and Estimation of Heterosis

The resultant hybrids along with parents were evaluated during summer season of 2020 in Randomized Complete Block Design with two replications and maintained the spacing of 2m between rows and 60cm between vine. Black polythene mulch was used for moisture conservation and weed prevention. Drip irrigation method was adopted for healthy crop harvest. The data were recorded on five randomly selected vines from each replication for the characters vine length (cm), days to first female flower appearance, node at first female flower appearance, fruit weight (g), fruit length (cm), fruit width (cm), fruit yield per vine (kg), flesh thickness (cm), number of marketable fruits per vine, TSS (%) and Shelf life (days) of fruits.

The replicated mean data of parents and hybrids for each of the characters was used in estimation of mean performance and heterosis. Heterosis was calculated as the percentage increase or decrease of mean F1 performance (F1) over the means of better parent (BP) and the mid parent (MP) following formulae given by Jinks and Jones (1958).

RESULTS AND DISCUSSION

The mean performance of parents for growth, yield and quality traits under study is presented in Table 1. Among the parents MS 30 took minimum days to produce first female flower (28.10 days) followed by MS-28 (30.60 days) while ArkaSiri took maximum time (34.20 days). The maximum fruit weight was recorded in MS 30 (905.50 g) followed by MS 28 (861.00 g) whereas, it was minimum in MS-5 (236.60 g) followed by ArkaJeeth (328.80 g). *MS 30* resulted in maximum fruit length (25.10 cm) and it was minimum in ArkaJeeth (8.28 cm).

Table 1: Mean performance of parents used in Intraspecific hybridization.

Parents	VL	DFFF	NFFF	SR	FL	FW	AFW	NFPV	FY	FT	TSS	SL
Haramadhu	151.60	34.00	4.60	6.19	13.90	11.00	589.60	4.36	2.63	3.83	8.35	12.00
ArkaJeeth	152.40	34.10	3.00	5.06	8.28	8.11	328.80	3.50	1.35	1.75	8.65	10.00
ArkaSiri	156.30	34.20	3.70	5.05	12.28	11.43	816.16	3.58	2.76	4.30	9.93	15.00
Madhuras	160.20	33.90	3.00	5.54	8.76	10.20	700.60	3.48	2.82	3.03	8.80	14.00
MS 17	169.10	32.30	3.50	4.70	18.98	10.83	838.30	3.66	3.58	3.41	4.36	221.00
MS 28	157.30	30.60	3.80	4.76	19.53	9.45	861.00	3.35	2.10	3.50	4.35	198.00
MS 30	180.80	28.10	3.90	5.89	25.10	8.93	905.50	2.55	2.20	2.38	4.10	210.00
MS 74	164.20	31.60	3.90	4.37	15.28	7.01	442.60	2.85	1.11	2.26	3.73	201.00
MS 78	166.00	31.80	3.70	5.02	17.33	8.63	769.30	3.55	2.25	3.21	3.66	197.00
MS 79	177.00	32.80	2.40	4.82	18.55	10.38	771.00	3.11	2.62	3.45	4.46	198.00
MS 5	166.30	32.30	5.00	4.44	15.83	7.05	236.60	4.10	1.14	2.08	6.50	99.00
SEm+	2.05	0.78	0.67	0.41	0.42	0.39	28.53	0.24	0.13	0.06	0.13	0.45
CD 5%	6.47	2.47	2.10	1.30	1.32	1.24	89.90	0.77	0.40	0.20	0.41	1.43
CD 1%	9.20	3.51	2.99	1.84	1.88	1.77	127.87	1.09	0.56	0.28	0.58	2.03

where, VL – Vine length (cm), DFFF – Days for first female flower, NFFF – Node at first female flower, SR – Sex ratio (%), FL – Fruit length (cm),

FW – Fruit width (cm), AFW – Average fruit weight (g), NFPY - Number of fruits per vine, FYPV - Fruit yield per vine (kg/vine), FT – Flesh thickness (cm),

TSS – Total soluble sugars (^{o} brix), SL – Shelf life (days).

Fruit width ranged from 7.01 - 11.00 cm being minimum in MS-74 and maximum in Haramadhu. The fruits of ArkaSiri had highest flesh thickness (4.30 cm) and ArkaJeeth had lowest (1.75cm). The maximum TSS was recorded in ArkaSiri (9.93^{o}brix) and minimum in MS-78 (3.66^{o}brix). The number of fruits per vine varied from 2.55 to 4.36. The Mangalore melon accession MS 30 was having the lowest number of fruits per vine and Haramadhu reported the highest number of fruits per vine (4.37). The fruit yield per vine was ranged between 1.11 kg (MS 74) to 3.58 kg (SS-17). The shelf life of the fruits in the muskmelon it ranged between 10 days to15 days and in the Mangalore melon it varies from 99 to 221 days.

Significant difference was observed among the intraspecific F1 hybrids for different growth yield and quality traits (Table 2). Among the hybrid, ArkaJeeth X MS 17 had maximum vine length (196.50cm) followed by ArkaJeeth X MS 28 (192.60 cm). ArkaSiri X MS 79 was found to be minimum in vine length (128.70cm) followed by Madhuras X MS 17(146.90 cm). There was no significant difference observed for nodes and days to first female flower appears among hybrids. The maximum average fruit weight was recorded in ArkaSiri X MS 79 (993.10 g) followed by Haramadhu X MS 78 (917.50 g) whereas, it was minimum in Madhuras X MS 17(381.10 g) followed by Madhuras X MS 28 (518.60 g). ArkaSiri X MS 79 resulted in maximum fruit length (18.46 cm) while it was minimum in Madhuras X MS 17(12.66 cm). The cross ArkaJeeth X SS-17 had maximum fruit width (12.91 cm) followed by ArkaJeeth X MS 78 (12.16 cm) and Haramadhu X MS-30 had minimum (7.70 cm). Flesh thickness varied from 2.45 cm in ArkaSiri × MS-5 and Haramadhu X MS-28 (3.56 cm). The maximum TSS was observed in ArkaSiri X SS-17 (9.82^{o}brix) and minimum in Haramadhu X MS-28 (4.80^{o}brix). Muskmelon genotypes are andromonoecious and Mangalore melons were monoecious in sex expression whereas all evaluated intraspecific hybrids showed monoecious sex expression indicating it is male parent has dominance in expression of trait.

Table 2: Mean performance intraspecific hybrids for 12 quantitative traits.

Cross combinations	VL	DFFF	NFFF	SR	FL	FW	AFW	NFPV	FY	FT	TSS	SL
ArkaJeeth X SS17	196.50	33.20	3.80	4.72	14.66	12.91	801.8	3.4	2.30	2.9	5.51	89.00
ArkaJeeth X MS 28	192.60	32.90	3.70	5.06	14.36	9.45	558.00	3.68	1.96	2.75	6.28	67.00
ArkaJeeth X MS 78	187.80	32.90	4.00	4.94	15.91	12.16	867.60	3.48	2.18	2.96	6.13	58.00
ArkaSiri X MS 78	181.70	34.00	4.50	6.41	15.78	8.98	842.00	3.4	2.73	3.13	7.45	68.00
ArkaSiri X MS 17	172.10	32.00	3.50	5.79	15.85	9.26	566.00	3.23	2.49	2.98	9.82	83.00
ArkaSiri X MS 30	152.30	32.30	3.90	6.46	16.75	10.10	942.30	3.38	2.65	2.88	4.83	61.00
ArkaSiri X MS 79	128.70	32.85	3.70	5.69	18.46	10.50	993.10	3.2	3.04	3.58	6.53	85.00
ArkaSiri X MS 5	146.70	31.90	5.30	7.14	14.21	8.55	749.60	3.3	2.74	2.45	8.58	73.00
Madhuras X MS 28	184.60	34.00	3.90	5.44	14.16	11.08	518.60	3.48	2.05	3.25	8.38	81.00
Madhuras X MS 74	176.80	33.90	3.90	4.92	13.91	10.08	630.50	3.48	2.38	3.25	7.70	78.00
Madhuras X MS 79	154.20	31.60	4.70	6.91	15.63	10.96	820.37	3.5	2.29	3.08	7.50	46.00
Madhuras X MS 17	146.90	31.80	4.90	5.47	12.66	9.43	381.10	2.83	1.49	2.98	7.51	59.00
Haramdhu X MS 28	190.20	33.80	4.30	5.47	17.2	9.88	843.80	4.05	3.17	3.56	4.80	75.00
Haramdhu X MS 30	160.60	32.40	5.50	4.66	15.58	7.70	706.60	3.85	3.00	3.03	5.06	82.00
Haramdhu X MS78	186.40	33.70	3.10	4.96	17.58	10.95	917.50	3.76	3.75	3.03	5.83	90.00
SEm$\pm$	6.52	0.66	0.47	0.44	0.54	0.55	65.18	0.13	0.10	0.10	0.19	0.26
CD 5%	19.79	2.01	1.42	1.33	1.65	1.66	197.71	0.38	0.31	0.31	0.57	0.78
CD 1%	27.46	2.79	1.98	1.84	2.29	2.30	274.41	0.53	0.43	0.43	0.80	1.09

Where, VL – Vine length (cm), DFFF – Days for first female flower, NFFF – Node at first female flower, SR – Sex ratio (%), FL – Fruit length (cm),
FW – Fruit width (cm), AFW – Average fruit weight (g), NFPY - Number of fruits per vine, FYPV - Fruit yield per vine (kg/vine), FT – Flesh thickness (cm),
TSS – Total soluble sugars (^{o} brix), SL – Shelf life (days).

The morphology of the hybrids as well as fruits characteristics was intermediate between their parental varietal forms. Earlier several researchers observed great variability in melons and characterized the landraces of muskmelon as well as hybrids (More and Seshadri, 2002; Choudhary *et al.,* 2019), snap melon (Dhillon *et al.*,2007) and melons (More and Seshadri 2002; Malik *et al.,* 2014). The main objective of study is to transfer shelflife trait of Mangalore melon to Muskmelon through hybridization. The hybrids were intermediate for shelf life compared to parents and ranged from 46 to 90 days (Fig. 1). The highest shelf life was noticed in Haramadhu X MS 78 (90 days) followed by ArkaJeeth × MS 17 (89 days) and ArkaSiri X MS 17 (83 days) whereas lowest was observed for Madhuras X MS 79 (46 days) It indicates the possibility of enhancing shelf life of muskmelon through intraspecific hybridization followed by backcross breeding (Gunnaiah *et al.,* 2021).

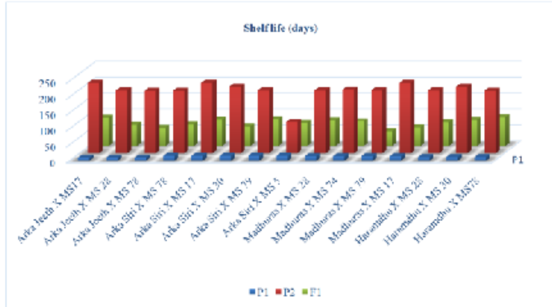

Fig. 1. Mean performance parents and intraspecific hybrids for shelf-life trait.

Heterosis study in Intraspecific hybrids: The main goals of the present paper were to assess hybrids performances for a number of important productivity traits. The results of mid parent and better parent heterosis for various productivity traits were presented in Table 3. The growth traits namely vine length, days for first female flower appearance, node at first female flower appearance and sex ratio has greater advantage for increasing the yield of hybrid. Among the hybrids the highest positive and significant heterosis for vine length was reported in the hybrid ArkaJeeth X MS 28 over the mid parent (22.44%) and the better parent (24.38 %). The hybrid ArkaSiri X MS 30 have exhibited highest negative heterosis over mid parent (-4.55 %) and better parent (-6.27%) for days to first female flower appearance. The hybrid Haramadhu X MS 28 exhibited highest significant heterosis over mid parent (-4.44 %) as well as better parent (-9.47%) in the desirable direction for node at first female flower appearance while other hybrids showed positive heterosis. This hybrid can be exploited as early hybrid (Singh *et al*., 2015; Mule *et al*., 2012 in cucumber). Sex ratio is another important parameter which indicates the required male to female flower for successful fruit set. The lower ratio of male to female flowers during peak flowering stage enhance the number of female flower that results in more fruits per vine (Thangamani *et al*. 2011). The hybrid ArkaSiri X MS 5 showing negative mid parent (-33.52 %) and better parent heterosis (-37.76 %) can be promoted for further evaluation. Yield is the most important quantitative trait, its components greatly influence in determining the productivity of the crop, obtaining higher yield is one of prime objectives of all breeding experiments. The fruit characteristics such as length and width of the fruit, fruit number and weight of the fruit are the most important productivity trait which determine the yield of the crop. The values for mid parent heterosis were found to be positive for all the hybrids for the character fruit length whereas the better parent heterosis exhibited in both directions. The hybrid ArkaJeeth X MS 78 reported highest significant heterosis over mid parent (24.27%). However, Haramadhu X MS 78 revealed positive and significant heterosis over better parent (1.44%). Similar results were noticed for fruit length in cucumber hybrids by Kiran and Singh (2014) and in Squash by El-Hadi *et al*. (2015). The highest significant heterosis for fruit width was reported in the hybrid ArkaJeeth X MS 78 for both better parent heterosis (40.94%) and mid parent heterosis (45.28%). The intraspecific hybrid ArkaJeeth X MS 78 reported maximum and positive significant heterosis over mid parent (58.02%), while the maximum positive heterosis over better parent was reported in the ArkaSiri X MS 79 (21.69 %) for the trait average fruit weight. Singh and Vashisht (2018) in Muskmelon and El-Hadi *et al*., (2015) in Squash also observed indistinguishable results for fruit width and average fruit weight. The intraspecific hybrids exhibited heterosis in both the direction for the number of fruits per vine, the hybrid ArkaJeeth X MS 78 had shown maximum positive heterosis over mid parent (5.14%), whereas ArkaJeeth X MS 28 (5.23%) was found to be superior over better parent. These results are in line with the findings of Hanchinamani and Patil (2009); Choudhary *et al*., (2003); Pandey *et al*., (2005) in Cucumber. The hybrids recorded heterosis in both the direction for fruit yield per vine. The maximum positive heterosis for fruit yield over both mid parent and better parent for fruit yield per vine reported in Haramadhu X MS 78 and the magnitude of heterosis 53.20% and 42.02% respectively followed by Haramadhu X MS 28 (33.71% and 20.33%) and Haramadhu X MS 30 (26.03% and 15.66%). The flesh thickness determines the pulp content in the fruit. In the study most of the hybrids exhibited negative heterosis over both mid parent and better parent for flesh thickness, but the hybrid Madhuras X MS 74 have shown positive and significant heterosis over the mid parent (22.64%) and better parent (7.15%). The hybrids recorded both positive and negative heterosis for the character TSS, maximum positive and significant heterosis over the mid parent was reported in the hybrid Madhuras X MS 28 (27.50%). On the contrary no single hybrid exhibited positive heterosis over the better parent. These results are the same as those obtained by Singh and Vashisht (2018); Duradundi *et al*., (2018) in Muskmelon. None of the hybrid exhibited positive heterosis over the mid parent and better parents. Among the hybrids Haramadhu X MS 78 was having a better parent heterosis of (-54.31 %) and mid parent heterosis of (-13.88 %). The batter parent Mangalore melon having more than 180 days of shelf life and muskmelon had maximum of 15days. Due to diverse nature of trait, they are failed to express better heterosis over parents. However, the derived hybrids showed intermediate expression for shelf life and significant improvement over inferior parent muskmelon. These hybrids can be further evaluated in segregating generation for identification of desirable muskmelon types with enhanced shelf life.

Table 3: Heterosis over better parent and mid parent values for quantitative traits.

Cross combinations	VL (cm)		DFFF (days)		NFFF (days)		SR(%)		FL (cm)		FW (cm)		AFW (g)	
	% Heterosis over		% Heterosis over		% Heterosis over		% Heterosis over		% Heterosis over		% Heterosis over		% Heterosis over	
	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP
HaraMadhu X MS 28	23.15	20.92	-4.44	-9.47	-4.44	-9.47	0.03	-13.07	2.89	-11.94	-3.34	-10.15	-4.69	-7.24
HaraMadhu X MS 30	-3.37	-11.17	-4.17	-13.27	-4.17	-13.27	29.57	26.33	-20.09	-37.92	-22.74	-30	-22.14	-22.32
HaraMadhu X MS 78	17.38	12.29	-2.37	-5.64	-2.37	-5.64	12.89	1.05	12.59	1.44	11.55	-0.45	9.29	0.86
ArkaJeeth X MS 17	22.24	16.2	0.00	-2.71	0	-2.71	3.29	-0.49	7.58	-22.74	36.33	19.24	37.4	-4.35
ArkaJeeth X MS 28	24.38	22.44	-1.67	-6.99	-1.67	-6.99	-2.96	-5.93	3.3	-26.45	7.59	0	-6.21	-35.19
ArkaJeeth X MS 78	17.96	13.13	0.15	-3.34	0.15	-3.34	1.9	1.48	24.27	-8.17	45.28	40.94	58.02	12.78
ArkaSiri X MS 78	12.75	9.46	-2.94	-6.47	-2.94	-6.47	-21.51	-21.75	6.58	-8.94	-10.47	-21.43	6.21	3.17
ArkaSiri X MS 17	5.78	1.77	3.91	0.94	3.91	0.94	-15.76	-18.75	1.39	-16.5	-16.76	-18.95	-31.58	-32.49
ArkaSiri X MS 30	-9.64	-15.76	-3.56	-13.00	-3.56	-13	-15.38	-8.86	-10.39	-33.27	-0.82	-11.66	9.47	4.07
ArkaSiri X MS 79	-22.77	-27.29	1.98	-0.15	1.98	-0.15	-13.31	-15.29	19.79	-0.45	-3.74	-8.16	25.15	21.69
ArkaSiri X MS 5	-9.05	-11.79	4.23	1.25	4.23	1.25	-33.53	-37.76	1.13	-10.21	-7.48	-25.22	42.41	-8.15
Madhuras X MS 28	16.28	15.23	-5.15	-10.00	-5.15	-10	-5.42	-12.57	0.12	-27.47	12.8	8.66	-33.58	-39.76
Madhuras X MS 74	9	7.67	-3.39	-6.78	-3.39	-6.78	0.64	-11.2	15.73	-8.94	17.13	-1.15	10.29	-10.01
Madhuras X MS 79	-8.54	-12.88	5.54	3.80	5.54	3.8	-25.05	-30.22	14.46	-15.73	6.56	5.62	11.49	6.4
Madhuras X MS 17	-10.78	-13.13	4.09	1.57	4.09	1.57	-6.48	-14.11	-8.71	-33.27	-10.3	-12.92	-50.47	-54.53

Where, VL – Vine length (cm)   DFFF – Days for first female flower, NFFF – Node at first female flower,
SR – Sex ratio (%),   FL – Fruit length (cm), FW – Fruit width (cm), AFW – Average fruit weight (g)

Continued…

Cross combinations	NFPV		FYPV (kg/vine)		FT (cm)		TSS(^{o} brix)		SL (Days)	
	% Heterosis over		% Heterosis over		% Heterosis over		% Heterosis over		% Heterosis over	
	MP	BP	MP	BP	MP	BP	MP	BP	MP	BP
HaraMadhu X MS 28	4.96	-7.26	33.71	20.33	-2.71	-6.94	-24.41	-42.51	-28.57	-62.12
HaraMadhu X MS 30	11.32	-11.84	26.03	15.66	-2.41	-20.87	-18.6	-39.32	-26.13	-60.95
HaraMadhu X MS 78	8.92	-13.74	53.2	42.02	-13.96	-20.87	-2.92	-30.14	-13.88	-54.31
ArkaJeeth X MS 17	-5.12	-7.28	17.27	-10.68	12.25	-15.13	-15.23	-36.22	-24.58	-59.73
ArkaJeethX MS 28	7.53	5.23	13.69	-6.69	4.76	-21.43	-3.34	-27.36	-37.09	-66.16
ArkaJeeth X MS 78	15.14	-0.49	21.33	-2.89	19.47	-7.77	-0.41	-29.1	-45.28	-70.56
ArkaSiri X MS 78	10.88	-5.11	8.95	-1.12	-16.64	-27.14	9.56	-25	-41.88	-69.23
ArkaSiri X MS 17	-10.81	-11.84	-44.05	-45.86	-22.69	-30.63	20.04	-13.59	-29.52	-63.10
ArkaSiri X MS 30	10.32	-5.58	6.89	-3.94	-13.72	-32.95	-31.12	-51.34	-38.69	-67.20
ArkaSiri X MS 79	-4.48	-10.69	13.03	10.17	-7.54	-16.67	-9.26	-34.23	-25.44	-60.47
ArkaSiri X MS 5	-14.1	-19.51	40.46	-0.62	-23.23	-43.02	19.58	-1.09	-31.13	-63.32
Madhuras X MS 28	1.95	0	-16.67	-27.21	-0.51	-7.14	27.5	-4.74	-31.06	-63.35
Madhuras X MS 74	10	0	21.09	-15.59	22.64	7.15	22.88	-12.5	-27.44	-61.19
Madhuras X MS 79	6.06	0.49	-15.61	-18.6	-4.89	-10.64	13.06	-14.77	-56.60	-76.77
Madhuras X MS 17	-20.76	-22.74	-44.82	-47.15	-7.5	-12.7	14.18	-14.58	-48.47	-72.56

Where, NFPY - Number of fruits per vine,   FYPV – Fruit yield per vine (kg/vine), FT – Flesh thickness (cm),
TSS – Total soluble sugars (^{o} brix), SL – Shelf life (days)

CONCLUSION

Out of the 15 intraspecific hybrids, 11 intraspecific hybrids showed significant positive heterosis over mid parent and only four intraspecific hybrids were found to be superior to the better parent for fruit yield per vine. The intraspecific hybrids Haramadhu X MS 78 exhibited highest and significant heterosis over both mid parent (53.20%) and better parent (42.02%) followed by Haramadhu X MS 28 (33.71% and 20.33%) and Haramadhu X MS 30 (26.03% and 15.66%). From the overall study, the results were summarized that the intraspecific hybrid Haramadhu X MS 78 showed highest and significant heterosis over both mid parent (53.20%) and better parent (42.02%) with the yield capacity of 3.75 kg per vine. Apart from that the quality traits such as flesh thickness, TSS and shelf life the hybrid ArkaSiri X MS 17 found to be superior compared to other hybrids and it can be further evaluated in segregating generations to identify desirable progeny for said quality traits with muskmelon background.

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Conflict of interest. The authors declare that they do not have any conflict of interest

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