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Evaluation of exotic mango germplasm for varietal improvement in Bangladesh

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ABSTRACT

Five exotic mango germplasms (MI Ex-001, MI Ex-002, MI Ex-003, MI Ex-004, and MI Ex-005) were evaluated in an experiment carried out in 2014–15 and 2015–16 at the Fruit Research Farm of Horticulture Research Centre, BARI, Joydebpur, Gazipur. Regarding plant height, base girth, tree volume, canopy spread, width, thickness, and TSS throughout both fruiting seasons, there are no significant differences across the genotypes. Full bloom occurred from early January to late February, whereas MI Ex-001 was the earliest and MI Ex-005 was the latest for both years. MI Ex-005 produced the maximum number of fruits per tree (138 & 44), while it was noticed as a minimum in MI Ex-002 (12) & MI Ex-003 (16), respectively, in 2014-15 and 2015-16. The fruit harvesting period ranged from 1st week of June 2015 to 1st week of July 2015 where MI Ex-005 was the earliest and MI Ex-002 was the latest fruit-producing germplasm. Maximum fruit weight was recorded in MI Ex-003 (451.33 g & 371.67 g) and the minimum was recorded in MI Ex-005 (159.33 g & 167.00 g), respectively, in 2014-15 and 2015-16. Total Soluble Solids were the highest in MI Ex-2 (21.0%) while the lowest TSS was found in MI Ex-005 (12.67 %). The highest infestation of leaf-cutting weevil was found in MI EX- 005 while it was recorded lowest in MI EX -001. MI Ex-003 was not affected by any types of Disease and physiological malformation in both years but Severe fruit cracking was observed in MI Ex-002 (14.21%) only in 2014-15, but none of the germplasm was affected in 2015-16. The germplasm MI Ex -001 and MI Ex -003 can be released as a high-yielding variety.

Key Words: *Mango; Exotic germplasm; Qualitative & quantitative characteristic and Pest infestation*

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I. Introduction

The mango, or *Mangifera indica* L., is considered the king of fruits and a staple in Bangladeshi cuisine. It has been raised for more than 4,000 years (Candole, 1984). The mango is a fruit that originated in South Asia and has spread around the world to become one of the most widely grown tropical crops. It is highly nutritious and has a wide range of applications. According to DAE, the northern districts have about 4.5 million mango trees of various ages and kinds spread across around 35,000 hectares, with a large number of mango orchards and a growth in household mango farming over the past several years. Cultivars are generally site-specific, and commercial varieties from one place could not grow well in another (Majumder et al., 2001). However, Kamaluddin (1967), Mollah and Siddique (1973), Hossain (1974), Samad and Faruque (1976), Bhuyan and Islam (1990) and Mannan (2003) reported only sketchy information on some common mango cultivars in Bangladesh. Unfortunately, there is not enough information on cultivating exotic mango germplasms. There are many different types grown in our nation, but a significant economic issue arises from the irregular or biannual bearing habits of commercial cultivars. The nutritional and economic issues in Bangladesh are becoming worse as the country's population grows quickly. To overcome these problems, varietal improvement by introducing and selecting exotic germplasm is crucial. With this aim, a study was undertaken with five exotic mango germplasm at HRC, Joydebpur, Gazipur.

II. Materials and Methods

The experiment was conducted at the Fruit Research Farm of Horticulture Research Centre, BARI, Gazipur, during 2014-15 and 2015-16. Five exotic germplasm of mango were included in this study. These were MI Ex-001, MI Ex-002, MI Ex-003, MI Ex-004 and MI Ex-005. Among the germplasm, MI Ex-004 fruit-setting did not occur in 2014-15 and fruits fell due to hailstorms but very few fruit-setting was occurred in 2015-16. The experiment was laid out in a Randomized Complete Block Design (RCRD) with three replications. One-year-old vineer grafts were planted in July 2006 at a spacing of 8 m × 8 m. A single tree of each germplasm constituted the unit of replication. The trees were fertilized with recommended manure and fertilizers (Hossain, 1989) at the beginning and end of the rainy season. The trees were fertilized with 25 kg rotten cowdung, 750 g urea, 500 g TSP, 250 g MoP, 250 g gypsum and 15 g zinc sulphate in two split doses of manure and fertilizers (recommended dose for 8-10 years old plants) at the beginning and the end of the rainy season with light irrigation. Intercultural operations such as weeding and ploughing were done in September, December, March, May, and July. Regular irrigations at 15-day and 30 days intervals were applied at blooming and fruiting stages, respectively. Confidor @ 1 ml/ 5 L and Indofil @ 1ml/ 1 L of water were applied twice, one before the flower opening stage and another at the pea stage, to control mango hopper and anthracnose. Necessary actions were taken against other pests and diseases as and when needed. Data on tree growth as well as quantitative characteristics were recorded as per 'Descriptors for Mango' published by IBPGR in (1989). Tree volume was calculated by using the formula of Castle (1983). Tree Volume= $1/6\ \pi \times$ plant height $\times (2r)^2$, where 2r = (East-West spread + North-South spread)/2.

III. Results and Discussion

There were no significant differences in the germplasm when all the growth characteristics for both fruiting seasons were considered (Table 01). The tallest tree was obtained from MI Ex-005 (4.65 m & 4.83 m respectively in 2014-15 and 2015-16), while the lowest plant height was recorded (3.67 m) in MI Ex-003 & (3.97 m) in MI Ex-002 respectively in 2014-15 and 2015-16. In case of Base girth, Tree volume, and canopy spread, there is no significant difference for both the 2014-15 and 2015-16—fruiting seasons. The highest canopy spread (5.55 m) in the north-south direction was found in MI Ex-001 in 2014-15, but 5.83 m in MI Ex-003 in 2015-16 and lowest (3.25 m and 4.77 m, respectively, in 2014-15 and 2015-16) was found in MI Ex-002. The highest canopy spread in the east-west direction (5.58 m) and (5.93 m) was noted in MI Ex-003 and lowest (3.75) and (4.70) in MI Ex-002, respectively in 2014-15 and 2015-16.

First emergence of inflorescence occurred from mid-December to late January for both seasons (Table 02). Full bloom occurred from early January to late February, where MI Ex-001 was the earliest and MI Ex-005 was the latest for both years. Majumder et al. (2001) stated that the flowering time in mango depends on the climatic factors prevailing in an area. The inflorescence shapes of all the studied

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germplasm were conical. The inflorescence positions of the mango germplasm were terminal. The **i**nflorescence color of the germplasm varied from light green (MI Ex-002) to light green with red patches (in the remaining varieties).

Table 01. Quantitative growth characteristics of exotic mango germplasm in 2014-15 and 2015-16 seasons

Germplasm	Plant height (m)		Base girth (cm)		Tree volume (m^3)		Canopy spread (m)			
							N-S	E-W	N-S	E-W
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15		2015-16	
MI EX-001	4.00	4.00	65.33	74.33	66.33	69.23	5.55	5.38	5.53	5.47
MI EX-002	3.72	3.97	41.33	55.67	61.07	48.88	3.25	3.75	4.77	4.70
MI EX-003	3.67	4.20	62.67	71.67	68.50	76.17	3.67	5.58	5.83	5.93
MI EX-005	4.65	4.83	59.33	73.00	61.51	68.95	4.65	4.77	5.23	4.73
Level of sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	18.23	16.63	16.89	13.74	57.50	30.39	21.45	24.37	23.18	25.84

* Indicates the significant level at 5%; ** indicates the significant level at 1%; NS: Not significant

Table 02. Date of 1st emergence, full bloom and inflorescence characteristics of exotic Mango germplasm in 2014-15 and 2015-16 Seasons

Germplasm	Date of 1st emergence		Date of full bloom		Shape of inflorescence	Position of inflorescence	Color of inflorescence
	2014-15	2015-16	2015	2016			
MI EX-001	17.12.14	20.12.15	Late Jan	Late Jan	Conical	Terminal	Light green with red patches
MI EX-002	31.12.14	28.12.15	Early Feb	Early Feb	Pyramidal	Terminal	Light green
MI EX-003	31.12.14	31.12.15	Early Feb	Early Feb	Pyramidal	Terminal	Light green with red patches
MI EX-005	31.01.15	25.01.16	Late Feb	Late Feb	Conical	Termina	Light green with red patches

Fruit characteristics were presented in Table 03 and it showed that the harvesting period ranged from 1st week of June to 1st week of July in 2014-15 and 2015-16 where MI Ex-005 was the earliest and MI Ex-002 was the latest fruit-producing germplasm. There was a significant difference among the germplasm regarding the number of fruits per tree. MI Ex-005 produced the maximum number of fruits per tree (138 & 44), while it was noticed minimum in MI Ex-002 (12) & MI Ex-003 (16), respectively in 2014-15 and 2015-16. There was a significant difference among the germplasm concerning fruit weight, yield length, breadth, thickness, and TSS. Maximum fruit weight was recorded in MI Ex-003 (451.33 g & 371.67 g) and the minimum was recorded in MI Ex-005 (159.33 g & 167.00 g), respectively, in 2014-15 and 2015-16. The same trend was also observed in fruit size. The largest fruit with respect to length (13.50 cm) in MI Ex-001 and (14.60 cm) in MI Ex-002 and the smallest fruit (7.10 cm & 7.13 cm) was observed in MI Ex-005, respectively, for both years.

Table 03. Date of harvest, number of fruits and fruit characters of exotic mango germplasm at Joydebpur in 2014-15 and 2015-16 Seasons

Germplasm	Date of harvest		No. of fruits/plant		Fruit wt (g)		Yield (kg)/ plant	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
MI EX-001	2nd wk of June	2nd wk of June	62.47c	37.53c	289.00b	225.33c	18.05c	8.46b
MI EX-002	1st wk of July	Last wk of June	12.00d	43.60b	266.00c	263.00b	3.19d	11.47a
MI EX-003	Last wk of June	Last wk of June	70.17b	16.50d	451.33a	371.67a	31.67a	6.13d
MI EX-005	1st wk of June	1st wk of June	138.00a	44.40a	159.33d	167.00d	21.99b	7.41c
Level of sig.	-	-	***	***	***	***	***	***
CV%	-	-	0.99	0.77	0.15	0.47	1.31	0.94

* indicates the significant level at 5%; ** indicates the significant level at 1%; NS: Not significant

The largest fruit with respect to breadth (9.17 cm & 9.17 cm) and thickness (8.57 cm & 7.93 cm) was obtained from MI Ex-003 as against the smallest fruit breadth (5.83 cm) MI Ex-002 & (5.40 cm) MI Ex-005 and (5.30 cm & 4.83 cm) thickness fruit from MI Ex-002 & MI Ex-005 respectively in 2014-15 and 2015-16. Total Soluble Solids was noted the highest in MI Ex-001 (18.33%) and MI Ex-003 (21.00%) which was statistically at par to that of MI Ex-002 (18.33%) and MI Ex-001, while the lowest was manifested in MI Ex-003(13.67 %) & MI Ex-005 (12.67 %) which was statistically similar to MI Ex-004 (13.67%) and MI Ex-003 (13.67%) respectively in 2014-15 and 2015-16.

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Table 03. Cont'd

Germplasm	Fruit size (cm)						TSS (%)	
	Length	Breadth	Thickness	Length	Breadth	Thickness		
	2014-2015			2015-2016			2014-15	2015-16
MI EX-001	13.50a	6.60b	6.17b	12.57	6.40b	6.03	18.33a	19.33a
MI EX-002	13.38a	5.83b	5.30c	14.60	6.30b	5.70	18.33a	21.00a
MI EX-003	10.30b	9.17a	8.57a	10.50	9.17a	7.93	13.67b	13.97b
MI EX-005	7.10c	6.20b	5.83bc	7.13	5.40b	4.83	13.67b	12.67b
Level of sig.	**	**	**	NS	**	NS	*	**
CV%	6.85	8.29	5.04	25.47	6.55	35.32	9.94	5.89

* indicates the significant level at 5%; ** indicates the significant level at 1%; NS: Not significant

Different types of fruit shapes were observed in the germplasm like ovate, oblong and roundish etc. The color of mature fruits of the germplasm showed differences such as light green to green. The ripe fruit colour of the included germplasm varied from yellowish green to greenish yellow colour. Mannan et al. (2003) also observed a wide range of variability regarding different physico-chemical characteristics of mango fruit, where skin and pulp color of ripe fruits varied from green to yellow and yellow to orange, respectively. Among the germplasm MI Ex-001 and MI Ex-005 had the same shoulder (rising and then rounded) except MI Ex-002 and MI Ex-003 (ending in a long curve). Smooth skin textures were observed in fruits of all the germplasm. The basal cavity and pointed beak were observed in MI Ex-003 only. Among the studied germplasm sinus was shallow to deep in MI Ex-001 and MI Ex-002, respectively and absent in the rest of the germplasm sinus. Acute apex was found in MI Ex-001 and MI Ex-002, while it was obtuse in MI Ex-005 and rounded in MI Ex-003. All the germplasm had more or less fibrous pulp and yellow to deep yellow color pulp was observed in MI Ex-001, MI Ex-002, MI Ex-003 and MI Ex-005 (Table 04).

Table 04. Qualitative fruit characteristics of exotic mango germplasm

Germplasm	Fruit shape	Fruit color at maturity	Fruit color at ripen	Pulp color	Shoulder	Skin texture
MI EX-001	Oblong	Light Green	Yellowish green	Yellow	Rising and then rounded	Smooth
MI EX-002	Oblong	Green	Yellowish green	Yellow	Ending in a long curve	Smooth
MI EX-003	Ovate	Green	Greenish yellow	Yellow	Ending in a long curve	Smooth
MI EX-005	Roundish	Green	Greenish yellow	Deep yellow	Rising and then rounded	Smooth

Table 4. Cont'd

Germplasm	Basal cavity	Beak	Sinus	Apex	Fiber in pulp	Skin adherence
MI EX-001	Absent	Slightly pointed	Shallow	Acute	Absent	Absent
MI EX-002	Absent	Absent	Deep	Acute	Slightly present	Absent
MI EX-003	Present	Pointed	Absent	Rounded	Present	Absent
MI EX-005	Present	Absent	Absent	Obtuse	Scanty	Present

Table 05. Incidence of insect pests and diseases in exotic mango germplasm

Germplasm	% Insect infestation		% Diseases infection				Physiological disorder	
	Leaf cutting weevil		Vegetative malformation	Fruit anthracnose	Vegetative malformation	Fruit anthracnose	Fruit cracking	
	2014-15	2015-16	2014-2015		2015-2016		2014-15	2015-16
MI-EX 001	1.25	1.50	5.12	-	4.11	1.50	-	-
MI- EX 002	2.66	-	2.20	3.10	1.25	4.20	14.21	-
MI- EX 003	6.10	5.00	-	-	-	-	-	-
MI- EX 005	9.00	8.00	-	-	-	2.10	-	-
Mean	4.75	3.62	1.83	0.78	1.34	1.95	3.55	-

The highest infestation of cutting weevil was found in MI Ex-005 (9.0% & 8.0%), while it was noted the lowest in MI Ex-001 (1.25% & 1.50%) (Table 05), respectively, in 2014-15 and 2015-16. Among the

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germplasm, MI Ex 001 was the most susceptible, showing 5.12% and 4.11% vegetative malformation, respectively, in 2014-15 and 2015-16. MI Ex-003 was not affected by any types of Disease and physiological malformation in both years, but Severe fruit cracking was observed in MI Ex-002 (14.21%) only in 2014-15 but none of the germplasm was affected in 2015-16.

IV. Conclusion

The overall growth conditions of all the exotic germplasm were satisfactory. This suggests that the germplasm has the potential to contribute significantly to agricultural productivity and meet the needs of farmers and consumers alike. The potential selection of MI Ex-001, MI Ex-002, and MI Ex-003 as high-yielding exotic varieties suggests a positive outlook for agricultural productivity.

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References

[1]. Bhuyan, M. A. J. and Islam, M. S. (1990). Phsysico-Morphological Charaters of some popular Mango cultivars in Bangladesh. Bangladesh Journal of Agriculture, 14, 181-187.
[2]. Candole, A. D. (1984). Origin of Cultivated Plants. Vegal Paul Trench and Co., London pp.1-67
[3]. Castle, S. W. (1983). Growth, yield and cold hardiness of seven years “Bears” Lemon trees on twenty seven root stocks. Proc. Fla, State Hort. SOC. 96: 23-25.
[4]. Hossain, A. K. M. A. (1989). Manual on Mango Cultivation in Bangladesh. Horticulture Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, Bangladesh.
[5]. Hossain, M. A (1974). Characteristics of Bangladeshi mango grown in Rajshahi. M.S. Ag. Thesis. Bangladesh Agricultural University, Mymensing. Bangladesh.
[6]. IBPGR. (1989). Descriptors for Mango. International Board for Plant Genetic Resources, Rome, Italy. 22p.
[7]. Kamaluddin, A. S. M (1967). Amer Chash. Kamrun Nahar, 2/4 Block B, Mohammadpur Housing State, Dhaka. Pp 112.
[8]. Majumder, P. K., Sharma,, D. K. and Sanyal, D. (2001). Mango. *In:* Fruits: Tropical and Subtropical. 3rd edn. Vol.1. (Eds. T.K. Bose, S.K. Mitra and D. Sanyal), Naya Udyog, 206, Bidhan Sarani, Calcutta, India. p.68.
[9]. Mannan, M. A. et al. (2003). A study on the physico-chemical characteristics of some mango varieties in Khulna region. Pakistan Journal of Biological Sciences, 6(24), 2034-2039. https://doi.org/10.3923/pjbs.2003.2034.2039
[10]. Mollah, S. and Siddique, M. A. (1973). Studies on some mango varieties of Bangladesh.
[11]. Samad, M. A. and Faruque, A. H. M. (1976). A study on the physical characteristics of some common mango varieties of Bangladesh. Bangladesh Horticulture, 4(1), 18-23.

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