

MORPHOLOGICAL CHARACTERIZATION OF SIXTY MANGO (*Mangifera indica*) GERMPLASM OF BANGLADESH

ABSTRACT

A Study was conducted in the research field of Regional Horticulture Research Station, Bangladesh Agricultural Research Institute, Chapainawabganj to know the morphology of 60 germplasm of mango leaf, inflorescence, flower and fruits. A great morphometric variation was observed in the leaf. The inflorescences were pyramidal or conical in form except for Khudikhirsha, Narikeli and Himsagor which were cylindrical. The ratio of hermaphrodite and male flowers showed variation. Fruit characters like length, breadth, weight and colour were studied. The highest fruit weight and length were found in Fazli (760 g and 15.17 cm) and the lowest fruit weight was recorded in Modhuchoski (128.50 g). Variation in fruit colour was also recorded among the germplasm. The highest TSS in the germplasm khodikhirsapat (24.33%), maximum stone weight was recorded in Fazli (69.87g). The longest fruit length was observed in the germplasm of Ashwina (13.03 cm). The highest fruit breadth was observed in the germplasm Fazli (9.87 cm). The present investigation has established that the morphological characters can be used as a tool for the taxonomic discrimination of varieties of *Mangifera indica*.

Key words: mango, morphology, inflorescence, fruit, taxonomic

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important fruit crops of the Anacardiaceae family. It is a popular tropical fruit, especially in Asia. All mango cultivars belong to the species *Mangifera*[1]. It is an important and popular fruit in the world for its excellent flavour, attractive colour and delicious taste. It has been cultivated in different countries of the world from times immemorial. Records suggest that it has been in cultivation in the Indian subcontinent from 4000 years ago [2]. The fruit is believed to have originated in Eastern India, Burma or the Malayan region [3]. It is a perennial tree and is now widely cultivated in tropical and subtropical countries of the world. The mango is the national fruit of India, Pakistan, and the Philippines. It is also the national tree of Bangladesh. The principal mango-producing countries in the world are India, Pakistan, Mexico, Haiti, Brazil, Bangladesh, Philippines and USA. India is the single largest producer of mango with approximately 66% of the world's mango production [4]. It is the most popular fruit in Bangladesh. Mango has got a unique position in respect of nutritional quality, taste, consumer preference, etc. among the different kinds of fruits grown in Bangladesh [5]. The main mango-growing districts are Chapainawabganj, Rajshahi, Naogaon, Meherpur, Dinajpur, Kustia and Chattogram hill tracts. According to BBS 2020, out of 1219450 metric tons from 95.30 thousand hectares of land about 197080 metric tons of mango were produced in Chapainawabganj, the second most mango producing district of Bangladesh [6]. In 2011,

more than about 38.90 million tons of mangoes were produced worldwide [7]. In Bangladesh, mango ranks 1st in terms of area and 2nd in terms of production.

MATERIALS AND METHODS

Sixty local germplasm of mango were selected from the district of Chapainawabganj. The experimental site is under AEZ 11 (Agro-Ecological Zones) which is geographically located at 24°35' North latitude and 88°16' East longitude with a total annual rainfall of 1200 mm [8].

Data Collection

Three trees of each germplasm were used, ten adult leaves, ten blossoms and ten fruits per tree were collected. Samples were collected from all around the canopy except the blossoms which were measured directly on the plant. The germplasm were evaluated for 50 morphological descriptors as published by International Plant Genetic Resources Institute, 2006.

Leaf Characteristics

Measurements for the length and breadth of the leaf were carried out using a measuring scale. The procedures as described by International Plant Genetic Resources Institute. The shape of the leaves was observed as oblong, oblong-lanceolate and lanceolate. The margin of the leaf was recorded as entire and wavy. The tip of the leaf was observed as acute. The color of the mature leaf was determined by comparing it with a color chart and recorded either as light green or green.

Inflorescence Characteristics

Inflorescence length and breadth were measured by a measuring scale. The shape of the inflorescence was observed as pyramid, broadly pyramid and conical. The density of inflorescence was recorded into scarce, medium and dense. The colour of inflorescence was determined by eye estimation and recorded either as light green, green with red patches or crimson. The types of the flower were observed as tetramerous or pentamerous.

Flower Characteristics

The flowers were identified as male, bisexual and unopened. The total number of flowers was also recorded and then the percentage of flowers was calculated. At first male and the bisexual flower was counted then the ratio was calculated.

Fruit Characteristics

Fruits for analysis were collected at the proper maturity stage. Fruit length and breadth measurements were carried out using vernier slide calipers. Measuring balance was used to determine the weight of the fruits. The fruit thickness was measured with vernier slide

calipers (Model Mitutoyo, Japan). The shape of the fruit was observed as oblong, round and elliptic. The color of mature fruit was determined by comparing it with a color chart and recorded either as light green, green or deep green. The color of ripe fruit was determined by comparing with a color chart and recorded either as light green, yellow, radish yellow and light red. The weight of the skin was measured by a measuring balance and the skin thickness was observed as thick, medium thick and thin.

Pulp Characteristics

The texture of pulp was measured by juice and it was observed as juicy and firm. The color of the pulp was determined by eye estimation and recorded as either yellow or orange. Most of the germplasm had fiber adherence to fruit skin. The minimum number of germplasm had absent fiber to fruit skin. The weight of the pulp was measured by a measuring balance. The total soluble solids content was determined by a Refractometer.

Stone Characteristics

Stone weight was measured by a measuring balance. The length of the stone, breadth and thickness was measured by vernier slide calipers. The veins on the stone were classified into levels with surface, depressed and elevated.

Table 1. List of 60 Mango germplasm

SL. No.	Name of germplasm	SL. No.	Name of germplasm
01	Fazli	31	Borogutti
02	ShurmaFazli	32	Sipiard
03	Khirsapat	33	SadaGutti
04	KhudiKhirsa	34	ChongaFazli
05	Gopalbhog	35	Nora
06	Langra	36	Modhuchoski
07	Bombai	37	Ranibhog
08	China Bombai	38	Kohitur
09	Kachamitha	39	Golapkhas
10	Ashwina	40	Dudsor
11	Kuapahari	41	Gutti-1
12	Kalua	42	Gutti-2
13	Kalibhog	43	Gutti-3
14	Boglagutti	44	Gutti-4
15	Batasa	45	Gutti-5
16	Mohonbhog	46	Gutti-6
17	Lokhonbhog	47	Gutti-7

18	Sindhuri	48	Gutti-8
19	Himsagor	49	Gutti-9
20	Dalvanga	50	Gutti-10
21	Lokhna	51	Gutti-11
SL. No.	Name of germplasm	SL. No.	Name of germplasm
22	Fonia	52	Gutti-12
23	Kaiadp	53	Gutti-13
24	Narikali	54	Gutti-14
25	Brindaboni	55	Gutti-15
26	Shamlota	56	Gutti-16
27	Darika	57	Gutti-17
28	KalamSindhuri	58	Gutti-18
29	Misrikanto	59	Gutti-19
30	Miakhaoa	60	Gutti-20

RESULTS AND DISCUSSION

Leaf characteristics

The leaf characteristics like leaf length, breadth, petiole length, leaf shape, tip, margin and colour of mature leaf were recorded and the results have been presented in Table 2. Leaf length and breadth varied from germplasm to germplasm. It ranged from 18.67 cm to 38.33 cm and 5.07 cm to 17.33 cm respectively (Table 2). The longest leaf was observed in the germplasm Lokhonbhog (38.33 cm) and the shortest leaf was recorded in the germplasm Gutti-10 (18.67 cm). The highest leaf breadth was observed in the germplasm Kuapahari (17.33 cm) and the lowest was recorded in the germplasm SadaGutti (5.07 cm). Most of the germplasm were observed that the leaf shape lanceolate (Fazli, ShurmaFazli, Bombai, Khirsapat, Gopalbhog, Langra) and minimum number germplasm was observed as oblong-lanceolate (Brindaboni, Gutti-3, Gutti-10, Ranibhog) (Table 2). Biswas (2005) found similar results to Nowrin (2009) [9][10]. Based on leaf tip as observed among 60 mango germplasm had acute (Table 2). Most of the germplasm was observed entire (Fazli, ShurmaFazli, Bombai, Langra, Gopalbhog, Khudikhirsa, Ashwina, Kuapahari, lokhna). Khirsapat, Kalua, Kaiadp and Gutti-4 was observed wavy (Table 2). The color of mature leaf varied from light green to dark green. It was observed that the color of the young leaf of the germplasm was light green, Kalua and Kalibhog were dark green.

Table 2. Leaf characteristics of mango in respect of leaf length, breadth, petiole length, leaf shape, tip, margin and color of mature leaf

Acc. No.	Germplasm	Leaf Length (cm)	Leaf breadth (cm)	petiole length (cm)	Leaf shape	Leaf tip	Leaf margin	Colour of mature leaf
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MI-1	Fazli	29.50	9.20	8.17	Lanceolate	Acute	Entire	Light green
MI-2	ShormaFazli	25.67	9.33	7.97	Lanceolate	Acute	Entire	Light green
MI-3	Khirsapat	27.43	7.20	8.20	Lanceolate	Acute	Wavy	Light green
MI-4	Khodikhirsapat	26.00	7.30	3.17	Lanceolate	Acute	Entire	Light green
MI-5	Gopalbhog	24.33	6.33	4.73	Lanceolate	Acute	Entire	Light green
MI-6	Langra	24.63	6.57	2.12	Lanceolate	Acute	Entire	Light green
Acc. No.	Germplasm	Leaf Length (cm)	Leaf breadth (cm)	petiole length (cm)	Leaf shape	Leaf tip	Leaf margin	Colour of mature leaf
MI-7	Bombai	24.33	7.37	5.20	Lanceolate	Acute	Entire	Light green
MI-8	Chainabombai	29.33	9.23	4.10	Lanceolate	Acute	Entire	Light green
MI-9	Kachamithi	32.67	9.57	5.13	Lanceolate	Acute	Entire	Light green
MI-10	Ashina	25.67	8.22	5.15	Lanceolate	Acute	Entire	Light green
MI-11	Kuapahari	33.00	17.33	5.17	Lanceolate	Acute	Entire	Light green
MI-12	Kalua	34.33	7.20	5.14	Lanceolate	Acute	Wavy	Dark green
MI-13	Kalivog	30.25	6.25	3.10	Lanceolate	Acute	Entire	Dark green
MI-14	BoglaGutti	24.00	5.33	5.18	Lanceolate	Acute	Entire	Light green
MI-15	Batasa	34.00	7.20	4.10	Lanceolate	Acute	Entire	Light green
MI-16	Mohonvog	23.33	7.27	4.13	Lanceolate	Acute	Entire	Light green
MI-17	Lokhonvog	38.33	7.20	7.27	Lanceolate	Acute	Entire	Light green
MI-18	Sindhuri	25.33	5.33	4.11	Lanceolate	Acute	Entire	Light green
MI-19	Himsagor	23.33	7.20	4.07	Lanceolate	Acute	Entire	Light green
MI-20	Dalvanga	27.67	6.27	4.10	Lanceolate	Acute	Entire	Light green
MI-21	Lokhna	26.33	5.19	4.23	Lanceolate	Acute	Entire	Light green
MI-22	Fonia	31.67	7.07	5.12	Lanceolate	Acute	Entire	Light green
MI-23	Kaiadp	33.67	8.20	5.17	Lanceolate	Acute	Wavy	Light green
MI-24	Narikeli	20.33	6.23	3.16	Lanceolate	Acute	Entire	Light green
MI-25	Brindaboni	25.50	5.11	3.13	O. Lanceolate	Acute	Entire	Light green
MI-26	Shamlota	29.58	7.27	6.26	Lanceolate	Acute	Entire	Light green
MI-27	Darika	25.33	7.27	5.17	Lanceolate	Acute	Entire	Light green
MI-28	Kalamsindhuri	30.67	8.30	7.25	Lanceolate	Acute	Entire	Light green
MI-29	Misrikanto	28.67	6.20	6.27	Lanceolate	Acute	Entire	Light green
MI-30	Miakhaoa	20.33	5.12	3.13	Lanceolate	Acute	Entire	Light green
MI-31	BoroGutti	28.67	9.35	4.23	Lanceolate	Acute	Entire	Light green
MI-32	Sipiard	36.11	9.00	6.20	Lanceolate	Acute	Entire	Light green
MI-33	SadaGutti	25.33	5.07	4.19	Lanceolate	Acute	Entire	Light green
MI-34	Chongafazli	22.33	6.25	3.12	Lanceolate	Acute	Entire	Light green
MI-35	Nora	30.67	8.14	2.17	Lanceolate	Acute	Entire	Light green
MI-36	Modhochoski	21.33	7.23	5.21	Lanceolate	Acute	Entire	Light green
MI-37	Ranibhog	25.27	6.17	4.24	O. Lanceolate	Acute	Entire	Light green
MI-38	Kohitor	30.33	6.25	5.22	Lanceolate	Acute	Entire	Light green
MI-39	Golapkhas	29.58	9.18	8.16	Lanceolate	Acute	Entire	Light green
MI-40	Dudsor	36.67	7.20	5.14	Lanceolate	Acute	Entire	Light green
MI-41	Gutti-1	32.57	7.17	4.11	Lanceolate	Acute	Entire	Light green
MI-42	Gutti-2	29.50	6.13	3.13	Lanceolate	Acute	Entire	Light green
MI-43	Gutti-3	36.67	7.18	5.30	O. Lanceolate	Acute	Entire	Light green
MI-44	Gutti-4	31.00	6.23	7.22	Lanceolate	Acute	Wavy	Light green
MI-45	Gutti-5	30.67	6.32	5.17	Lanceolate	Acute	Entire	Light green
MI-46	Gutti-6	30.33	7.14	5.20	Lanceolate	Acute	Entire	Light green
MI-47	Gutti-7	34.67	9.13	3.14	Lanceolate	Acute	Entire	Light green
MI-48	Gutti-8	21.67	5.13	5.24	Lanceolate	Acute	Entire	Light green
MI-49	Gutti-9	22.33	6.07	6.16	Lanceolate	Acute	Entire	Light green
MI-50	Gutti-10	18.67	5.20	3.13	O. Lanceolate	Acute	Entire	Light green
MI-51	Gutti-11	28.93	7.12	3.07	Lanceolate	Acute	Entire	Light green
MI-52	Gutti-12	25.33	6.13	4.14	Lanceolate	Acute	Entire	Light green
MI-53	Gutti-13	30.67	7.20	5.14	Lanceolate	Acute	Entire	Light green
MI-54	Gutti-14	25.53	6.13	3.13	Lanceolate	Acute	Entire	Light green
MI-55	Gutti-15	30.29	7.07	5.04	Lanceolate	Acute	Entire	Light green

MI-56	Gutti-16	21.33	6.11	2.09	Lanceolate	Acute	Entire	Light green
MI-57	Gutti-17	24.43	7.21	5.15	Lanceolate	Acute	Entire	Light green
MI-58	Gutti-18	24.33	5.12	5.13	Lanceolate	Acute	Entire	Light green
MI-59	Gutti-19	28.67	6.15	4.22	Lanceolate	Acute	Entire	Light green
MI-60	Gutti-20	25.13	6.03	3.13	Lanceolate	Acute	Entire	Light green
Average		27.90	7.11	4.75				
Acc. No.	Germplasm	Leaf Length (cm)	Leaf breadth (cm)	petiole length (cm)	Leaf shape	Leaf tip	Leaf margin	Colour of mature leaf
LSD _{0.05}		1.45	0.42	0.29				
LSD _{0.01}		1.91	0.56	0.38				
Level of significance		**	**	**				

O. lanceolate = Oblong lanceolate

Inflorescence characteristics

The inflorescence consists of inflorescence or clusters which emerged usually at the end of the branches, sometimes from the axils. Inflorescence characteristics for the length of panicle, breadth, shape, the density of flower, color, leafy bract and types of the flower were recorded and results are presented in Table 3. Panicle length and breadth varied from germplasm to germplasm. It ranged from 10.46 cm to 38.58 cm and 5.93 cm to 31.67 cm respectively (Table 3). The longest inflorescence was observed in the germplasm Gutti-07 (38.58 cm) and the shortest leaf was recorded in the germplasm Kaiadp (10.46 cm). The longest was observed in the germplasm Gutti-4 (31.67 cm) and the shortest leaf was recorded in the germplasm Kaiadp (18.67 cm). Hossain and Talukder (1974) examined that length of panicle in different mango varieties ranged from 13.97 to 22.60 cm but Bhuyan and Islam (1989) conducted an experiment and found that maximum and minimum values for panicle length were 25.33 to 31.78 cm, respectively [11] [12]. Nowrin (2009) evaluated the 35-mango germplasm and that the length of the panicle ranged from 17.43 to 46.83 cm [10]. Majumder (2010) found the length of the panicle ranged from 17.75 cm to 42.17 cm [13]. Bhuyan and Islam (1989) also reported that the breadth of a panicle of different mango varieties ranged from 10.11 to 22.85cm [12]. Biswas (2005) found 12.06 to 22.63 cm panicle breadth in 21 mango germplasm [9].

The shape of the inflorescence was observed as pyramid, broadly pyramid and conical. The inflorescence shape was noticed as conical in germplasm Khodikhirsa, Himsagor, Lokhna, Kaiadp, Narikeli, Gutti-7 and Gutti-14, broadly pyramid in Langra, Batasa, Dalvanga, Misrikanti, Miakhaoa, Sipiard, Gutti-1, 3, 4, 5, 6, 13, 15, 16, Dudsor and rest of the germplasm was found to have pyramid type panicle. The density of the flower was observed scarce and dense. The germplasm Kachamithi, Kupahari, BoglaGutti and Gutti-5 were found dense and the rest of the germplasm was found scarce (Table 3). The color of the inflorescence was observed as light green, green with red patches and creamy. Panicle colour Misrikanti, Gutti-9 was creamy and rest of the germplasm was found light green and light green with red patches (Table 3). Leafy bract of the inflorescence was observed present and absent. Most of the germplasm was found to have leafy bract absent minimum germplasm was present (Table 3).

Table 3. Inflorescence characteristics of mango in respect of inflorescence length, breadth, shape, density of flower, colour, leafy bract and types of flower

Acc. No.	Germplasm	Length of inflorescence(cm)	Breadth of inflorescence(cm)	Shape of inflorescence	Density of flower	Colour of inflorescence	Leafy bract	Types of flower
MI-1	Fazli	30.50	15.53	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-2	ShormaFazli	24.80	12.57	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-3	Khirsapat	29.00	11.67	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-4	Khodikhirsapat	21.50	20.17	Conicle	Scarce	Light green	Absent	Pentamerous
MI-5	Gopalbhog	24.60	16.33	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-6	Langra	21.33	20.67	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-7	Bombai	15.53	9.33	Pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-8	Chainabombai	31.17	21.43	Pyramid	Scarce	Light green	Absent	Tetramerous
MI-9	Kachamithi	16.02	6.33	Pyramid	Dense	Light red with patch	Absent	Pentamerous
MI-10	Ashina	22.50	12.47	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-11	Kuapahari	29.17	17.67	Pyramid	Dense	Light green	Absent	Pentamerous
MI-12	Kalua	20.63	18.13	Pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-13	Kalivog	28.13	18.33	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-14	BoglaGutti	25.48	8.23	Pyramid	Dense	Light green	Absent	Pentamerous
MI-15	Batasa	26.27	24.17	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-16	Mohonvog	29.25	16.58	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-17	Lokhonvog	24.43	14.45	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-18	Sindhuri	25.90	16.23	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-19	Himsagor	10.57	6.33	Conicle	Scarce	Light red with patch	Absent	Pentamerous
MI-20	Dalvanga	30.83	23.33	B.pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-21	Lokhna	27.55	13.17	Conicle	Scarce	Light green	Absent	Pentamerous
MI-22	Fonia	24.75	12.53	Pyramid	Scarce	Light green	Absent	Tetramerous
MI-23	Kaiadp	10.46	5.93	Conicle	Scarce	Light red with patch	Absent	Pentamerous
MI-24	Narikeli	21.17	7.87	Conicle	Scarce	Light red with patch	Absent	Pentamerous
MI-25	Brindaboni	19.58	7.60	Pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-26	Shamlota	30.96	17.45	Pyramid	Scarce	Light red	Absent	Pentamerous
MI-27	Darika	37.62	19.52	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-28	Kalamsindhuri	30.75	18.47	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-29	Misrikanto	25.70	12.48	B.pyramid	Scarce	Crimy	Absent	Pentamerous
MI-30	Miakhaoa	21.47	14.43	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-31	BoroGutti	12.35	16.33	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-32	Sipiard	36.38	23.45	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-33	SadaGutti	25.37	13.47	Pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-34	Chongafazli	27.53	15.60	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-35	Nora	23.43	19.45	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-36	Modhochoski	25.33	14.27	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-37	Ranibhog	18.32	13.55	Pyramid	Scarce	Light green	Absent	Pentamerous

MI-38	Kohitor	24.58	12.16	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-39	Golapkhas	22.47	9.29	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-40	Dudsor	27.56	23.49	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-41	Gutti-1	29.47	23.33	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-42	Gutti-2	29.17	14.60	Pyramid	Scarce	Light green	Absent	Pentamerous
Acc. No.	Germplasm	Length of inflorescence(cm)	Breadth of inflorescence(cm)	Shape of inflorescence	Density of flower	Colour of inflorescence	Leafy bract	Types of flower
MI-43	Gutti-3	33.45	22.60	B.pyramid	Scarce	Light green	Absent	Tetramerous
MI-44	Gutti-4	36.58	31.67	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-45	Gutti-5	29.60	25.53	B.pyramid	Dense	Light green	Absent	Pentamerous
MI-46	Gutti-6	24.50	21.58	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-47	Gutti-7	38.58	12.53	Conicle	Scarce	Light green	Absent	Tetramerous
MI-48	Gutti-8	16.60	11.47	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-49	Gutti-9	18.33	15.50	Pyramid	Scarce	Crymi	Absent	Pentamerous
MI-50	Gutti-10	22.17	9.33	Conicle	Scarce	Light red with patch	Absent	Pentamerous
MI-51	Gutti-11	15.25	15.60	Pyramid	Scarce	Light red	Absent	Pentamerous
MI-52	Gutti-12	19.46	10.27	Pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-53	Gutti-13	20.50	19.33	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-54	Gutti-14	21.33	7.27	Conicle	Scarce	Light green	Absent	Pentamerous
MI-55	Gutti-15	23.37	19.43	B.pyramid	Scarce	Light green	Absent	Pentamerous
MI-56	Gutti-16	33.33	21.47	B.pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-57	Gutti-17	17.53	13.17	Pyramid	Scarce	Light red with patch	Absent	Pentamerous
MI-58	Gutti-18	25.23	13.33	Pyramid	Scarce	Light green	Absent	Pentamerous
MI-59	Gutti-19	27.43	19.07	Pyramid	Scarce	Light green	Present	Pentamerous
MI-60	Gutti-20	25.50	18.57	Pyramid	Scarce	Light green	Absent	Tetramerous
Average		24.81	15.77					
LSD _{0.05}		1.58	0.98					
LSD _{0.01}		2.09	1.30					
Level of significance		**	**					

Types of flower

Flowering is one of the most important phenological stages of the mango crop production. The type of inflorescence observed in mango varieties was panicle inflorescence. Most of the germplasm was pentamerous and minimum number of germplasm was tetramerous (Chainabombai, Fonia, Gutti-3, Gutti-7, Gutti-20) (Table 3).

Male flower

The result revealed that the male flower (%) of different mango germplasm varied from 68.00 to 95.00. The highest male flower (95.00%) was obtained from the germplasm Gopalbhog. The lowest male flower (68.00%) was recorded from Kalua. Biswas (2005) observed 57.63 to 93.57% of male flowers in 21 mango germplasm, which is closely related to the present study [9]. Iqbal et al. (1995) observed 69.86 to 93.39% male flower in 18 mango germplasm [14].

Hossain and Talukder (1974) observed 2.90 to 59.91% of male flowers in 38 mango varieties [11].

Bisexual flower

It was calculated that bisexual flowers per panicle varied significantly. Kalua was the highest (32.00%) bisexual and the minimum bisexual flower observed in the germplasm of Gopalbhog (5.00%) per panicle was noted (Table 7). Uddin *et al.* (1995) evaluated 18 exotic mango germplasm at Chapainawabganj and reported that the bisexual flowers (%) of the studied germplasm varied from 6.61 to 30.46 [15].

Ratio of male and bisexual flower

The ratio of male and bisexual flowers varied from 2.12 to 19.00 among the 60 mango germplasm. The highest ratio was observed in Gopalbhog (19.00). The germplasm Kalua had the lowest (2.12) sex ratio (Table 4). Mukherjee (1997) observed that the ratio of male and female flowers is strongly influenced by environmental and cultural factors [3]. Biswas (2005) observed sex ratio ranged from 1.46 to 49.22 among the 21-mango germplasm [9].

Initial fruit set per inflorescence

The initial fruit set per panicle varied significantly among the 60 mango germplasm. It varied from 13.00 to 32.00. The highest number of initial fruit sets per panicle was recorded (32.00) in the germplasm Kaidp. The germplasm Fonia had the lowest (13.00). Iqbal *et al.* (1995) also found 1.22 to 37.33 fruit sets per panicle in 18 mango germplasm [14]. Nowrin (2009) found 8.66 to 33.33 fruit sets per panicle in 35 mango germplasm [10].

Table 4. Different types of flower in respect of male flower, hermaphrodite flower, sex ratio and initial fruit set/ Panicle.

Acc. No.	Germplasm	Male (%)	Hermaphrodite (%)	Sex ratio	Initial fruit set/panicle
Acc. No. 01	Fazli	86.00	14.00	6.14	26.00
Acc. No. 02	ShormaFazli	89.00	11.00	8.09	25.00
Acc. No. 03	Khirsapat	91.00	9.00	10.11	23.00
Acc. No. 04	Khodikhirsapat	70.00	30.00	2.38	27.00
Acc. No. 05	Gopalbhog	95.00	5.00	19.00	15.00
Acc. No. 06	Langra	69.00	31.00	2.22	31.00
Acc. No. 07	Bombai	71.00	29.00	2.45	30.00
Acc. No. 08	Chainabombai	72.00	28.00	2.57	30.00
Acc. No. 09	Kachamithi	81.00	19.00	4.26	21.00
Acc. No. 10	Ashina	89.00	11.00	8.09	24.00
Acc. No. 11	Kuapahari	83.00	17.00	4.88	29.00
Acc. No. 12	Kalua	68.00	32.00	2.12	32.00
Acc. No. 13	Kalivog	90.00	10.00	10.00	16.00
Acc. No. 14	BoglaGutti	88.00	12.00	7.33	17.00
Acc. No. 15	Batasa	84.00	16.00	5.25	22.00
Acc. No. 16	Mohonvog	91.00	9.00	10.11	14.00
Acc. No. 17	Lokhonvog	77.00	23.00	3.35	23.00
Acc. No. 18	Sindhuri	88.00	12.00	7.33	17.00
Acc. No. 19	Himsagor	90.00	10.00	9.00	15.00
Acc. No. 20	Dalvanga	87.00	13.00	6.69	31.00

Acc. No. 21	Lokhna	91.00	9.00	10.11	19.00
Acc. No. 22	Fonia	85.00	15.00	5.66	13.00
Acc. No. 23	Kaiadp	89.00	11.00	8.09	32.00
Acc. No. 24	Narikeli	87.00	13.00	6.69	18.00
Acc. No.	Germplasm	Male (%)	Hermaphrodite (%)	Sex ratio	Initial fruit set/panicle
Acc. No. 25	Brindaboni	88.00	12.00	7.33	17.00
Acc. No. 26	Shamlota	90.00	10.00	9.00	15.00
Acc. No. 27	Darika	88.00	12.00	7.33	22.00
Acc. No. 28	kalamsindhuri	89.00	11.00	8.09	16.00
Acc. No. 29	Misrikanto	78.00	22.00	3.54	24.00
Acc. No. 30	Miakhaoa	82.00	18.00	4.55	14.00
Acc. No. 31	BoroGutti	89.00	11.00	8.09	18.00
Acc. No. 32	sipiard	87.00	13.00	6.69	21.00
Acc. No. 33	SadaGutti	91.00	9.00	10.11	14.00
Acc. No. 34	Chongafazli	75.00	25.00	3.00	27.00
Acc. No. 35	Nora	89.00	11.00	8.09	23.00
Acc. No. 36	Modhochoski	87.00	17.00	6.69	30.00
Acc. No. 37	Ranibhog	88.00	12.00	7.33	28.00
Acc. No. 38	Kohitor	79.00	21.00	3.76	27.00
Acc. No. 39	Golapkhas	81.00	19.00	4.26	25.00
Acc. No. 40	Dudsor	78.00	22.00	3.54	31.00
Acc. No. 41	Gutti-1	78.00	22.00	3.54	14.00
Acc. No. 42	Gutti-2	83.00	17.00	4.88	16.00
Acc. No. 43	Gutti-3	88.00	12.00	7.33	21.00
Acc. No. 44	Gutti-4	79.00	21.00	3.76	19.00
Acc. No. 45	Gutti-5	87.00	13.00	6.69	27.00
Acc. No. 46	Gutti-6	91.00	9.00	10.11	25.00
Acc. No. 47	Gutti-7	89.00	11.00	8.09	20.00
Acc. No. 48	Gutti-8	72.00	28.00	2.57	18.00
Acc. No. 49	Gutti-9	82.00	18.00	4.55	22.00
Acc. No. 50	Gutti-10	87.00	13.00	6.69	17.00
Acc. No. 51	Gutti-11	90.00	10.00	9.00	28.00
Acc. No. 52	Gutti-12	91.00	9.00	10.11	17.00
Acc. No. 53	Gutti-13	88.00	12.00	7.33	16.00
Acc. No. 54	Gutti-14	85.00	15.00	5.66	15.00
Acc. No. 55	Gutti-15	81.00	19.00	4.26	14.00
Acc. No. 56	Gutti-16	88.00	12.00	7.33	20.00
Acc. No. 57	Gutti-17	91.00	9.00	10.11	16.00
Acc. No. 58	Gutti-18	93.00	7.00	13.00	14.00
Acc. No. 59	Gutti-19	92.00	8.00	11.50	19.00
Acc. No. 60	Gutti-20	90.00	10.00	9.00	15.00
Average		84.92	15.15	6.81	21.25
LSD _{0.05}		1.60	1.10	0.29	1.50
LSD _{0.01}		2.11	1.45	0.39	1.98
Level of significance		**	**	**	**

B. pyramid = Broadly pyramid

Fruit characteristics

The mango germplasm has a different fruit weight. The highest fruit weight was observed in the germplasm Fazli (760 g) and the lowest fruit weight was recorded in the germplasm Modhochoski 128.50 g (Table 5). Bhuyan and Islam (1989) evaluated five mango germplasm and they observed in fruit weight ranged from (208.00-654.44 g) [12]. There was significant variation among the germplasm with the length of the fruit. It ranged from 7.27 cm to 15.17

cm. The longest fruit length was observed in the germplasm Fazli (15.17 cm) and the shortest fruit length was recorded in the germplasm Miakhaoa 7.27 cm (Table 5). Bhuyan and Islam (1989) evaluated five mango germplasm they observed in fruit lengths ranging from (8.60-13.87 cm) [12]. The highest fruit breadth was observed in the germplasm SadaGutti (31.40 cm) and the shortest fruit breadth was recorded in the germplasm ChongaFazli 4.67 cm (Table 5). Different germplasm showed a significant variation in the thickness of the fruit. It ranged from 4.47 cm to 9.33 cm. The highest fruit thickness was observed in the germplasm Fazli (9.33 cm) and the shortest fruit was recorded in the germplasm Chongafazli 4.47 cm (Table 5). Most of the germplasm was observed that the fruit shape oblong, Khodikhirsas, BoglaGutti, Batasa, Mohonbhog, and Nora was found round and Kachamithi, Kalibhog, Chongafazli was found elliptic. The mango germplasm has different fruit (mature) colour, most of the germplasm was found to have light green, Khirsapat, Khodikhirsas, Kalua, Kaiadp was found deep green and Sindhuri, Kalamsindhuri was found light red. The color of the ripened fruit was observed as light green, greenish yellow, light red and yellow, most of the germplasm was found to have yellow light green Fazly, Shormafazly, Khodikhirsas, Gutti-6, Gutti-12 was found Greenish yellow and Sindhuri, Kalamsindhuri was found reddish yellow and light red respectively. Skin weight varied significantly among mango germplasm, it ranging from 23.57 gm to 98.50 gm (Table 7). The highest skin weight was observed in the germplasm Gutti-19 (98.50gm) and the lowest skin weight was recorded in the germplasm Kaidp 23.57gm (Table 5) and Skin thickness was observed as very thick, medium thick, thick and thin. Most of the germplasm was found to have thick and thin, Khirsapat was medium thick and Kalamsindhuri, Gutti-10, 17, 19 and Golapphas (Table 5).

Table 5. Fruit characteristics of mango in respect of fruit weight, length, breadth, fruit thickness and skin weight.

Acc. No.	Gerpalsm	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Fruit thickness	Skin weight(g)
MI-1	Fazli	760.10	15.17	9.87	9.33	92.93
MI-2	Shormafazli	557.00	14.00	9.00	8.13	56.73
MI-3	Khirsapat	294.03	9.37	7.67	6.79	41.60
MI-4	khodikhirsapat	170.60	7.37	6.77	6.00	36.00
MI-5	Gopalbhog	187.23	8.53	6.50	6.03	41.30
MI-6	Langra	238.47	9.17	6.87	6.33	40.33
MI-7	Bombai	423.27	11.67	8.37	8.27	45.07
MI-8	Chainabombai	471.23	11.83	9.13	9.07	56.73
MI-9	Kachamithi	268.13	11.70	6.87	5.97	45.77
MI-10	Ashina	596.03	14.60	9.33	8.07	79.30
MI-11	Kuapahari	265.23	9.97	7.30	6.33	49.33
MI-12	Kalua	380.97	10.63	7.93	7.30	33.33
MI-13	Kali vog	304.20	12.33	6.80	6.20	29.87
MI-14	BoglaGutti	269.63	8.40	8.13	6.63	27.67
MI-15	Batasa	237.00	8.70	7.10	6.23	39.67
MI-16	Mohonvog	366.33	9.70	8.37	7.63	71.50
MI-17	Lokhonvog	451.77	11.53	8.40	8.27	48.00
MI-18	Sindhuri	239.47	8.57	7.67	6.70	48.77
MI-19	Himsagor	274.53	8.70	7.20	7.30	49.43
MI-20	Dalvanga	290.27	11.30	7.03	6.50	52.20
MI-21	Lokhna	270.97	10.17	7.47	6.50	42.43

MI-22	Fonia	294.23	9.67	7.30	7.13	45.90
MI-23	Kaiadp	144.27	7.27	5.80	5.50	23.57
MI-24	Narikeli	204.57	9.00	6.60	6.03	35.60
MI-25	Brindaboni	176.07	7.93	6.40	6.20	25.67
Acc. No.	Gerpalsm	Fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Fruit thickness	Skin weight(g)
MI-26	Shamlota	423.03	12.20	8.93	7.20	56.23
MI-27	Darika	221.23	8.63	7.43	6.20	42.70
MI-28	Kalamsindhuri	324.63	10.47	7.40	7.37	63.30
MI-29	Misrikanto	186.53	9.47	5.90	5.10	29.00
MI-30	Miakhaoa	180.37	7.27	6.43	5.80	24.67
MI-31	BoroGutti	466.13	13.40	8.33	7.37	68.77
MI-32	Sipiard	168.13	9.47	5.63	5.43	41.23
MI-33	SadaGutti	255.63	9.67	31.40	6.80	54.33
MI-34	Chongafazli	142.17	11.43	4.67	4.47	25.53
MI-35	Nora	439.17	10.33	9.23	8.13	54.00
MI-36	Modhochoski	128.50	7.33	5.50	5.30	25.27
MI-37	Ranibhog	208.57	8.50	6.60	5.80	29.23
MI-38	Kohitor	335.70	9.40	7.57	7.27	64.67
MI-39	Golapphas	420.00	11.37	8.23	7.70	84.63
MI-40	Dudsor	231.37	11.43	6.45	5.60	49.17
MI-41	Gutti-1	177.40	9.03	5.53	5.67	32.53
MI-42	Gutti-2	249.10	9.17	7.00	6.80	49.27
MI-43	Gutti-3	324.63	9.90	7.97	7.43	57.17
MI-44	Gutti-4	211.43	8.67	6.47	6.37	33.50
MI-45	Gutti-5	311.83	11.13	7.33	7.07	45.20
MI-46	Gutti-6	244.23	9.77	6.77	6.23	30.13
MI-47	Gutti-7	231.63	8.83	6.57	6.90	37.60
MI-48	Gutti-8	308.07	10.23	7.30	7.33	47.43
MI-49	Gutti-9	254.57	11.40	6.50	5.73	42.70
MI-50	Gutti-10	473.20	12.93	8.47	7.77	89.80
MI-51	Gutti-11	468.00	12.07	8.47	8.00	73.47
MI-52	Gutti-12	417.93	14.07	9.20	7.40	80.97
MI-53	Gutti-13	181.80	8.67	6.20	5.73	43.37
MI-54	Gutti-14	230.17	10.10	6.57	6.13	43.43
MI-55	Gutti-15	382.63	11.60	8.20	7.40	75.37
MI-56	Gutti-16	205.23	9.57	5.93	5.50	26.13
MI-57	Gutti-17	540.33	11.83	9.17	8.63	64.63
MI-58	Gutti-18	328.70	10.60	7.33	7.67	50.30
MI-59	Gutti-19	638.03	13.63	9.10	8.73	98.50
MI-60	Gutti-20	322.63	9.97	7.47	7.17	47.00
Average		312.81	10.35	7.79	6.83	49.00
LSD _{0.05}		46.84	0.69	0.36	0.32	2.82
LSD _{0.01}		61.94	0.92	0.48	0.43	3.73
Level of significance		**	**	**	**	**

Pulp characteristics

The Pulp characteristics like pulp texture, colour, adherence to the pulp, pulp weight, pulp/peel ratio and Total soluble solid (TSS) were recorded and the results have been presented in Table 8. Most of the pulp texture of mango germplasm was juicy (Fazli, Shormafazli, Khirsapat, Khudikhirs, langra, Batasa, Brindaboni) and Ranibhog was firm. The color of the pulp was observed yellow and orange, and most of the germplasm was found to have yellow (Bombai, Chainabombai, Kachamiti, Ashina, Himsagor, Dudzor. Gopalbhog

and Golapkhas was orange. Most of the germplasm was adherence to pulp present and someone was absent. Pulp weight varied significantly among mango germplasm. It ranged from 73.67 g to 620.70 g. The highest pulp weight was observed in the germplasm Fazli (620.70 g) and the lowest skin weight was recorded in the germplasm Chongafazli 73.67 g (Table 6). The pulp and peel ratio of the fruits varied from 2.21 to 8.84 among the 60 mango germplasm. The highest ratio was observed in Kalua (8.84). The germplasm Sipiard had the lowest (2.21) ratio. Total soluble solids contents of mango fruits were measured at the ripening stage and presented in Table 9. It was observed that the variation in TSS among different mango germplasm. The ripened mango contained the highest TSS in the germplasm Khirsapat (24.33 %) and the lowest in the germplasm Gutti-6 (11.30%). Bhuyan and Islam (1989) evaluated five mango germplasm they observed in TSS ranging from (17.47-22.63) [12].

Stone characteristics

Different germplasm concerning fruit stones were observed to vary from variety to variety. The stone characteristics like stone weight, length, breadth, thickness, veins on stone and fiber were recorded and the results have been presented in Table 10. Stone weight varied among mango germplasm, it ranging from 21.43g to 69.87 g. The highest stone weight was observed in the germplasm Fazli (69.87g) and the lowest stone weight was recorded in the germplasm Khodikhirsapata 21.43 g (Table 6). The stone length differed significantly among the 60 mango germplasm. It ranged from 5.70 cm to 13.03 cm. The longest stone length was observed in the germplasm Ashina (13.03 cm) and the shortest stone length was recorded in the germplasm Modhochoski (5.70 cm (Table 6). Bhuyan and Islam (1989) evaluated five mango germplasm they observed in stone lengths ranging from (6.88-12.22 cm) [12]. A highly significant variation was manifested among the 60 mango germplasm. It ranged from 3.00 cm to 5.37 cm. The highest stone breadth was observed in the germplasm Fazli (5.37 cm) and the shortest stone breadth was recorded in the germplasm Kaidp 4.67 cm (Table 6). Stone thickness varied significantly among the 60 mango germplasm. It ranged from 1.60 cm to 9.07 cm. The highest stone thickness was observed in the germplasm Gutti-5 (9.07 cm) and the shortest stone was recorded in the germplasm Fonia 1.60 cm (Table 6). Veins on the stone were observed as elevated, depressed and level. Most of the mango germplasm was elevated and level and minimum germplasm was depressed. All mango germplasm was observed present fiber in the stone.

Table 6. Pulp and Stone characteristics of mango in respect of Pulp weight, Pulp peel ratio, TSS, stone weight, length, breadth and thickness.

Acc. No.	Germplasm	Pulp weight (g)	Pulp/peel ratio	TSS (%)	Stone weight (g)	Stone length (cm)	Stone breadth (cm)	Stone thickness (cm)
MI-1	Fazli	620.70	6.70	16.50	69.87	11.67	5.37	2.27
MI-2	Shormafazli	452.10	7.95	18.50	48.17	11.93	4.73	1.83
MI-3	Khirsapat	208.37	4.99	24.33	44.07	7.67	4.43	2.20
MI-4	khodikhirsapat	113.17	3.14	16.33	21.43	5.87	3.30	1.97
MI-5	Gopalbhog	109.23	2.64	21.57	36.70	7.03	3.73	2.17
MI-6	Langra	169.37	4.20	15.33	28.77	7.63	3.77	2.07
MI-7	Bombai	345.80	7.66	21.33	32.40	9.20	3.40	1.83
MI-8	Chainabombai	375.57	6.60	22.33	38.93	8.87	3.87	2.10

MI-9	Kachamithi	179.67	3.92	14.33	42.70	10.97	4.40	2.10
MI-10	Ashina	472.23	5.95	20.67	44.50	13.03	4.87	1.70
MI-11	Kuapahari	169.57	3.43	16.27	46.33	8.83	3.87	2.20
MI-12	Kalua	294.77	8.84	14.33	52.87	8.73	4.50	2.10
Acc. No.	Germplasm	Pulp weight (g)	Pulp/peel ratio	TSS (%)	Stone weight (g)	Stone length (cm)	Stone breadth (cm)	Stone thickness (cm)
MI-13	Kalivog	225.00	7.52	14.53	49.33	10.73	4.07	2.20
MI-14	BoglaGutti	193.97	7.03	13.47	48.00	6.80	4.67	2.27
MI-15	Batasa	135.73	3.42	16.27	61.60	7.70	4.30	2.97
MI-16	Mohonvog	246.53	3.44	16.27	48.30	8.37	3.83	2.40
MI-17	Lokhonvog	364.87	7.60	15.33	38.90	9.93	4.20	2.03
MI-18	Sindhuri	151.47	3.10	20.33	39.23	7.40	4.23	2.20
MI-19	Himsagor	193.03	3.90	18.67	32.07	7.07	4.20	2.07
MI-20	Dalvanga	182.30	3.49	12.50	55.77	9.30	3.80	2.37
MI-21	Lokhna	195.57	4.61	12.50	32.97	7.50	4.00	1.77
MI-22	Fonia	220.30	4.80	11.33	28.03	7.30	3.50	1.60
MI-23	Kaiadp	94.60	4.01	17.50	26.10	5.97	3.00	1.87
MI-24	Narikeli	132.73	3.73	16.60	36.23	7.27	4.03	2.20
MI-25	Brindaboni	126.93	4.93	14.17	23.47	6.43	3.17	1.77
MI-26	Shamlota	304.27	5.40	15.00	62.53	10.33	5.27	2.40
MI-27	Darika	143.90	3.37	16.60	34.63	7.07	4.30	2.17
MI-28	Kalamsindhuri	213.10	3.36	11.33	48.23	8.70	3.73	2.20
MI-29	Misrikanto	122.80	4.27	18.67	34.73	7.40	3.17	2.03
MI-30	Miakhaoa	118.63	4.81	13.33	37.07	7.90	3.20	1.90
MI-31	BoroGutti	332.13	4.83	15.47	65.23	11.53	4.37	2.40
MI-32	Sipiard	91.13	2.21	15.33	35.77	6.30	3.33	2.37
MI-33	SadaGutti	163.23	3.00	15.41	38.07	7.77	3.40	1.97
MI-34	Chongafazli	73.67	2.88	16.10	42.97	10.60	3.23	2.30
MI-35	Nora	336.73	6.23	13.17	48.43	8.60	5.13	2.07
MI-36	Modhochoski	79.97	3.16	14.17	23.27	5.70	3.00	1.73
MI-37	Ranibhog	141.43	4.84	15.47	37.90	7.10	3.90	1.97
MI-38	Kohitor	231.53	3.58	18.56	39.50	7.50	3.60	1.90
MI-39	Golapphas	271.77	3.21	15.53	63.60	9.70	4.43	2.17
MI-40	Dudsor	143.93	2.92	16.60	38.27	10.53	4.20	1.80
MI-41	Gutti-1	103.63	3.17	17.60	41.23	8.10	3.13	2.13
MI-42	Gutti-2	160.80	3.26	15.60	39.03	7.97	3.43	2.00
MI-43	Gutti-3	211.20	3.69	14.60	56.27	8.50	4.17	2.23
MI-44	Gutti-4	144.90	4.33	22.17	33.03	7.30	3.57	2.07
MI-45	Gutti-5	223.80	4.95	15.47	42.83	9.30	3.60	9.07
MI-46	Gutti-6	177.83	5.90	14.60	36.27	8.13	3.20	2.00
MI-47	Gutti-7	161.73	4.31	15.47	32.30	7.50	3.80	2.17
MI-48	Gutti-8	217.70	4.60	12.50	42.93	8.63	3.30	2.07
MI-49	Gutti-9	154.73	3.62	13.47	57.13	11.40	4.20	2.07
MI-50	Gutti-10	347.37	3.86	13.52	36.03	10.37	3.80	2.03
MI-51	Gutti-11	356.60	4.85	20.47	37.93	9.63	4.13	2.20
MI-52	Gutti-12	294.57	3.64	16.40	42.40	11.73	4.53	2.30
MI-53	Gutti-13	105.87	2.44	18.58	32.57	7.53	3.60	2.10
MI-54	Gutti-14	153.93	3.53	12.47	32.80	8.37	3.37	2.00
MI-55	Gutti-15	270.93	3.60	13.53	36.33	9.67	4.20	1.97
MI-56	Gutti-16	142.53	5.43	11.30	36.57	7.90	3.63	2.07
MI-57	Gutti-17	425.73	6.57	14.41	49.97	9.60	3.60	2.40
MI-58	Gutti-18	233.00	4.61	19.33	45.40	8.70	4.20	2.17
MI-59	Gutti-19	476.87	4.84	15.47	62.67	11.80	4.80	2.60
MI-60	Gutti-20	216.50	4.60	19.48	59.13	8.30	4.20	2.50
Average		222.03	4.52	15.99	42.16	8.67	3.93	2.23
LSD _{0.05}		44.67	0.77	1.04	1.92	0.67	0.31	0.19
LSD _{0.01}		59.07	1.02	1.37	2.54	0.89	0.41	0.25

Level of significance		**	**	**	**	**	**	**
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