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## Evaluation of potentiality of mango (*Mangifera indica* L) genotypes for physical attributes of fruits

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#### Abstract

Evaluation of fruit crops has been successfully utilized for studying the performance of varieties under different agro climatic regions. The main aim of the research was to investigate the physical attributes of different mango genotypes at Horticultural College and Research Institute (TNAU), Periyakulam during 2017-18. Outcome of the present research work revealed that the maximum fruit weight (315.08 g), fruit width (9.20 cm), fruit volume (345 cc), stone weight (33.82 g), pulp weight (252.85 g), pulp percentage (80.25%), pulp to stone ratio (7.48:1) and pulp to peel ratio (8.90:1) was obtained in Au Rumani, while, the maximum fruit length (15.20 cm), stone length (8.36 cm) and stone width (4.48 cm) was recorded in Shajahan. The genotype Ratna was recorded significantly maximum specific gravity (1.76 g/cc). The maximum peel weight (29.86 g) and peel thickness (1.86 mm) was recorded significantly in Kundur Pacharisi and Sendhuram respectively; whereas, the maximum stone percentage (19.91%) and peel percentage (16.25%) was recorded in Kovankachi and P.K.Patti respectively. Hence, it can be concluded that the genotype Au Rumani was found superior in terms of pulp weight, fruit weight, pulp percentage, pulp to stone ratio and pulp to peel ratio.

**Keywords:** Evaluation, mango, genotypes, physical attributes

#### Introduction

Mango (*Mangifera indica* L.) is an important fruit crop of India belonging to the family Anacardiaceae and acknowledged as “King of Fruits”. It is the national fruit of India widely grown for its special features like high nutritive value, high productivity, processing potential, delicious taste and suitability in widely ecological amplitude. The genetic diversity within mango offers various opportunities to utilize these genomic resources and technologies to manipulate desirable traits. Assessment of genetic variation within natural populations and among breeding lines is crucial for effective conservation and exploitation of genetic resources for crop improvement programs. India has the richest germplasm collection and centre for cultivating mangoes. It occupies an area of 2.263 million hectares with an annual production of 19.68 million tonnes and the productivity is 8.71 MT/hac. The export potential of india is 52761 MT of fresh and dried products of mango with the benefit cost of Rs.44,366 Lacs. (APEDA, 2016-17) [4] The area, production and productivity of mango in TamilNadu is 160.49 thousand hac, 1.157 million tonnes and 7.19 MT/hac (India stat 2016-17) [10]. Different cultivars of mango varied in their performance and these differences are governed by various genetic, cultural and environmental factors. Most of the north Indian varieties, viz. Dashehari, Langra, Chausa and Bombay Green are alternate bearer, while, most of the South Indian varieties bear regularly (Pandey and Dinesh, 2010) [15]. Low productivity is the resultant effect of alternate bearing, inadequate fruit set followed by heavy fruit drop. The initial fruit set in mango is directly related to the proportion of perfect flowers (Singh *et al.*, 2015) [17].

Physical characteristics of mangoes may be explained by the differences between varieties and methodologies of analysis, the ripeness of the fruit when harvested and climatic differences between the regions they were produced. The proportion between pulp, skin and endocarp is strongly influenced by the variety. There are many discrepancies concerning the physical and chemical characteristics of mangoes. The proportion between pulp, skin and endocarp is strongly influenced by the variety and the soluble solids and titratable acidity ratio in mangoes. These characteristics are commonly used for evaluating flavour.

Study of physical and chemical characteristics of mango trees can help to identify the best varieties for consumption and industrialization. In general, processing industry prefers mangoes with a higher yield of pulp, high soluble solid content and lack of fiber. For fresh consumption, consumers prefer fruit with low acidity, high soluble solid content and lack of fibers. The fruit quality is attributed to its physical characteristics, especially the color of skin and fruit's shape and size. The quality attributes such as colour, shape, size and flavour should be maintained in newly evolved varieties so that India can increase its presence in the international market (Thulasiram *et al.*, 2016) [19]. However, all the cultivars are not suited for diverse climatic conditions. Some cultivars are preferred for their early or late ripening, while some are liked for the amount and quality of their fruit pulp. However, in the same region, different environmental conditions at different years can affect maturity and quality of the fruit (Devilliers, 1998) [8]. A large number of mango varieties are being grown in India, most of them do not satisfy the requirements of an ideal commercial variety and fail in competition with other countries. So, to work out physio-chemical attributes of different mango cultivars were taken for study. Therefore, evaluation of different mango cultivars for a given set of ecology is one of the pre-requisite for successful mango cultivation.

## Materials and Methods

The present investigation was conducted at The present investigation was conducted at Horticultural College and Research Institute (HC&RI) of TamilNadu Agricultural University, Periyakulam, Tamil Nadu, during the period of 2017 and 2018. The experiment was carried out on twenty seven mango genotypes namely, Alphonso, Amarapali, Arka Aruna, Au Rumani, Banganapalli, Duraipandi, Iswarya, Javari, Komangai, Kovankachi, Kundur Pacharisi, Kuruvi Neelum, Mallika, Malpacharisi, Mohandhas, Natham Palamani, Neelum, P.K.Patti, Pedharasam, PKM 1, PKM 2, Ratna, Samba Kooja, Shajahan, Sendhuram, Sindhu and Sundar Langra available at the experimental orchard of the Horticultural College and Research Institute (HC&RI), Periyakulam situated at 10.13° N latitude and 77.59° E longitude and at an altitude of 289 m above mean sea level. The mean maximum and minimum temperature were 36.6°C and 24°C respectively with mean relative humidity of 72.88 percent and the mean rainfall of 84.54 mm per annum. The nature of soil of the experimental plot is sandy loam with the pH of 7.8 and EC of 0.35 dsm<sup>-1</sup>. The experiment was carried out on healthy and bearing of 15 years old trees. The number of treatments were twenty seven and replicated thrice. The experiment was laid out in Randomized Block Design (RBD). The observations were recorded on physical attributes of fruit as length and width of the fruit (cm), length and width of the stone (cm), fruit weight (g), pulp weight (g), stone weight (g), peel weight (g), pulp percentage, stone percentage, peel percentage, peel thickness (mm), pulp to stone ratio and pulp to peel ratio. The data's were calculated by following formulas.

$$\text{Pulp percentage} = \frac{\text{Pulp weight (g)}}{\text{Fruit weight (g)}} \times 100$$

$$\text{Stone percentage} = \frac{\text{stone weight (g)}}{\text{Fruit weight (g)}} \times 100$$

$$\text{Peel percentage} = \frac{\text{Peel weight (g)}}{\text{Fruit weight (g)}} \times 100$$

Pulp: stone ratio (weight basis)

The ratio of pulp to stone was calculated as follows. (Keeping the stone weight as constant one).

$$\text{Pulp: stone ratio} = \frac{\text{Pulp weight}}{\text{Stone weight}} : \text{Stone weight}$$

Pulp: peel ratio (weight basis)

The ratio of pulp to peel was calculated as follows. (Keeping the peel weight as constant one).

$$\text{Pulp: peel ratio} = \frac{\text{Pulp weight}}{\text{Peel weight}} : \text{Peel weight}$$

## Result and Discussion

### Physical attributes of different mango genotypes

#### Fruit size (Length and width) (cm)

The maximum fruit length (15.20 cm) and fruit width (9.20 cm) was recorded significantly in shajahan and Au Rumani respectively; whereas, Kuruvi Neelum recorded the lowest fruit length (5.70 cm) and fruit width (3.20 cm) (Table 1). This result was in accordance with the findings of Singh *et al.* (2009) [18]. They reported that maximum fruit length (11.23 cm), fruit breadth (7.46 cm) and fruit weight (220.13 g) in mango cv. Fazli. The variations among the fruits of the mango for the fruit length and fruit width might be due to their environmental interaction and genetic makeup.

#### Weight of the fruit (g)

The genotype Au Rumani was recorded significantly maximum fruit weight (315.08 g); whereas, Samba kooja recorded the minimum fruit weight (119.56 g) (Table 1). Shirin *et al.* (2013) [16] recorded the maximum fruit weight (648.0 g) in different cultivars of mango which is in close proximity with the present study. The variations in the fruit weight depend upon the genetic makeup of an individual genotype and are highly influenced by environmental factors.

#### Fruit volume (cc) and Specific gravity (g/cc)

The genotype Au Rumani recorded significantly maximum fruit volume (345 cc); whereas, Kuruvi Neelum recorded the lowest fruit volume (115 cc) (Table 1). Tripathi (2000) [20] reported that the fruit weight and volume of cultivars *viz.*, Mallika, Nariyal, Fazli and Dadamiyan were more than 400 g and 400 cc per fruit, respectively among the 93 germplasm of mango studied in *Tarai* conditions which is in close proximity with the present study.

The genotype Ratna recorded significantly maximum specific gravity (1.76 g/cc); whereas, Komangai recorded the lowest specific gravity (0.72 g/cc) (Table 1). These results are in line with Bihari *et al.* (2012) [7]. They observed the significant variation for specific gravity which ranged from 0.81 to 1.06 among the fifty mango varieties.

#### Stone size (Length and width) (cm)

Stone size is an important character of mango as it determines the edible portion in the fruit. The genotype Shajahan recorded significantly maximum stone length (8.36 cm) and stone width (4.48 cm); whereas, Kuruvi Neelum recorded the minimum stone length (5 cm) and stone width (2.69 cm) (Table 2). Significant variation in stone length and width of different mango varieties were also reported by Kundu and Ghosh (1992) [12] and Abirami *et al.* (2004) [1]. This variation in stone characteristics might be due to difference in environmental interaction and genetic composition.

**Stone weight (g)**

Highly significant variation was recorded in selected genotypes of mango for stone weight. Au Rumani was noted significantly maximum stone weight (33.82 g); whereas, minimum stone weight was recorded in Samba Kooja (15.38 g) (Table 2). The present findings related to stone weight are also in accordance with the results of Jilani *et al.* (2010) [11] and Anila and Radha (2005) [3], who observed that stone weight ranged from 22.99 g to 47.07 g in four varieties and two hybrids *viz.*, Alphonso, Prior, Muvandan, Neelum and hybrids Ratna (Neelum x Alphonso) and H-151 (Kalapady x Neelum). Variation in stone weight may be due to soil, environmental conditions and genetic influence.

**Pulp weight (g)**

The genotype Au Rumani was recorded significantly maximum pulp weight (252.85 g; whereas, Samba kooja (91.80 g) recorded the lowest pulp weight (91.8 g) (Table 2). This confirms with the findings of previous workers Bains and Dhillon (1999) [5], Kundu and Ghosh (1992) [12] and Dhillon *et al.* (2004) [9].

**Peel weight (g)**

The genotype Kundur pacharisi was recorded significantly maximum peel weight (29.86 g); whereas, Samba kooja recorded the lowest peel weight (12.38 g) (Table 2). The present findings related to peel weight are also in accordance with the results of Anila and Radha (2003) [3] and Bakshi and Bajwa (1959) [6].

**Peel thickness (mm)**

The maximum peel thickness (1.86 mm) was recorded significantly in Sendhuram which was highest among the investigated genotypes, while the minimum peel thickness (0.84 mm) was recorded in Samba kooja (Table 2). Similar trends of results were also obtained by Mannan *et al.* (2003) [14], who reported the range of peel thickness varied from 1.48 mm to 2.72 mm in different mango varieties *viz.*, Amrapali, Fazli, Neelambari, Indian Tota and Madrazi Tota. Peel

thickness provides a protection against fruit fly and help to reduce post-harvest losses, however this fact could increase the difficulty of removing peel before processing.

**Pulp, Stone and Peel content (%)**

Genotypes of mango differed significantly with respect to pulp percentages. The maximum pulp percentage was recorded significantly in Au Rumani (80.25%); whereas, minimum pulp percentage was recorded in Malpacharisi (66.41%). The data on stone percentage showed significant differences among the genotypes evaluated. Genotype Kovankachi recorded significantly maximum stone percentage (19.91%); whereas, the lowest stone percentage was recorded in Au Rumani (10.73%).

The data for peel percentage showed significant variation among the genotypes. Genotype P.K.Patti was recorded significantly maximum peel percentage (16.25%); whereas, minimum peel percentage was observed in Au Rumani (9.02%) (Table 3). These findings are in accordance with Abourayya *et al.* (2011) [2] who studied the physical and chemical characteristics at maturity stage of mango cv. Tommy Atkins, Keitt and Kent mango grown under Nubariya conditions. Among these, cv. Keitt exhibited the highest pulp percentage (81.60%) followed by cv. Kent (77.47%), while, cv. Tommy Atkins recorded the highest peel percentage (15.82%) followed by cv. Kent (11.86%) and cv. Tommy Atkins showed the highest stone percentage (12.8%) followed by cv. Kent (10.67%).

**Pulp: stone ratio and Pulp: peel ratio**

The genotype Au rumani was recorded significantly maximum pulp to stone ratio (7.48:1) and pulp to peel ratio (8.90:1); whereas, the lowest pulp to stone ratio (3.44:1) and pulp to peel ratio (4.18:1) was recorded in Kovankachi and P.K. Patti respectively (Table 3). These findings are in accordance with Chatterjee *et al.* (2005) who recorded the maximum stone/pulp ratio (4.63) in Langra. Variation in stone size was also investigated by Kundu and Ghosh (1992) [12] and Majumder *et al.* (2011) [13].

**Table 1:** Mean performance of mango genotypes for fruit physical characters

S. No.	Genotypes	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Fruit volume (cc)	Specific gravity (g/cc)
1	Alphonso	11.00*	7.50*	230.86*	220.00*	1.05*
2	Amarapali	12.20*	7.10*	227.89*	215.00*	1.06*
3	Arka Aruna	11.00*	7.30*	264.10*	335.00*	0.79
4	Au Rumani	12.00*	9.20*	315.08*	345.00*	0.91
5	Banganapalli	12.30*	7.40*	244.96*	262.50*	0.93
6	Duraipandi	15.00*	8.20*	234.62*	280.00*	0.84
7	Iswarya	13.00*	6.60	250.52*	240.00*	1.04*
8	Javari	10.30	6.50	165.89	195.00	0.85
9	Komangai	10.00	6.00	146.58	205.00*	0.72
10	Kovankachi	9.20	6.40	143.46	157.50	0.91
11	Kundur Pacharisi	13.00*	8.40*	268.00*	227.50*	1.18*
12	Kuruvi Neelum	5.70	3.20	138.38	115.00	1.20*
13	Mallika	13.10*	6.70*	254.76*	225.00*	1.13*
14	Malpacharisi	10.00	7.00*	145.47	136.50	1.07*
15	Mohandhas	9.80	6.50	148.64	158.70	0.94
16	Natham Palamani	11.00*	7.10*	185.08	160.00	1.16*
17	Neelum	12.00*	7.00*	200.07*	220.00*	0.91
18	P.K.Patti	11.00*	7.40*	155.55	205.00*	0.76
19	Pedharasam	10.10	6.80*	171.01	155.00	1.10*
20	PKM 1	13.00*	7.00*	237.86*	202.50*	1.17*
21	PKM 2	14.00*	7.20*	208.42*	185.00	1.13*
22	Ratna	11.20*	7.10*	254.88*	145.00	1.76*
23	Samba Kooja	7.80	4.60	119.56	122.50	0.98*
24	Sendhuram	12.00*	7.80*	225.63*	212.50*	1.06*

25	Shajahan	15.20*	8.20*	298.57*	335.00*	0.89
26	Sindhu	12.00*	7.30*	225.88*	235.00*	0.96
27	Sundar Langra	10.20	7.30*	235.01*	240.00*	0.98*
	Mean	10.24	6.29	189.89	191.17	0.92
	CD at 5%	0.45	0.29	8.17	9.17	0.04
	SE.m	0.16	0.10	2.88	3.23	0.02
	SE.d	0.23	0.14	4.07	4.60	0.02
	CV (%)	2.69	2.85	2.63	2.95	2.81

\*-Significant at 5%

**Table 2:** Mean performance of mango genotypes for Stone, pulp and peel characters

S. No.	Genotypes	Stone length (cm)	Stone width (cm)	Stone weight (g)	Pulp weight (g)	Peel weight (g)	Peel thickness (mm)
1	Alphonso	6.25*	3.54*	28.37*	176.75*	25.74*	1.26
2	Amarapali	6.67*	3.1	32.67*	168.54*	26.68*	1.2
3	Arka Aruna	7.15*	3.98*	31.46*	206.16*	26.48*	1.44*
4	Au Rumani	6.51*	3.22	33.82*	252.85*	28.41*	1.68*
5	Banganapalli	7.27*	4.23*	28.82*	189.67*	26.47*	1.25
6	Duraipandi	7.96*	3.37*	31.28*	179.56*	23.78*	1.84*
7	Iswarya	6.75*	3.24	27.58*	196.45*	26.49*	1.42*
8	Javari	5.32	3.48*	23.71	123.53	18.65	1.04
9	Komangai	6.52*	3.72*	26.34*	98.46	21.78	1.26
10	Kovankachi	5.36	3.60*	28.56*	98.32	16.58	1.24
11	Kundur Pacharisi	6.67*	3.42*	32.28*	205.86*	29.86*	1.34*
12	Kuruvi Neelum	5	2.69	16.84	102.27	19.27	0.99
13	Mallika	7.31*	3.90*	29.24*	198.87*	26.65*	1.11
14	Malpacharisi	6.52*	3.65*	27.53*	96.6	21.34	1.49*
15	Mohandhas	5.89	3.27*	18.29	113.86	16.49	0.93
16	Natham Palamani	6.96*	3.60*	25.38*	134.88	24.82*	1.49*
17	Neelum	6.38*	3.78*	24.47	153.24*	22.36*	1.33*
18	P.K.Patti	6.97*	3.29*	24.58	105.7	25.27*	1.39*
19	Pedharasam	5.86	3.29*	24.83	123.64	22.54*	1.55*
20	PKM 1	7.72*	3.67*	26.46*	187.65*	23.75*	1.49*
21	PKM 2	7.84*	3.24	25.63*	158.96*	23.83*	1.33*
22	Ratna	6.32*	3.42*	27.73*	201.56*	25.59*	1.31*
23	Samba Kooja	5.18	2.72	15.38	91.8	12.38	0.84
24	Sendhuram	6.42*	3.90*	26.53*	174.28*	24.82*	1.86*
25	Shajahan	8.36*	4.48*	33.76*	235.43*	29.38*	1.35*
26	Sindhu	6.66*	3.42*	26.23*	174.79*	24.86*	1.52*
27	Sundar Langra	6.32*	3.43*	27.38*	183.27*	24.36*	1.40*
	Mean	5.94	3.16	24.17	144.43	21.29	1.21
	CD at 5%	0.3	0.12	1.15	7.06	0.99	0.06
	SE.m	0.11	0.04	0.4	2.49	0.35	0.02
	SE.d	0.15	0.06	0.57	3.52	0.5	0.03
	CV (%)	3.08	2.4	2.89	2.98	2.84	3.03

\*-Significant at 5%

**Table 3:** Mean performance of mango genotypes for stone, pulp and peel characters in % and ratio

S. No.	Genotypes	Pulp %	Stone %	Peel %	Pulp to stone ratio	Pulp to peel ratio
1	Alphonso	76.56*	12.29	11.15*	6.23:1*	6.87:1*
2	Amarapali	73.96*	14.34*	11.71*	5.16:1	6.32:1
3	Arka Aruna	78.06*	11.91	10.03	6.55:1*	7.79:1*
4	Au Rumani	80.25*	10.73	9.02	7.48:1*	8.90:1*
5	Banganapalli	77.43*	11.77	10.81	6.58:1*	7.17:1*
6	Duraipandi	76.53*	13.33*	10.14	5.74:1*	7.55:1*
7	Iswarya	78.42*	11.01	10.57	7.12:1*	7.42:1*
8	Javari	74.47*	14.29*	11.24*	5.21:1	6.62:1*
9	Komangai	67.17	17.97*	14.86*	3.74:1	4.52:1
10	Kovankachi	68.53	19.91*	11.56*	3.44:1	5.93:1
11	Kundur Pacharisi	76.81*	12.04	11.14*	6.38:1*	6.89:1*
12	Kuruvi Neelum	73.91*	12.17	13.93*	6.07:1*	5.31:1
13	Mallika	78.06*	11.48	10.46	6.80:1*	7.46:1*
14	Malpacharisi	66.41*	18.92*	14.67*	3.51:1	4.53:1
15	Mohandhas	76.60*	12.30	11.09*	6.23:1*	6.90:1*
16	Natham Palamani	72.88*	13.71*	13.41*	5.31:1	5.43:1
17	Neelum	76.59*	12.23	11.18*	6.26:1*	6.85:1*
18	P.K.Patti	67.95	15.80*	16.25*	4.30:1	4.18:1
19	Pedharasam	72.30*	14.52*	13.18*	4.98:1	5.49:1
20	PKM 1	78.89*	11.12	9.98	7.09:1*	7.90:1*

21	PKM 2	76.27*	12.30	11.43*	6.20:1*	6.67:1*
22	Ratna	79.08*	10.88	10.04	7.27:1*	7.88:1*
23	Samba Kooja	76.78*	12.86*	10.35	5.97:1*	7.42:1*
24	Sendhuram	77.24*	11.76	11.00*	6.57:1*	7.02:1*
25	Shajahan	78.85*	11.31	9.84	6.97:1*	8.01:1*
26	Sindhu	77.38*	11.61	11.01*	6.66:1*	7.03:1*
27	Sundar Langra	77.98*	11.65	10.37	6.69:1*	7.52:1*
	Mean	67.85	11.81	10.35	5.35:1	6.05:1
	CD at 5%	2.680	0.520	0.480	0.220	0.310
	SE.m	0.95	0.18	0.17	0.08	0.11
	SE.d	1.34	0.26	0.24	0.11	0.15
	CV (%)	2.42	2.68	2.84	2.5	3.08

\*-Significant at 5%

### Conclusion

Based on the present findings, it can be concluded that the mango genotype Au Rumani was found superior in terms of fruit weight, pulp weight, pulp percentage, pulp to stone ratio and pulp to peel ratio.

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### References

1. Abirami K, Nachegowda V, Reddy YTN. Physico-chemical attributes of certain polyembryonic varieties of mango. *South Indian Hort.* 2004; 52(1-6):291-296.
2. Abourayya MS, Kassim NE, Sheikh MH, Rakha AM. Fruit physical and chemical characteristics at maturity stage of Tommy Atkins, Keitt, Kent mango cultivars grown under Nubariya conditions. *J Amer. Sci.* 2011; 7(3):228-233.
3. Anila R, Radha T. Physico-chemical analysis of mango varieties under Kerala conditions. *J Trop. Agri.* 2003; 41(1-2):20-22.
4. APEDA Agri exchange, Ministry of commerce and Industry, Govt of India, 2016-17.
5. Bains KS, Dhillon WS. Physico-chemical characters of different mango (*Mangifera indica* L.) cultivars grown under sub-montaneous conditions of Punjab. *Haryana J Horticult. Sci.* 1999; 28(3-4):174-176.
6. Bakshi JC, Bajwa BS. Studies on varietal differences in fruit quality of the mango varieties grown in the Punjab. *Indian J Hort.* 1959; 16: 216-220.
7. Bihari M, Kumar R, Singh K, Kumar AP, Narayan S, Pandey SKN. Quality parameters studies on *Mangifera* genus and varieties. *Indian J Hort.* 2012; 69(2):272-276.
8. Devilliers EA. The cultivation of mango, Institute of Tropical and Subtropical Fruits, 1998, 28-30.
9. Dhillon WS, Sharma RC, Kahlon GS. Evaluation of some mango varieties under Punjab conditions. *Haryana J Horticult. Sci.* 2004; 33(3/4):157-159.
10. India Stat. Minister of state, Dept. of statistics, Planning and Public Grievances, Govt. of India, 2016-17.
11. Jilani MS, Bibi F, Waseem K, Khan MA. Evaluation of physico-chemical characteristics of mango (*Mangifera indica* L.) cultivars. *J Agri. Res.* 2010; 48(2):201-207.
12. Kundu S, Ghosh SN. Studies on physico-chemical characteristics of mango cultivars grown in lateritic tract of West Bengal. *Haryana J Horticult. Sci.* 1992; 21(3-4):129-134.
13. Majumder DAN, Hassan L, Rahim MA, Kabir MA. Studies on physiormorphology, floral biology and fruit characteristics of mango. *J Bangladesh Agri. Univ.* 2011; 9(2):187-199.
14. Mannan MA, Khan SAKU, Islam MR, Islam MS, Siddiq A. A study on the physico-chemical characteristics of some mango varieties in Khulna region. *Pakistan J Biol. Sci.* 2003; 6(24):2034-2039.
15. Pandey SN, Dinesh MR. Mango, Indian Council of Agricultural Research, New Delhi, 2010, 30-97.
16. Shirin F, Zuberi MI, Ghosh GP. Fruit characteristics of some locally important mango (*Mangifera indica* L.) cultivars at Chapai Nawabganj district. *Bangladesh J Biodiversity and Environ Sci.* 2013; 3(11):96-103.
17. Singh A, Singh CP, Singh AK. Flowering behaviour of mango genotypes under tarai conditions of uttarakhand. *Int. J Basic and Appl. Agri. Res.* 2015; 13(3):400-406.
18. Singh RK, Singh SK, Ojha RK, Singh C. Flowering and fruiting behaviour of different mango cultivars under Jharkhand condition. *Environment and Ecology.* 2009; 27(4B):213-215.
19. Thulasiram R, Alagumani T, Duraisamy MR. Preferences of quality attributes for mango export: A conjoint analysis approach. *Int. Res. J Agri. Economics and Statistics.* 2016; 7(1):42-47.
20. Tripathi SK. Evaluation of mango germplasm under Tarai condition of Pantnagar. Thesis, Ph.D. Horticulture. G.B. Pant Univ. Agric. Tech., Pantnagar, 2000.