# Comparative Study between Inflorescences Characteristics, Pollen Viability, Germination and Dimensions of Tommy Atkins, Kent and Keitt Mango Cultivars

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**Abstract:** The present study was conducted at orchard located at the side of Alexandria desert road (Cairo - Alexandria, Km. 140), at Nubariya region during 2007 and 2008 seasons. The three experimented mango cultivars were Tommy Atkins, Kent and Keitt. The trees of the three studied cultivars are grafted on seeded rootstocks, attained nine years old and grown in sandy Soil .Trees of all mango cvs. were planted at 3×5 meter apart and subjected to the same horticultural practices. The objective of the present study is comparing inflorescences characteristics, pollen viability, germination and dimensions of Tommy Atkins, Kent and Keitt cultivars grown under Nubaria conditions. There were significant differences among studied cultivars in the length of panicles. Keitt cv. was found to have longest panicle compared to the other cvs. Meanwhile the lowest value was found in Tommy Atkins cv. The highest value of panicle width was found in Keitt cv. meanwhile, the lowest value was found in Tommy Atkins cv. Keitt cv. had the highest Number of branches per panicle followed by Tommy Atkins cv. meanwhile Kent cv. had the lowest values. The highest number of flowers per panicle was found in Tommy Atkins cv. in the two seasons, meanwhile, the lowest value was found in Kent cv. Tommy Atkins cv. had the largest percentage of perfect flower per panicle followed by Kent cv. meanwhile Keitt cv. had lowerst percentage in the two seasons. The highest percentage of male flowers per panicle was detected in Kent cv. in the first season and Tommy Atkins in the second season. The lowest sex ratio was shown in Tommy Atkins cv. inflorescence in both seasons. Followed in a decreasing order by Keitt and Kent inflorescence. Keitt cv. was found to have the highest percentage of malformed panicles per tree, followed by Kent cv. while, Tommy Atkins cv. had the lowest percentage. Keitt cv. showed the highest percentage of pollen grains viability followed by Tommy Atkins and Kent cvs. Kent cv. recorded the highest percentage of pollen germination meanwhile, Keitt and Tommy Atkins cvs. recorded the lowest percentage of pollen germination in first season and Keitt cv. in second season. Pollen diameter was lower in Tommy Atkins cv. compered to Keitt and Kent cvs.

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**Keywords:** inflorescence characteristics, pollen viability germination and dimension, Tommy Atkins Kent and Keitt

## 1. Introduction

Mango (*Mangifera indica* L.) is one of the important fruits of the tropical and subtropical countries zone of the world. Mango grows on a wide range of climatic and soil conditions in the world where grows in Africa (Egypt, Nigeria, South Africa, *etc.*), Asia (India, Pakistan, Indonesia, *etc.*), Australia, North America and South America (Litz, 1997).

There are many factors that influence yield, maturity and quality of fruits the, same cultivar can attains different characteristics in different growing conditions. Even in the same region, different environmental conditions at different years can affect maturity and quality of the fruit (Devilliers, 1998).

Mango inflorescence is a pyramidal big flowering shoot called panicle, it's length varies from few inches to two - three feet. The inflorescence bears two types of nearly sessile flower, perfect (hermaphroditic) flowers and male (staminate) flowers. Number and percentage of distribution of both types of flowers per inflorescence vary according to many factors such as cultivar, year, and time of blooming, part of inflorescence, genetics and environment (Singh 1960).

The objective of the present study is comparing inflorescences characteristics, pollen viability, germination and dimensions of Tommy Atkins, Kent and Keitt cultivars grown under Nubaria conditions.

## 2. Materials and Methods

This study was carried out during two successive seasons (2007 and 2008) on three mango cultivars namely Tommy Atkins, Kent, and Keitt at a private orchard located in Nubariya at Alexandria at desert road (km. 140 Cairo – Alex), Beheira governorate, Egypt. The selected trees were about nine years old, budded on seedling rootstocks and planted at 3×5 meters apart, in sandy soil and irrigated by drip irrigation system.

Four branches, one year old on each tree, one towards each direction were chosen, and four

shoots from the current spring growth on each branch were labelled to carry out the following measurements:

Panicle characteristics

Three panicles of each replicate for each cultivar were chosen at random at the full bloom time to carry out the following measurements:

1. Panicle length (cm.)
2. Panicle width (cm.)
3. Panicle thickness (cm.)
4. Number of branches per panicle

Flower Sexuality

1. Number of flowers per panicle

Three panicles on each replicate for each cultivar were chosen at the full bloom time. Total number of flowers (male and perfect) per panicle was counted.

2. Percentage of perfect flowers per panicle

The percentage of perfect flowers on the same panicles were calculated as the following equation.

$$\frac{\text{No. of perfect flowers}}{\text{Total No. of flowers}} \times 100$$

3. Percentage of male flowers per panicle

The percentages of male flowers were calculated as the following equation:

$$\frac{\text{No. of male flowers}}{\text{Total No. of flower}} \times 100$$

4. Sex ratio (male/perfect flower)

Sex ratio was calculated as the following equation:

$$\frac{\text{No. of male flowers}}{\text{No. of perfect flowers}} \times 100$$

Pollen viability, germination and dimensions

1. Pollen grain viability

Pollen grain viability for each cv. was determined according to (Sharma and Bajpai, 1969).

2. Percentage of pollen grain germination

The percentage of pollen grain germination for each cv. was calculated as follows according to Fernandez – Escobar *et al*. (1983).

$$\frac{\text{No. of germinated pollen grain}}{\text{Total No. of pollen grains}} \times 100$$

3. Pollen diameter (µm)

Statistical analysis and comparison among means were made using L.S.D. test at 5% level according to Steel and Torrie (1980).

## 3. Results and Discussion

1. Panicle length

Data in Table (1) show that panicle length varied significantly according to three cultivars grown Nubariya region conditions in 2007 and 2008 seasons. Keitt cv. had the maximum length of panicles (38.75 cm. in 2007 season and 37.22 cm. in 2008 season) while, Kent cv. had the least length of panicles (27.50 cm. In 2007 season and 27.74 cm. in 2008 season); whereas Tommy Atkins cv. had as intermediate value (28.54 cm. in 2007 season and 28.97 cm. in 2008 season).

These results are in harmony with those obtained by Ahmed (2002), Ragab and Ahmed (2002), Hoda *et al*. (2003), Tawfik (2003) and Sweiden *et al*. (2007) who found that panicle length was varied according to different mango cvs.

2. Panicle width

Data in Table (1) indicate that panicle width varied significantly according to three cultivars grown Nubariya region conditions in 2007 season and 2008 seasons.

Keitt cv. had the maximum width of panicle (32.40 cm. in 2007 season and 30.88 cm. in 2008 season), while Tommy Atkins cv. had the minimum width of panicle (21.04 cm. in 2007 season and Kent cv. 21.05 cm. in 2008 season). The width of panicle in Kent cv. was in between.

Panicle thickness

Data presented in Table (1) revealed that panicle thickness varied significantly according to three mango cultivars grown under Nubariya region conditions in 2007 and 2008 seasons. Keitt cv. recorded the maximum values of panicle thickness (1.06 cm. in 2007 season and 1.05 cm. in 2008 season), while Kent cv. recorded the minimum values (0.95 in 2007 season and 0.87 cm. in 2008 season).

**4. Number of side branches per panicle**

Data in Table (1) show that Number side branches per panicle varied significantly according to three mango cultivars grown under Nubariya region conditions in 2007 and 2008 seasons.

Keitt cv. had the highest Number of branches per panicle (53.71 in 2007 season and 51.65 in 2008 season); meanwhile Kent cv. had the lowest values (48.69 in 2007 season and 48.58 in 2008 seasons).

Flower Sexuality

1. Number of flowers per panicle

Data presented in Table (2) show the number of flowers per panicle of three mango cultivars grown under Nubariya region conditions in 2007 and 2008 seasons.

There were significant differences among the studied cultivars in the averages number of flowers per panicle. The highest value of panicles flowers per panicle was detected in Tommy Atkins cv. in the two seasons (2205.00 in 2007 season and 2252.38 in 2008 season) followed by Keitt cv. (1628.48 in 2007 season and 1657.33 in 2008 season). Kent cv. registered the lowest value (1224.08 in 2007 season and 1279.08 in 2008 season).

The variation in total number of flowers per panicle among mango cvs. was announced by results of Shawky and Dahshan (1982), Ahmed (2002), Tawfik (2003) and Abd El-Hadi (2006) on various mango cvs. Many other workers reported that the total number of flowers per mango panicle varied according to many factors such as cultivar, year, time of blooming, genetics information and environment. (Singh 1960, Azzouz 1961, Chah 1964, El-Azzouni *et al*. 1965 and El-Kady 1973).

**Table 1. Inflorescences characteristics of the three mango cultivars grown under Nubariya rgion conditions in 2007 and 2008 seasons.**

| **Characteristics** | Cultivars | | |
|---|---|---|---|
| | **Tommy Atkins** | **Kent** | **Keitt** |
| **2007 season** | | | |
| **Panicle length (cm.)** | 28.54 b | 27.50 b | 38.75 a |
| **Panicle width (cm.)** | 21.04 b | 21.40 b | 32.40 a |
| **Panicle thickness (cm.)** | 0.96 a | 0.95 a | 1.06 a |
| **No. branches / panicle** | 49.66 b | 48.69 b | 53.71 a |
| **2008 season** | | | |
| **Panicle length (cm.)** | 28.97 b | 27.74 b | 37.22 a |
| **Panicle width (cm.)** | 2.94 b | 21.05 b | 30.88 a |
| **Panicle thickness (cm.)** | 0.91 b | 0.87 b | 1.05 a |
| **No. branches / panicle** | 50.55 a | 48.85 b | 51.65 a |

Mean having the same letter (s) in each row are insignificantly different at 5% level.

**Table 2. The number of flowers, Male flowers (%), perfect flowers (%) sex ratio and Malformed per tree (%) of three mango cultivar grown under Nubariya rgion conditions in 2007 and 2008 seasons**

| **Characteristics** | Cultivars | | |
|---|---|---|---|
| | **Tommy Atkins** | Kent | **Keitt** |
| **2007 season** | | | |
| No . flower per panicle | 2205.00 a | 1224.08 c | 1628.48 b |
| **Male flowers (%)** | 56.76 c | 64.85 a | 62.83 b |
| **Perfect flowers (%)** | 43.12 a | 36.16 b | 37.14 b |
| **Sex ratio** | 1.32 c | 1.86 a | 1.69 b |
| **Malformed panicle/ tree %** | 3.12 b | 4.61 b | 6.59 a |
| **2008 season** | | | |
| No . flower per panicle | 2252.33 a | 1279.08 c | 1657.33 b |
| **Male flowers (%)** | 57.81 b | 62.55 a | 63.42 a |
| **Perfect flowers (%)** | 42.18 a | 37.43 b | 36.53 b |
| **Sex ratio** | 1.36 b | 1.66 a | 1.73 a |
| **Malformed panicle/ tree %** | 2.77 b | 3.32 b | 5.3 a |

Mean having the same letter (s) in each row are insignificantly different at 5% level

2. Percentage of perfect flowers

Data presented in Table (2) show the percentage of perfect flowers of the three mango cultivars grown at Nubariya region conditions in 2007 and 2008 seasons. There were significant differences among the studied cultivars in the percentage of perfect flowers in the two seasons.

The highest percentage of perfect flowers was detected in Tommy Atkins cv. (43.12 in 2007 season and 42.18 % in 2008 season), followed by Kent cv. (36.16 % in 2007 season and 37.43 % in 2008 season) and Keitt cv. (37.14 % in 2007 season and 36.53 % in 2008 season) with insignificant differences between them in the two seasons of study.

These results are in agreement with those found by Singh (1954), Azzouz (1961), Bastawrous (1977), Kalyanasundaram (1978), Shawky and Dahshan (1982), Salem (1993), El-Masry (2001), Ahmed (2002), Tawfik (2003) and Abd El-Hadi

(2006) where significant differences were among cultivars in perfect flower percentages per panicle.

3. Percentage of male Flowers

Data in Table (2) show the percentage of male flowers of the three mango cultivars grown under Nubariya region conditions in 2007 and 2008 seasons. There were significant differences among studied cultivars in the percentage of male flowers.

The highest percentage of male flowers per panicle in 2007 season was detected in Kent cv. (64.85%). Followed by Keitt (62.83%) and Tommy Atkins (56.76%). In the second season, panicles of mango cvs. Keitt had the maximum percentage of male flower (63.42%), followed by Kent (62.55%) and Tommy Atkins (57.81%) cvs.

The minimum values were recorded in the panicle of mango cvs. Tommy Atkins in 2007 and 2008 seasons (56.76 and 57.81%).

These results are in agreement with those found by Shawky and Dahshan (1982), Salem (1993), Ahmed (2002) and Abd El-Hadi (2006) where significant differences were found among cultivars in percentage of male flowers.

4. Sex ratio (male/perfect flowers)

Data in Table (2) show the sex ratio in panicle of the studied three mango cultivars grown under Nubariya region conditions in 2007 and 2008 seasons.

Sex ratio in the panicle was significantly varied among the three mango cvs. The significant lowest sex ratio (more perfect flowers) was shown in Tommy Akins cv. inflorescence in both seasons (1.32 and 1.36, respectevely). Followed in a decreasing order by Keitt and Kent inflorescence.

The differences in sex ratio among the various mango cvs was confirmed by the results of El-Azzouni *et al*. (1965), Hassan (1970), Dahshan (1971), Rao and Bhandary (1976), Shawky *et al*. (1977), Hussein *et al.* (1989), Sukhvibul *et al*. (2000), El-Masry (2001), Ahmed (2002), Tawfik (2003), Abd El-Hadi (2006) and Sweidan *et al.* (2007).

Percentage of malformed panicles

Data in Table (2) indicated that Percentage of malformed panicles per tree varied significantly according to three cultivars grown under Nubariya region conditions in 2007 and 2008.

Malformed panicles occurred in the three studied mango cultivars grown under Nubariya conditions. Keitt cv. recorded the maximum percentage of malformed panicles per tree (6.59% in 2007 season and 5.30% in 2008 season), while Tommy Atkins cv. recorded the significant minimum percentage of malformed panicles per tree (3.12% in 2007 season and 2.77% in 2008 season).

Pollen viability, germination and dimensions

1. Pollen viability

Percentage of pollen viability determined by Acetocarmine dye-method showed significant differences among the three studied cultivars, i.e. Tommy Atkins, Kent and Keitt cvs. under Nubariya environments (Table 3) in the two studied seasons 2007 and 2008.

Data presented also show that the percentage of pollen grains viability indicated insignificantly differences among cultivars in 2007 season, while it significant in 2008 season.

Keitt cv. showed the highest percentage of pollen grains viability (71.67% in 2007 season and 70.00% in 2008 season) followed descendingly by Kent cv. (65.00% in 2007 season and 68.00% in 2008 season) then Tommy Atkins cv. (63.67% in 2007 season and 64.00% in 2008 season).

These results were in agreement with those found by Singh (1964), Dahshan (1971), El-Kady (1973), Deasi *et al*. (1986), El- Masry (2001), Tawfik (2003) and Abd El-Hadi (2006) that pollen grains viability percentages differed due to the cultivar.

2. Percentage of pollen germination

Data in Table (3) revealed that percentage of pollen germination varied insignificantly according to the three cultivars grown under Nubariya region conditions in 2007 and 2008 seasons. Kent cv. recorded the highest percentage of pollen germination (71.33% in 2007 season and 73.00% in 2008 season). Keitt and Tommy Atkins cvs. recorded the next percentage of pollen germination (70.33%) in 2007 season and Keitt cv. (69.67%) in 2008 season.

These results are in harmony with those obtained by Afify (1999), Afifi *et al.* (2000), Sukhvibul *et al.* (2000) who found that percentage of pollen germination was varied according to different mango cvs.

3. Pollen diameter

Data in Table (3) show pollen diameter of the three mango cultivars grown under Nubariya region conditions in 2007 and 2008 seasons. Pollen diameter varied insignificantly according to cultivars during the same seasons. Tommy Atkins and Keitt cvs. recorded higher pollen diameter (29 µm) in 2007 and 2008 seasons, than Kent cv. as it recorded insignificantly lower Pollen diameter (28 µm) in 2007 and 2008 seasons.

**Table 3.The pollen grains viability (%), germination (%) and diameter (µm) of the three mango cultivar grown under Nubariya rgion conditions in 2007 and 2008 seasons .**

| Characteristics | Cultivars | | |
|---|---|---|---|
| | **Tommy Atkins** | **Kent** | **Keitt** |
| 2007 season | | | |
| **Pollen viability (%)** | 63.67 a | 65.00 a | 71.67 a |
| **Pollen germination (%)** | 70.33 a | 71.33 a | 70.33 a |
| **Pollen diameter (µm)** | 29.00 a | 28.0 a | 29.00 a |
| 2008 season | | | |
| **Pollen viability (%)** | 64.00 b | 68.00 a | 70.00 a |
| **Pollen germination (%)** | 71.33 a | 73.00 a | 69.67 a |
| **Pollen diameter (µm)** | 29.00 a | 28.00 a | 29.00 a |

Mean having the same letter (s) in each row are insignificantly different at 5% level.

The obtained results agree with those of Singh (1961) found that pollen diameter of 50 Indian cultivars ranged from 23.50 to 28.30 µm. Two cultivars had large pollen grains which were over (41 µm) in length and Tawfik (2003) who reported that pollen diameter of Keitt and Tommy Atkins cvs. was (30 µm) compared to Sediek and Ewais cvs. (40 µm).

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