

STUDY ON FLORAL PARTS AND MALE FEMALE FLOWER RATIO OF THE *JATROPHA CURCUS* L. AND *JATROPHA GOSSYPIFOLIA* L. OF NORTH-EASTERN REGION OF INDIAN. K. Gam¹ and S.P. Borah²¹Dept. of Botany, Sibsagar College, Sivasagar, Assam, India.²Dept. of Botany, Gauhati University, Assam, India.
gamnava@yahoo.in**ABSTRACT**

The present study deals with the male female flower ratios and quantitative study of floral parts. *Jatropha curcus* L. had more male-female flower ratio (21.38±0.47:1) than that of *Jatropha gossypifolia* L. (20.44±0.15:1). In *Jatropha curcus* L. the male/female flower ratio in the rachis of the inflorescence varied from 17.50:1.08 to 23.75:1. Whereas, in *Jatropha gossypifolia* L., the rachis of the inflorescence showed a range of male/female flower ratio varied from 16.67:0.07 to 23.08:0.83. The male and female flowers of *Jatropha curcus* L. were bigger than those of *Jatropha gossypifolia* L. The male and female flowers of *Jatropha curcus* L. was of same length while the male flower of *Jatropha gossypifolia* L. was smaller than female flower. The investigation revealed the different in male/female flower ratios significantly of *Jatropha curcus* L. and *Jatropha gossypifolia* L. which seems to be critical for the improvement of *Jatropha* seed yield.

Key words: *Jatropha*, Male-female flower, North-eastern India, yield.

INTRODUCTION

The angiosperms are defined by their distinctive flowers which incorporate both male and female sex organs (stamens and carpals, respectively) (Sarah *et al.* 1994). Floral biology is the detail description of and functions of floral parts including behavioural pattern (Dutta, 2004). Floral biology provides an evolution and functional significance of floral traits. Since the beginning of civilization, man has been accustomed to use flowers to make his festivals more festive. For plants, flowers are parts of sexual reproduction. They are the reproductive structure of seed bearing plants, characteristically having specialized male or female organs or both male and female organs such as stamens and a pistil, enclosed in an outer envelope of petals and sepals (Siddique, 1991).

Plant morphologists regard flowers as a shoot of determinate growth with highly condensed internodes, and the leaves specialized variously to shoot apex that are transformed into floral apex (Dafni *et al.*, 2005). Flowers exhibit a great variation in size, colour, shape and insertion of different floral whorls. The male gametes in the flowers are the pollen, while ovules are the female gametes. Though most plants produce flowers that have both male and female reproductive parts

separately, male and female flowers bloom in the same plants.

Besides the evolution and functional significance of floral traits, information on floral biology and male and female flower ratio is extremely helpful in understanding the breeding behaviour in the species for their genetic improvement. Haber (1925) has described the morphology of Cyathium. Saunders (1939) gave an account of the floral anatomy of a few species of *Euphorbia*, *Spurge mercurialis* and *Ricinus communis*. The present account deals with aimed to investigate the floral biology of *Jatropha curcus* L. and *Jatropha gossypifolia* L. that would help in formulating breeding strategy for genetical improvement of these two species.

MATERIALS AND METHODS**Determination of male and female flower ratio**

For this study, 12 healthy and normal plants of *Jatropha curcus* L. and *Jatropha gossypifolia* L. were selected from different geographical locations. In each plant 12 inflorescences were considered for the study. In each inflorescence 12 rachis were taken into account and the numbers of male and female flowers were visually counted in each rachis.

The ratio of male and female flowers was worked out and as expressed per rachis.

Quantitative study of floral parts

Quantitative study of floral parts of *Jatropha curcus* L. and *Jatropha gossypifolia* L. were carried out from 12 plants of different geographical locations. In each plant 12 male and 12 female flowers were considered for the study. In each flower the separate floral parts were taken into account and the measurements of the floral parts were done for both male and female flowers separately. Average of measurement from 12 plants were recorded.

RESULT AND DISCUSSION

Male and female flower ratio

One of the most likely reasons for poor yield is that *Jatropha* has few female flowers resulting from a very low female-to-male flower ratio, which, depending on the genotype, is about 1:29–1:13 (Raju and Ezradanam, 2002; Tewari and

others, 2007). Thus, increasing the number of female flowers seems critical for the improvement of *Jatropha* seed yield. However, the present investigation revealed that *Jatrophacurcus* and *Jatropha gossypifolia* differs significantly in their male/female flower ratio (Table No.1 and 2). Table No. 4 and 5 clearly shows that *Jatropha curcus* L. had more male/female flower ratio (21.38±0.47:1) than that of *Jatropha gossypifolia* L. (20.44±0.15:1). In *Jatropha curcus* L. the male/female flower ratio in the rachis of the inflorescence varied from 17.50:1.08 to 23.75:1. The total number of male and female flowers in *Jatropha curcus* L. was of 3080 male flower and 87 female flowers. Similarly in *Jatropha gossypifolia* L. rachis of the inflorescence exhibit a range of male/female flower ratio from 16.67:0.07 to 23.08:0.83. Total number of male and female flowers in *Jatropha gossypifolia* L. was of 2897 male flower and 83 female flowers. Thus, it is clear from the Table No. 4 and 5 that the male/female flower ratio in *Jatropha curcus* L. was more than that found in *Jatropha gossypifolia* L.

Table 1: Male Female flower ratio in *Jatropha curcus* L.

| No. of rachis | Number of Plants | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|------------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|
| | I | | II | | III | | IV | | V | | VI | | VII | | VIII | | XI | | X | | XI | | XII | | | | | | | | | | | | | | | | | | | | | | | | | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 15 | 1 | 20 | 1 | 26 | 1 | 27 | 1 | 21 | 1 | 29 | 2 | 30 | 2 | 23 | 1 | 25 | 1 | 18 | 1 | 28 | 1 | 16 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 20 | 1 | 27 | 2 | 21 | 1 | 26 | 1 | 21 | 1 | 29 | 1 | 27 | 1 | 22 | 1 | 26 | 1 | 18 | 1 | 28 | 1 | 16 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 14 | 1 | 19 | 1 | 20 | 1 | 26 | 1 | 21 | 1 | 27 | 1 | 27 | 1 | 21 | 1 | 26 | 1 | 29 | 1 | 25 | 1 | 28 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 19 | 1 | 12 | 1 | 19 | 1 | 25 | 2 | 18 | 1 | 27 | 1 | 23 | 1 | 21 | 1 | 25 | 1 | 29 | 1 | 24 | 1 | 28 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 12 | 2 | 16 | 1 | 19 | 1 | 21 | 1 | 18 | 1 | 16 | 1 | 22 | 1 | 18 | 1 | 25 | 1 | 28 | 1 | 21 | 1 | 27 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 12 | 1 | 19 | 1 | 19 | 1 | 21 | 1 | 16 | 1 | 16 | 1 | 23 | 1 | 18 | 1 | 16 | 0 | 13 | 0 | 20 | 1 | 21 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 17 | 1 | 20 | 1 | 18 | 1 | 29 | 1 | 18 | 1 | 13 | 1 | 24 | 1 | 26 | 1 | 17 | 1 | 12 | 0 | 16 | 0 | 18 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 13 | 0 | 20 | 1 | 16 | 1 | 27 | 1 | 19 | 1 | 18 | 1 | 24 | 1 | 28 | 1 | 17 | 0 | 12 | 1 | 13 | 0 | 18 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | 16 | 1 | 26 | 1 | 14 | 1 | 16 | 1 | 13 | 0 | 18 | 1 | 21 | 1 | 28 | 1 | 17 | 0 | 25 | 1 | 14 | 1 | 27 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 25 | 1 | 26 | 1 | 17 | 1 | 18 | 1 | 26 | 2 | 19 | 1 | 20 | 1 | 27 | 1 | 26 | 1 | 25 | 1 | 14 | 0 | 25 | 1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | 27 | 1 | 24 | 1 | 29 | 1 | 15 | 1 | 29 | 1 | 16 | 1 | 19 | 1 | 28 | 1 | 27 | 1 | 26 | 1 | 26 | 1 | 14 | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | 20 | 2 | 22 | 1 | 28 | 1 | 26 | 1 | 29 | 1 | 15 | 1 | 17 | 1 | 25 | 1 | 27 | 1 | 26 | 1 | 25 | 1 | 15 | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| Mean values | 17.5 ± 1.41 | | 1.08 ± 0.15 | | 20.91 ± 1.27 | | 1.08 ± 0.08 | | 20.5 ± 1.37 | | 1.00 ± 0.00 | | 23.08 ± 1.36 | | 1.08 ± 0.08 | | 20.75 ± 1.44 | | 1.00 ± 0.12 | | 20.25 ± 1.72 | | 1.08 ± 0.08 | | 23.08 ± 1.06 | | 1.08 ± 0.08 | | 23.75 ± 1.09 | | 1.00 ± 0.00 | | 22.83 ± 1.31 | | 0.75 ± 0.13 | | 21.75 ± 1.94 | | 0.83 ± 0.11 | | 21.17 ± 1.63 | | 0.75 ± 0.13 | | 21.08 ± 1.60 | | 0.08 ± 0.11 | |
| M/F ratio | 17.50 : 1.08 | | 20.91 : 1.08 | | 20.50 : 1.00 | | 23.08 : 1.08 | | 20.75 : 1.00 | | 20.25 : 1.08 | | 23.08 : 1.08 | | 23.75 : 1.00 | | 22.83 : 0.75 | | 21.75 : 0.83 | | 21.17 : 0.75 | | 21.08 : 1.00 | | | | | | | | | | | | | | | | | | | | | | | | | |

Mean M/F Ratio=21.38 ± 0.47: 1

I – XII = No. of plants.

M = Male flower per rachis of the inflorescence.

F = Female flower per rachis of the inflorescence.

Table 2: Male Female flower ratio in *Jatropha gossypifolia* L.

| No. of rachis | Number of Plants | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------|------------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|---|--------------|-------------|--------------|--------------|--------------|-------------|--------------|--------------|--------------|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|--------------|--|-------------|--|
| | I | | II | | III | | IV | | | V | VI | | VII | | VIII | | XI | | X | | XI | | XII | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 13 | 1 | 26 | 1 | 18 | 1 | 26 | 1 | 29 | 1 | 27 | 1 | 25 | 1 | 21 | 1 | 26 | 1 | 25 | 1 | 28 | 1 | 18 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 12 | 0 | 26 | 1 | 19 | 1 | 18 | 1 | 27 | 1 | 13 | 0 | 21 | 1 | 25 | 1 | 25 | 1 | 13 | 0 | 16 | 1 | 29 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 17 | 1 | 20 | 1 | 18 | 1 | 15 | 0 | 16 | 1 | 16 | 0 | 12 | 0 | 28 | 1 | 26 | 1 | 14 | 0 | 17 | 1 | 30 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 15 | 0 | 21 | 1 | 17 | 1 | 16 | 0 | 14 | 0 | 16 | 1 | 19 | 1 | 28 | 1 | 25 | 1 | 14 | 0 | 14 | 0 | 16 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 20 | 0 | 24 | 1 | 17 | 1 | 29 | 1 | 18 | 1 | 15 | 0 | 16 | 1 | 26 | 1 | 12 | 0 | 26 | 1 | 13 | 0 | 12 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 19 | 1 | 22 | 1 | 15 | 1 | 27 | 1 | 21 | 1 | 29 | 1 | 29 | 1 | 23 | 1 | 13 | 0 | 16 | 0 | 25 | 1 | 10 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 14 | 0 | 19 | 0 | 13 | 0 | 21 | 1 | 20 | 0 | 29 | 1 | 23 | 1 | 20 | 1 | 12 | 1 | 28 | 1 | 29 | 1 | 15 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 16 | 1 | 16 | 0 | 14 | 0 | 25 | 1 | 21 | 1 | 27 | 1 | 24 | 1 | 18 | 1 | 29 | 1 | 28 | 1 | 27 | 1 | 19 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | 25 | 1 | 27 | 1 | 11 | 0 | 21 | 1 | 16 | 0 | 27 | 1 | 18 | 1 | 17 | 0 | 28 | 1 | 24 | 1 | 26 | 1 | 25 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 20 | 1 | 15 | 0 | 29 | 1 | 26 | 1 | 13 | 0 | 25 | 1 | 13 | 0 | 16 | 0 | 29 | 1 | 21 | 1 | 25 | 1 | 27 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | 27 | 1 | 13 | 0 | 13 | 1 | 27 | 1 | 19 | 1 | 15 | 1 | 15 | 1 | 20 | 1 | 18 | 1 | 25 | 1 | 21 | 1 | 27 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | 17 | 0 | 12 | 0 | 16 | 1 | 26 | 1 | 18 | 1 | 18 | 1 | 28 | 1 | 19 | 0 | 19 | 1 | 23 | 1 | 20 | 1 | 10 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mean values | 17.92 ± 1.32 | | 0.58 ± 0.15 | | 20.08 ± 1.50 | | 0.58 ± 0.15 | | 16.67 ± 1.32 | | 0.75 ± .013 | | 23.08 ± 1.36 | | | 0.83 ± 0.11 | | 19.33 ± 1.38 | | 0.67 ± 0.14 | | 21.41 ± 1.83 | | 0.75 ± 0.13 | | 20.25 ± 1.64 | | 0.83 ± 0.11 | | 21.75 ± 1.20 | | 0.83 ± 0.07 | | 21.83 ± 1.93 | | 0.83 ± 0.11 | | 21.42 ± 1.64 | | 0.67 ± 0.42 | | 21.75 ± 1.64 | | 0.83 ± 0.11 | | 19.83 ± 2.16 | | 0.58 ± 0.15 | |
| Male/Female flower ratio | 17.92 : 0.15 | | 20.08 : 0.58 | | 16.67 : 0.75 | | 23.08 : 0.83 | | 19.33 : 0.67 | | 21.41 : 0.75 | | 20.25 : 0.83 | | 21.75 : 0.83 | | 21.83 : 0.81 | | 21.42 : 0.67 | | 21.75 : 0.83 | | 19.83 : 0.58 | | | | | | | | | | | | | | | | | | | | | | | | | | |

Mean M/F ratio=20.44± 0.15:1

I – XII = Number of plants.

M = Male flower per rachis of the inflorescence.

F = Female flower per rachis of the inflorescence.

Quantitative study of floral parts

The length of the flower and its parts in *Jatropha curcus* L. and *Jatropha gossypifolia* L. is shown in the Table No. 3 and 4. Tables show that the range of length of different floral parts was as follow.

A. *Jatropha curcus* L.

1. Male flower.

- (i). Flowers – 5 mm to 7 mm.
- (ii) Petioles – 5 mm to 7 mm.
- (iii). Sepals – 3 mm to 5 mm.
- (iv). Petals – 7 mm to 10 mm.
- (v). Filaments – 3.8 mm to 4 mm and
- (vi). Anther lobes – 1.8 mm to 2 mm.

2. Female flower.

- (i). Flowers – 5 mm to 7 mm.
- (ii) Petioles – 6 mm to 7 mm.
- (iii). Sepals – 3.5 mm to 7 mm.
- (iv). Petals – 4 mm to 8 mm.
- (v). Style – 1 mm.
- (vi). Stigma – 1 mm and
- (vii). Ovaries – 2.9 mm to 3 mm.

Table 3: Measurement of different floral parts of *Jatropha curcus* L.

| No. of plants | Male Flower | | | | | | Female flower | | | | | | |
|-----------------------|--------------------------|----------------------|-----------------------|-----------------------|-----------------------------|--------------|------------------------|----------------------|-----------------------|-----------------------|----------------------------|-------------|-------------|
| | Length of petiole in mm. | Length of flrs. (mm) | Length of sepals (mm) | Length of petals (mm) | Length of Androecium's (mm) | | Length of petiole (mm) | Length of flrs. (mm) | Length of sepals (mm) | Length of petals (mm) | Length of Gynoecium's (mm) | | |
| | | | | | Filaments | Anther lobes | | | | | Style | Stigma | Ovary |
| 1. | 10 | 7 | 5 | 10 | 4 | 2 | 9 | 7 | 6.5 | 8 | 1 | 1 | 3 |
| 2. | 10 | 7 | 5 | 10 | 4 | 2 | 6 | 7 | 3.5 | 8 | 1 | 1 | 3 |
| 3. | 9 | 6 | 4 | 9 | 4 | 2 | 9 | 7 | 7 | 4 | 1 | 1 | 3 |
| 4. | 7 | 6 | 5 | 7 | 3.9 | 2 | 9 | 6 | 6 | 7 | 1 | 1 | 3 |
| 5. | 5 | 7 | 5 | 10 | 3.8 | 2 | 9 | 7 | 6 | 7 | 1 | 1 | 3 |
| 6. | 10 | 7 | 5 | 10 | 3.9 | 1.9 | 9 | 6 | 6.4 | 8 | 1 | 1 | 3 |
| 7. | 10 | 7 | 3 | 9 | 3.9 | 2 | 8 | 5 | 6 | 6 | 1 | 1 | 2.9 |
| 8. | 9 | 5 | 5 | 10 | 4 | 2 | 8 | 7 | 6 | 6 | 1 | 1 | 2.9 |
| 9. | 10 | 6 | 5 | 8 | 4 | 1.8 | 7 | 7 | 3.5 | 5 | 1 | 1 | 3 |
| 10. | 10 | 7 | 5 | 10 | 4 | 2 | 9 | 5 | 6 | 8 | 1 | 1 | 3 |
| 11. | 9 | 7 | 4 | 9 | 4 | 2 | 9 | 7 | 6 | 8 | 1 | 1 | 2.9 |
| 12. | 9 | 5 | 4 | 10 | 3.8 | 2 | 8 | 7 | 7 | 7 | 1 | 1 | 3 |
| Range of flower parts | 5-10 | 5-7 | 3-5 | 7-10 | 3.8-4 | 1.8-2 | 6-9 | 5-7 | 3.5-7 | 4-8 | 0 | 0 | 2.9-3 |
| Mean values | 9.00 ± 0.44 | 6.42 ± 0.22 | 4.58 ± 0.18 | 9.33 ± 0.28 | 3.94 ± 0.02 | 1.98 ± 0.02 | 8.33 ± 0.28 | 6.50 ± 0.23 | 5.82 ± 0.33 | 6.83 ± 0.38 | 1.00 ± 0.00 | 1.00 ± 0.00 | 2.97 ± 0.01 |

B. *Jatropha gossypifolia* L.**1. Male flower.**

- (i). Flowers – 3 mm to 5 mm.
- (ii) Petioles – 1.5 mm to 3 mm.
- (iii). Sepals – 3.2 mm to 4.2 mm.
- (iv). Petals – 5 mm to 6 mm.
- (v). Filaments – 1.6 mm to 2 mm and
- (vi). Anther lobes – 1 mm to 1.3 mm.

2. Female flower.

- (i). Flowers – 5 mm to 6 mm.
- (ii) Petioles – 1 mm to 1.2 mm.
- (iii). Sepals – 2.5 mm to 3 mm.
- (iv). Petals – 4.6 mm to 5 mm.
- (v). Style – 1 mm.
- (vi). Stigma – 0.98 to 1 mm and
- (vii). Ovaries – 2.8 mm to 3 mm.

The Table No. 3 clearly indicated that the length of male and female flower was similar in the *Jatropha curcus* L. (5 mm to 7 mm). In the same species when male and female flowers are taken into for measurement, the length of the flowers was found to be in the range between 3 mm to 5 mm in case of male flowers and 5 mm to 6 mm in case of female flowers in *Jatropha gossypifolia* L. (Table No.4).

Thus, it is clear that the male and female flowers of *Jatropha curcus* L. were bigger than those of *Jatropha gossypifolia* L. The male and female flowers of *Jatropha curcus* L. was of same length while the male flower of *Jatropha gossypifolia* L. was smaller than female flower.

Table 4: Measurement of different floral parts of *Jatropha gossypifolia* L.

| No. of plants | Male Flower | | | | | | Female flower | | | | | | |
|-----------------------|--------------------------|---------------------|-----------------------|-----------------------|-----------------------------|--------------|------------------------|---------------------|-----------------------|-----------------------|----------------------------|-------------|-------------|
| | Length of petiole in mm. | Length of frs. (mm) | Length of sepals (mm) | Length of petals (mm) | Length of Androecium's (mm) | | Length of petiole (mm) | Length of frs. (mm) | Length of sepals (mm) | Length of petals (mm) | Length of Gynoecium's (mm) | | |
| | | | | | Filaments | Anther lobes | | | | | Style | Stigma | Ovary |
| 1. | 2 | 4 | 4 | 6 | 2 | 1 | 1 | 6 | 3 | 5 | 1 | 1 | 3 |
| 2. | 3 | 5 | 4 | 6 | 2 | 1.2 | 1 | 5 | 3 | 5 | 1 | 1 | 3 |
| 3. | 2 | 5 | 4 | 6 | 2 | 1 | 1 | 5 | 3 | 5 | 1 | 1 | 3 |
| 4. | 2 | 5 | 3.8 | 5 | 2 | 1 | 1 | 5 | 2.9 | 5 | 1 | 1 | 3 |
| 5. | 1.8 | 4.8 | 3.8 | 6 | 1.8 | 1 | 1 | 5 | 2.9 | 5 | 1 | 1 | 3 |
| 6. | 3 | 3 | 4.2 | 5.8 | 1.6 | 1.3 | 1.2 | 6 | 2.7 | 4.9 | 1 | 1 | 3 |
| 7. | 2 | 4.5 | 3.8 | 5.7 | 2 | 1.2 | 1.1 | 6 | 3 | 4.9 | 1 | .98 | 2.9 |
| 8. | 2 | 4 | 3.5 | 5.6 | 2 | 1.2 | 1.2 | 6 | 3 | 4.9 | 1 | .97 | 2.9 |
| 9. | 2 | 5 | 3.2 | 5.8 | 2 | 1 | 1 | 5.6 | 3 | 4.6 | 1 | .97 | 2.8 |
| 10. | 2 | 5 | 4 | 6 | 2 | 1 | 1 | 5.6 | 3 | 5 | 1 | 1 | 3 |
| 11. | 1.7 | 4 | 4 | 6 | 1.8 | 1 | 1 | 5.8 | 3 | 5 | 1 | 1 | 3 |
| 12. | 1.5 | 5 | 4 | 6 | 1.9 | 1 | 1 | 6 | 2.5 | 5 | 1 | 1 | 3 |
| Range of flower parts | 1.5-3 | 3-5 | 3.2-4.2 | 5-6 | 1.6-2 | 1-1.3 | 1-1.2 | 5-6 | 2.5-3 | 4.6-5 | 1 | .98-1 | 2.8-3 |
| Mean values | 2.08 ± 0.13 | 4.52 ± 0.19 | 3.85 ± 0.08 | 5.82 ± 0.08 | 1.92 ± 0.04 | 1.07 ± 0.03 | 1.04 ± 0.02 | 5.58 ± 0.13 | 2.92 ± 0.04 | 4.94 ± 0.03 | 1.00 ± 0.00 | 0.99 ± 0.00 | 2.97 ± 0.00 |

LITERATURE CITED

- Dafni A, Kevan PG and Husband BC, 2005.** Practical Pollination Biology. Enviroquest, Cambridge, Ontario, Canada.
- Dutta AC, 2004.** Botany For Degree Students (revised). Pp. 81-103; Oxford University Press.
- Haber JM, 1925.** The anatomy and the morphology of the flower of Euphorbia. *Ann. Bot.*, **39**: 657-707.
- Jun Wu, Yuan Liu, Lin Tang, Fuli Zhang and Fang Chen, 2011.** A study on structural features in early flower development of *Jatropha curcas* L. and the classification of its inflorescences. *African Journal of Agricultural Research* Vol. **6**(2): 275-284,
- Raju AJS, Ezradanam V, 2002.** Pollination ecology and fruiting behaviour in a monoecious species, *Jatropha curcas* Lin. (Euphorbiaceae). *Curr Sci.*, **83**:1395–1398.
- Sarah Grant, Beate Hunkirchen and Heinz Saedler, 1994.** Developmental differences between male and female flowers in the dioecious plant *Silene latifolia*; *The Plant Journal*, **6**(4), 471-480.
- Saunders ER, 1939.** *Floral morphology, a new outlook*, with special reference to the interpretation of the gynoecium. Vol. **2**. Cambridge.
- Siddique, MAA, 1991.** Germplasm Assessment of some Raw and Threatened Medicinal Plants of Kashmir Himalayas, Ph.D. thesis, University of Kashmir, India.
- Tewari JP, Dwivedi HD, Pathak M, Srivastava SK, 2007.** Incidence of a mosaic disease in *Jatropha curcas* Lin. from eastern Uttar Pradesh. *Curr. Sci.*, **93**:1048–1049.