Tropical Agricultural Research and Extension 5(1 & 2) : 2002

# Fruit-setting behaviour in relation to floral morphology of eggplant (*solanum melongena* L.)

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*Accepted 02nd July 2002*

**ABSTRACT**

**Floral morphology of eggplants in 56 accessions was examined to study fruit setting behaviour. While most accessions (80.3%) produced both single flowers and inflorescences on the same plant, there were accessions with inflorescence only (16.0%) and single flowers only (3.6%). Flower number per inflorescence varied within individual plants as well as between accessions. Though the basic type of inflorescence appeared as scorpioid cyme, the first flower was always different, being larger and in a separate position with a strong pedicel. The remainder was attached to a single peduncle, forming a cluster. Only the first flower of inflorescence set fruit in all accessions, except in accession 02270. The stigma of first flower was well developed and its position in relation to anther tips, varied between accessions, i.e. above (58.9%), on the same level (25.0%) or both same level and below (16.1%) anther tips. However, first flowers with stigmas that were below anther tips and cluster flowers were aborted. Cluster flowers had very rudimentary stigmas, which were below anther tips in a concealed position. Only the accession 02270 produced fruits in cluster flowers which had stigmas above anther tips. Results showed a close relationship between fruit setting and stigma position in eggplant.**

***Key words***: Aubergine, eggplant, floral morphology, fruit-setting, *Solanum melongena* L., stigma position

## INTRODUCTION

Cultivars of eggplant (*Solanum melongena* L.) bear hermaphrodite flowers in clusters as well as singly (Som and Maity 1986). According to Hepper (1987), flowers are either solitary or in few-flowered inflorescences and latter is supra-axillary with lower flower hermaphrodite and upper ones male. Kanahama *et al.* (1989) reported that the fundamental inflorescence type in eggplant is a scorpioid cyme. A study on flower types in 29 cultivars showed that they all bear flower cluster along with a solitary flower and in most of the cultivars, the flowers in cluster are either short-styled and medium or all medium styled (Chadha and Saimbhi 1977).

Murtasow *et al*. (1971) and Prasad and Prakash (1968) found that the number of flowers per inflorescence varied from 2 to 4 and 3 to 5, respectively. Furthermore, they observed that the flower developed first is larger than others, while the latter has short styles. Popova (1961) stated that the style length or the position of stigma in relation to anthers varied with cultivars and can also vary in different flowers of the same cultivar. She found that stigmas are either above, on the same level or below anthers. Krishnamurthi and Subramanium (1954) reported 4 types of flowers in eggplant depending on the length of style, *viz.,* long-styled with big size ovary, medium-styled with medium size ovary, pseudo short-styled with rudimentary ovary and true short-styled with very rudimentary ovary. A study of large collection from many countries showed that, in 21.5% of varieties, the stigma protruded above anthers, 28.0% below anthers and 50.5% at the same level with anthers (Murtasow *et al.* 1971).

Som and Maity (1986) reported that in eggplant, the fruit is borne either singly or in clusters. Several studies were done on fruit-set in relation to the stigma position. Some of them showed that fruit-set is high where the stigma is above or on the same leve,l while short styled stigmas do not set fruits at all (Krishnamurthi and Subramanium 1954; Passam and Bolmatis 1997 and Prasad and Prakash 1968). Popova (1961) and Mohideen *et al*. (1977) also found the percentage of fruit-set is high in long-styled flowers. In contrast, Chadha and Saimbhi (1977) pointed out that fruiting habit in a cultivar is not directly related to the length of style.

However, there is little published information on fruit setting behaviour of eggplant flowers at inflorescence level. The objective of this study was to investigate the fruit-setting behaviour in relation to floral morphology of eggplant, with special emphasis on the level of inflorescence. Fifty six eggplant accessions, conserved in the genebank of Plant Genetic Resources Centre, Gannoruwa, Sri Lanka were studied in this study.

## MATERIALS AND METHODS

Fifty six *Solanum melongena* accessions were used for the study, conducted during the period 1999/2000. The collection consisted of forty seven indigenous landraces, three locally recommended varieties and six introduced accessions from five different countries.

The seedlings were raised in a nursery and transplanted thirty days after sowing in the field at the Plant Genetic Resources Centre at Gannoruwa, Sri Lanka (latitude 7 18' N; longitude 80 35' E; altitude: 480m ). Each accession was grown in an unreplicated 2-row plot of 5m length at a spacing of 75cm × 75cm. Pesticides were applied to control shoot and pod borer (*Leucinodes orbonalis*) following the recommendations of the Department of Agriculture (DOA), Sri Lanka (Anon 1990). Other agronomic practices were also carried out according to DOA recommendations (Anon 1990).

Data recording commenced when 50% of plants reached the stage of flower initiation and continued throughout the reproductive stage for each accession.

The following data were recorded from all the accessions:

The number of floral buds per inflorescence, the structure/type of the inflorescence, stigma position in relation to anther tips at full anthesis (below/ same level/ above ), the number of fruits per inflorescence and the diameter (cm) of fully opened flowers from randomly selected three inflorescences per accession. Randomly selected five inflorescences per accession were tagged on first flower bud and these inflorescences were examined for fruit setting. Also, randomly selected first flowers whose stigmas were below anther tips were tagged and checked for fruit set.

## RESULTS

### The number of floral buds per inflorescence

Two accessions produced single flower buds only while the remainder had inflorescences only or both inflorescences and single buds together. The variation in the number of floral buds per inflorescence in the eggplant collection is given in Table 1.

### The structure/type of the inflorescence

Accessions produced supra-axillary inflorescences. The basic type of inflorescence was scorpioid cyme. The anthesis of flowers of an inflorescence occurred in sequence from base to top and often, last floral buds were aborted. A special feature of flower position was observed in eggplant inflorescences (Fig. 1).

### Stigma position in relation to anther tips

Variability for the stigma position was observed even within the inflorescence, between first flower and cluster flowers in all accessions except 02270. When considering the first flower, its stigma position in relation to anther tips varied between accessions, i.e. above (58.9%), on the same level as (25.0%) and both same level and below anther tips (16.1%). Thirty three accessions which had stigmas protruded above anther tips consisted of three sub groups such as accessions with stigmas extended much beyond anther tips, those having less extended stigmas and those with slightly extended stigmas, possessing fourteen, six and thirteen accessions respectively. Meanwhile, cluster flowers produced stigmas which

**Table 1. The number of flowers per inflorescence on a single plant basis in fifty six eggplant accessions.**

| Flower number per inflorescence | Number of accessions | Percentage |
|---|---|---|
| Single flower buds only | 02 | 3.6 |
| Both single buds and inflorescences | | |
| a. mainly 1, very rarely 2 | 06 | 10.7 |
| b. mainly 1, rarely 2 and 3 | 10 | 17.8 |
| c. mainly 1, rarely 4 | 01 | 1.8 |
| d. mainly 1, rarely 2, 3 and 4 | 08 | 14.3 |
| e. evenly 1, 2 and 3 | 03 | 5.3 |
| f. evenly 1, 2, 3 and 4 | 16 | 28.6 |
| g. evenly 1, 2, 3, 4 and 5 | 01 | 1.8 |
| inflorescences only | | |
| a. 2 and 3 | 03 | 5.3 |
| b. 2, 3 and 4 | 01 | 1.8 |
| c. 2, 3, 4 and 5 | 03 | 5.3 |
| d. 2, 3, 4, 5 and 6 | 02 | 3.6 |


**Fig. 1. Four-flowered inflorescence of eggplant. A, first flower bud with strong pedicel in a solitary position**

were below anther tips, showing no variability between accessions except in 02270, which had stigmas more extended than anther tips, in both first flower and cluster flowers. Also, stigmas of cluster flowers were very rudimentary compared to the stigma of first flower except in accession 02270. Fig. 2 shows the variability for stigma position.

**The number of fruits per inflorescence**

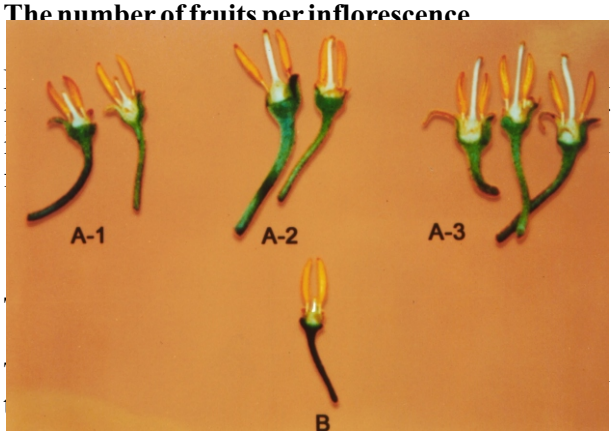


**Fig. 2. Variability for stigma position in relation to anther tips in eggplant. A- 1, first flower with stigma below, A-2, first flower with stigma on the same level as, A-3, first flower with stigma above, B, cluster flower with stigma much below anther tips.**

accessions. The diameter of first flower and second flower ranged from 3.0 cm to 5.2 cm respectively. The difference between diameter of first flower and second flower was equal or more than 1.0 cm in 78% of accessions tested.

**Productive flower of the inflorescence**

When accessions produced a single fruit per inflorescence, fruit-set was always observed in the first flower. Nevertheless, fruit-set in first flower buds was 83.3%. The abortion was observed after anthesis of first flower buds in accessions even having stigmas which were above or on the same level as anther tips. Cluster flower buds of those single fruited inflorescences were all aborted before or after anthesis. Twenty nine first flowers with stigmas which were below anther tips did not set fruits at all and they all aborted.

## DISCUSSION

Results of this study showed that eggplant produces flowers singly or in inflorescences, as has been described earlier by Hepper (1987) and Som and Maity (1986). Furthermore, the flower type in an individual plant varies between accessions. More often, eggplant produces flowers both singly and in inflorescences (80.3%) in the same plant while the occurrence of single floral bud only (3.6%) and inflorescences only (16.0%). is rare in the population.

Floral bud number per inflorescence varied within individual plants as well as between accessions. This variation could be grouped into twelve (Table 1). Though the largest group (28.6%) had two, three and four flowered inflorescences, nearly 44.7% of the total population also bore similar numbered inflorescences regardless of single flower bud.

As shown in Fig.1, first flower appeared directly from the main stem with a strong pedicel in a separate position while a single peduncle, arising from base of first flower pedicel bore all other flowers forming a flower cluster. These findings are in agreement with Hepper (1987), who observed that the inflorescence is supra-axillary and Kanahama *et al*. (1989) who found the type of inflorescence is scorpioid cyme. However, on the contrary to Hepper (1987), not only the first flower but also cluster flowers were hermaphrodite.

Data clearly showed that the first flower of inflorescence was larger than cluster flowers, agreeing with Murtasow *et al*. (1971) and Prasad and Prakash (1968). According to observations, the growth and position in relation to anther tips of stigma varied between first flower and cluster flowers. Furthermore, the position of stigma in first flower varied between accessions.

Except in 02270, fruit set was observed only in first flowers of inflorescence having stigmas which were either above or on the same level as anther tips, but not in flowers which produced stigmas that were below anther tips. Hence, fruit set was low in

accessions, having first flowers which produced both below and same level stigmas in relation to anther tips. Only accession 02270, introduced from Japan had stigmas extended well beyond anther tips in cluster flowers as well as in first flower and it produced fruits in clusters. Therefore, accession 02270 had the highest number of fruits per plant (23) in the collection. However, fruits from cluster flowers seemed to be smaller than that of first flower.

Results showed a relationship between cluster flower fruit setting failure and its stigma position which prevents receiving enough pollen for successful pollination. This idea is supported by previous studies which revealed a relationship between style length and fruit setting (Krishnamurthi and Subramanium 1954; Passam and Bolmatis 1997 and Prasad and Prakash 1968).

Several studies have been conducted to understand the genetic architecture and pattern of inheritance of style length, inflorescence type and fruiting in eggplant. Peter and Singh (1973) observed additive gene action controlling the number of long-styled and medium-styled flowers in eggplant. Zhou (1992) found that the first flower position and style length were controlled by two genes. Khapre and Wanjari (1992) found that the clustered inflorescence trait is controlled by two duplicate genes. Meanwhile, Swamy and Rao (1970) and Rangaswamy and Kadambavanasundaram (1973) observed dominance of clustered fruit over non-clustered fruit. On contrast, Ingale and Patil (1996) revealed non-clustered fruiting to be dominant over clustered fruiting and suggested that four complementary genes are involved. Khapre *et al*. (1987) also observed that four genes control fruiting pattern in eggplant.

In conclusion, only the first flower of inflorescence sets fruit and cluster flowers were aborted in most eggplant accessions (98.1%). Therefore, only the first flower of such accessions should be considered for hybridization and seed production thus reducing time and cost. According to results, a relationship can be identified between fruit setting and stigma position in eggplant. Further studies on genetics of fruiting pattern in eggplant would be important in crop improvement.

## ACKNOWLEDGEMENT

I thank Ms. Indra Kumari and Ms. J. Kahawatta for their valuable assistance in data collection. The support in maintenance of trial plots by Mr. E. B. Weerasekara and Mr. R. K. Wickramarane is much appreciated. I also thank Ms. S. Abeytunge, former Head and the staff of Evaluation Unit, Plant Genetic Resources Centre, Gannoruwa for their valuable support throughout the study.

## REFERENCES

Anon 1990 Crop Recommendations Technoguide. Dept. of Agric., Sri Lanka.

Chadha ML and Saimbhi MS 1977 Varietal variation in flower types in brinjal (*Solanum melongena* L.). Indian J. Hort. 34: 426-429.

Hepper FN 1987 Solanaceae. In: A Revised Hand Book to The Flora of Ceylon. Eds. Dassanayake MD and Fosberg FR. Amerind Publ., New Delhi. pp. 365-388.

Ingale BV and Patil SJ 1996 Inheritance of fruiting pattern in brinjal. J. of Maharashtra Agric. Univ. Publ. 1997. 21: 2. 300.

Kanahama K, Saito T and Qu YH 1989 Right-and left-handedness of phyllotaxis and flower arrangement and developmental order of flowers in the inflorescences of Solanaceae plants. J. of Japanese Society for Hort. Sci. 57:4 642-647.

Khapre PR, Wanjari KB and Deokar AB 1987 Inheritance of fruiting pattern in eggplant. J. of Maharashtra Agric. Univ. 12:3 401.

Khapre PR and Wanjari KB 1992 Inheritance of inflorescence type in *Solanum melongena* L. *Solanum indicum* L. J. of Maharashtra Agric. Univ. 17:2 335.

Krishnamurthi S and Subramanium D 1954 Some investigations on the types of flowers in brinjal (*Solanum melongena*) based on style length and their fruit set under natural conditions and in response to 2,4-D. Indian J. Hort. 11: 63-67.

Mohideen MK, Muthukrishnan CR, Rajagopal A and Metha VA 1977 Studies on the rate of flowering, flower types and fruit set in relation to yielding potential of certain eggplant (*Solanum melongena* L.) varieties with reference to weather conditions. South Indian Hort. 25:2 56-61.

Murtasow T, Petrow C and Doikowa M 1971 Some features of flower position and flowering in eggplant in relation to breeding and seed production. Nauchni-Trudove,-Vissh-Selskostopanski-Institut-"Vasil-Kolarov,"-Gradinarstvo. 20:2 53-61.

Passam HC and Bolmatis A 1997 The influence of style length on the fruit set, fruit size and seed content of aubergines cultivated under ambient temperature. Tropical Science. 37:4 221-227.

Peter KV and Singh RD 1973 Diallel analysis of economic traits in brinjal. Indian J. Agric. Sci. 43: 452-455.

Popova D 1961 A study of some problems connected

with the floral biology of eggplant (*Solanum melongena*). IZV. Centr. Nauc-izsled. Rasten. 12: 187-207.

Prasad DN and Prakash R 1968 Floral biology of brinjal (*Solanum melongena* L.) Indian J. Agric. Sci. 34: 1053-1061.

Rangaswamy P and Kadambavanasundaram M 1973 A study on the inheritance of certain qualitative characters in the cross between *Solanum indicum* L. and *Solanum melongena* L. . South Indian Hort. 21: 1-6.

Som MG and Maity TK 1986 Brinjal. In: Vegetable Crops in India. Eds. Bose TK and Som MG Naya Prokash, Calcutta. pp. 293-335.

Swamy Rao T 1970 A preliminary note on the inheritance of qualitative characters in brinjal. Madrs Agric. J. 57: 508-509.

Zhou WJ 1992 Inheritance of isozymes and morphological characters in eggplant. Acta Genetica Sinica. 19:5 423-429.