

**SEASONAL INFLUENCE ON POLYMORPHIC FLOWERING
BEHAVIOUR, FRUITSET AND SEED RECOVERY IN BRINJAL
(*SOLANUM MELONGENA* L.) CULTIVARS**

K RAJA*

*Department of Seed Science and Technology, Tamil Nadu Agricultural
University, Coimbatore-641 003, India*

Keywords: Seasonal influence, Brinjal, Heterostyly, Fruitset, Seed recovery

Abstract

Flowering behavior in brinjal (*Solanum melongena* L.) shows that it produces four type of flowers viz., long, medium, short and pseudoshort styled flowers. Among these flowers, the long and medium styled flowers have the biggest ovary and set fruits in both the cultivars viz., PLR 1 and PLR (Br.) 2. Whereas, short and pseudoshort styled flowers did not set fruits. In addition, the highest fruitset (84.7%) was recorded in long styled flowers than the medium styled flowers (77.7%). However, no significant difference in seed recovery was observed in the fruits from long and medium styled flowers. The seasonal influence on flowering and fruitset was also noticed; in which, Kharif season with less difference in day-night temperatures, high rainfall and relative humidity and less wind velocity favoured occurrence of more number of long and medium styled flowers with high fruitset in both the cultivars.

Introduction

Brinjal (*Solanum melongena* L.) is an important vegetable crop cultivated throughout India except in temperate regions. Young fruit contains protein, fibre, carbohydrate, calcium, magnesium, phosphorous, sulphur and vitamin A. It is a self-pollinating plant, although it can be cross-pollinated (6 - 10%) that results from transferring pollen by insects such as ants, thrips and bees (George 1985, Lawande and Chavan 1998). Being hermaphrodite, brinjal flowers show heterostyly phenomenon (Kowalska 2006), in which four types of flower have been reported depending on the length of styles viz., long-, medium-, short- and pseudoshort-styled flowers (Krishnamurthi and Subramaniam 1954). They also reported that long- and medium-styled flowers produce fruits, whereas short and pseudoshort-styled flowers do not set any fruits. The different style flowers in brinjal mainly depend on the variety and season (Kowalska 2006). But, it also depends on other factors such as fruiting dynamics and plant's age (Lenz 1970) as well as environmental conditions (Abney and Russo 1997). Hence, it is important to know the influence of season on flowering behaviour, fruit set and seed recovery for the better seed production.

Material and Methods

An experiment was conducted in two brinjal cultivars, namely PLR 1 and PLR (Br.) 2 at Vegetable Research Station, Palur (11⁰45' N latitude and 75⁰40' E longitude) during 2014 to 2015. The crops were raised in the field during two different seasons viz., Kharif and Rabi summer with five replications in both the cultivars. The seed sowing was done in May for Kharif and December for Rabi summer crops. The well-grown and uniform vigour seedlings were transplanted on the main field at 30 days after sowing. The recommended cultivation practices (http://agritech.tnau.ac.in/horticulture/horti_vegetables_brinjal_index.html) were followed. The morphological

*Author for correspondence: <kraja_sst@rediffmail.com>.

traits of the flowers and flowering behaviour were recorded at 25 days interval up to 150 days of planting. Also, the fruit set and seed recovery percentages were recorded during both the seasons. Weather factors were also recorded during the cropping period. Data recorded were subjected to statistical analysis (Panse and Sukhatme 1967) and the critical difference values were calculated at 5% probability level.

Results and Discussion

The results on the production of heterostyled flowers showed that the brinjal plant had produced four types of flowers *viz.*, long, medium, short, pseudo-short styled flowers in both the cultivars (Fig. 1a, b). The stylar tube in the long styled flower protruded out of the anther column with the length of 1.42 cm in cv. PLR 1 and 1.15 cm in cv. PLR (Br.) 2 during Kharif 2014. The medium styled flowers measured the stylar tube length of 1.08 cm in both the cultivars cv. PLR 1 and PLR (Br.)2 which ends with the level of the anther column. The short styled flowers measured

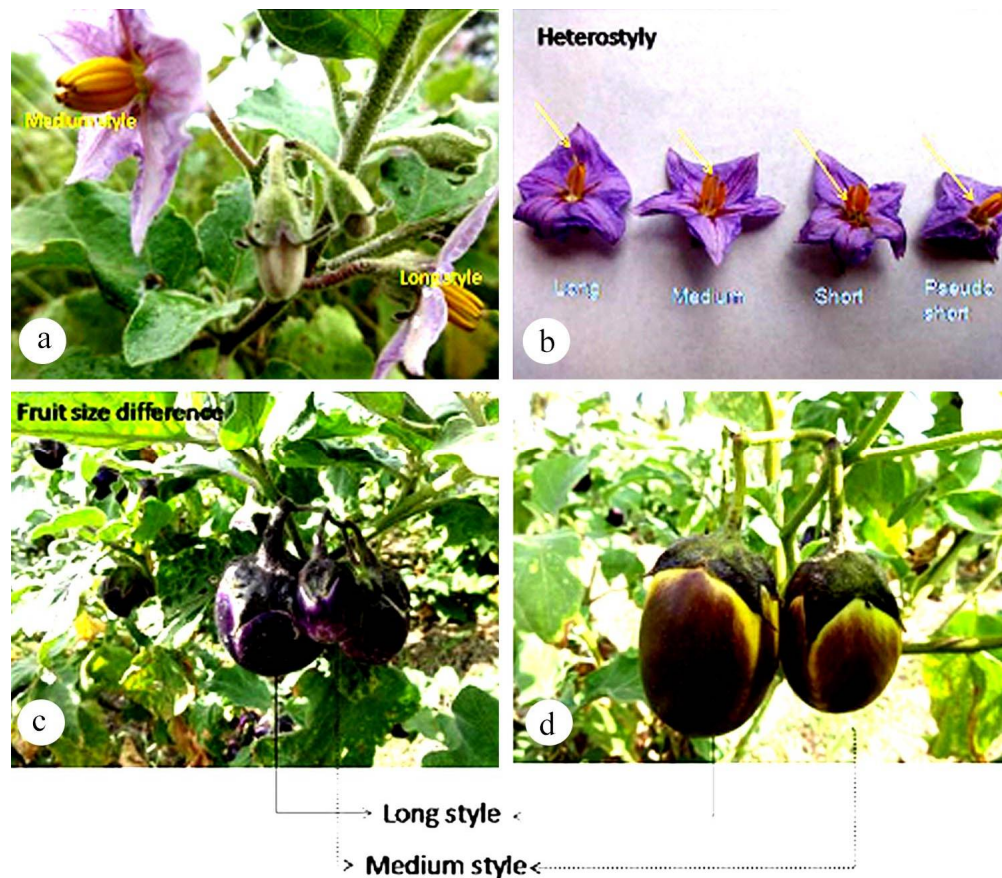


Fig.1. Heterostyly behavior and its influence on fruit traits in brinjal.

0.44 and 0.41 cm in PLR 1 and PLR (Br.) 2 and it was very rudimentary (0.24 cm) in pseudoshort styled flowers in both the cultivars, which lie deep within the anther column (Table 1). Similar trend of differences in style length like long (1.26 and 1.08 cm), medium (1.17 and 1.05 cm), short

(0.47 and 0.41 cm) and pseudoshort (0.27 and 0.23 cm) styled flowers of the cultivars PLR1 and PLR (Br.) 2 were also recorded in Rabi summer (Table 2). Ovary width (2.06 and 2.03 cm) and weight (0.102 and 0.109 g) were the highest in the long styled flowers followed by medium styled flowers in both the cultivars during Kharif 2014. In pseudoshort styled flowers, the least ovary width (1.14 and 0.90 cm) and weight (0.015 and 0.039 g) in the first season were recorded (Table 1). Similar trends were recorded in Rabi summer also (Table 2). However, slight differences in the morphological features of the flowers were recorded between the seasons in which the Kharif crop recorded higher values than Rabi Summer crop irrespective of the cultivars.

Table 1. Morphological traits of the heterostyled flowers in brinjal cultivars during Kharif 2014.

Flower styles	Cv. PLR 1			Cv. PLR (Br.) 2		
	Stylar tube length (cm)	Ovary width (cm)	Ovary weight (g)	Stylar tube length (cm)	Ovary width (cm)	Ovary weight (g)
Long	1.42	2.06	0.102	1.15	2.03	0.109
Medium	1.08	1.76	0.065	1.08	1.95	0.099
Short	0.44	1.43	0.029	0.41	0.96	0.059
Pseudoshort	0.24	1.14	0.015	0.24	0.90	0.039
SEd	0.04	0.06	0.005	0.04	0.10	0.005
CD (p = 0.05)	0.08	0.12	0.010	0.08	0.22	0.010

Table 2. Morphological traits of the heterostyled flowers in brinjal cultivars during Rabi summer 2014-2015.

Flower styles	Cv. PLR 1			Cv. PLR (Br.) 2		
	Stylar tube length (cm)	Ovary width (cm)	Ovary weight (g)	Stylar tube length (cm)	Ovary width (cm)	Ovary weight (g)
Long	1.26	2.02	0.098	1.08	2.08	0.103
Medium	1.17	1.86	0.049	1.05	1.83	0.094
Short	0.47	1.27	0.031	0.41	0.89	0.054
Pseudoshort	0.27	1.00	0.015	0.23	0.79	0.036
SEd	0.02	0.06	0.004	0.04	0.05	0.004
CD (p = 0.05)	0.04	0.12	0.008	0.09	0.12	0.009

Significant differences were recorded in the number of flowers/plant, in which more flowers were observed in long styled category (38.6%) followed by medium (24.7%), short (20.2%) and pseudoshort (16.5) styled flowers in Cv. PLR 1 during Kharif 2014 (Table 3). Similarly, Cv. PLR (Br.) 2 had more long styled flowers (31.9%) followed by medium (22.9%), short (26.4%) and pseudoshort (18.6 %) styled flowers in Kharif season (Table 4). Similar trend on occurrence of more number of long styled flowers in a plant were recorded during Rabi Summer also in both the cultivars (Tables 5 & 6). Kowalska (2008) found that the flowers with long-styled pistil are the majority among all flowers on a plant. This might be due to the fact that the long and medium styled flowers have well developed nodules and well permissible tissues rich in polysaccharides and proteins. However, short styled flowers have small stigma with underdeveloped nodules and due to worse absorption, they are not pollinated and do not set fruits.

Table 3. Flowering and fruitset of heterostyled flowers in brinjal var. PLR 1 during Kharif 2014.

Flower styles	No. of flowers/plant						Fruit set (%)					
	50 DAP	75 DAP	100 DAP	125 DAP	150 DAP	Mean	50 DAP	75 DAP	100 DAP	125 DAP	150 DAP	Mean
Long	1.62	3.40	4.02	6.48	6.72	4.45	71.9	84.7	85.6	94.0	94.6	86.2
Medium	0.60	0.80	1.69	6.05	5.04	2.84	63.6	82.3	93.2	87.8	92.8	83.9
Short	0.20	1.20	1.31	4.67	4.24	2.32	0.0	0.0	0.0	0.0	0.0	0.0
Pseudoshort	2.36	2.75	1.03	1.10	2.26	1.90	0.0	0.0	0.0	0.0	0.0	0.0
Mean	1.20	2.04	2.01	4.58	4.57	2.88	33.9	41.8	44.7	45.5	46.9	42.5
	Styles	Days	SxD				Styles	Days	SxD			
SEd	0.43	0.44	0.88				1.25	1.30	2.55			
CD (p=0.05)	0.79	0.88	1.76				2.29	2.56	5.12			

Table 4. Flowering and fruitset of heterostyled flowers in brinjal var. PLR (Br) 2 during Kharif 2014.

Flower styles	No. of flowers/plant						Fruit set (%)					
	50 DAP	75 DAP	100 DAP	125 DAP	150 DAP	Mean	50 DAP	75 DAP	100 DAP	125 DAP	150 DAP	Mean
Long	0.40	1.58	1.59	4.44	2.81	2.16	77.0	88.1	92.5	97.6	95.4	90.1
Medium	0.40	1.34	1.20	3.13	1.69	1.55	70.7	75.9	91.8	90.8	81.8	82.2
Short	0.40	1.40	1.20	3.03	2.95	1.79	0.0	0.0	0.0	0.0	0.0	0.0
Pseudoshort	1.50	0.60	0.80	1.30	2.10	1.26	0.0	0.0	0.0	0.0	0.0	0.0
Mean	0.68	1.23	1.20	3.00	2.39	1.69	36.9	41.0	46.1	47.1	44.3	43.1
	Styles	Days	SxD				Styles	Days	SxD			
SEd	0.20	0.23	0.45				0.92	1.13	2.21			
CD (p=0.05)	0.40	0.45	0.92				1.94	2.16	4.33			

In addition, more number of long styled flowers was observed during 125 to 150 days after planting in both the cultivars irrespective of the season. This might be due to the more crop canopy and branches. Proportionately, the possibilities of getting higher short and pseudoshort styled flowers were noticed during that period. The age of the plant and nutritional supply could be the reasons for the occurrence of the short styled flowers. Nevertheless, the number of long and medium styled flowers was more (7.29) in Cv. PLR 1 during Kharif season. Similarly, PLR (Br.) 2 had more long and medium (7.42) styled flowers in Rabi summer. These differences might be due to the seasonal effect on the performance of the cultivar.

Among the different styled flowers, in the long styled flowers highest fruitset (82.9 and 86.5%) followed by medium styled flowers (78.2 and 77.2%) in cv. PLR 1 and PLR (Br.) 2, respectively were recorded during both the seasons. However, short and pseudoshort styled flowers have set no fruits in both the cultivars and seasons. It might be mainly due to no pollen germination on the stigma or penetration of pollen tube into short styles (Rylski *et al.* 1984). The average fruit set (43.1 %) was higher in Cv. PLR (Br.) 2 than Cv. PLR 1 (42.5 %) during Kharif season and during Rabi Summer in which 38.7% in Cv. PLR (Br.) 2 and 38.0% in Cv. PLR 1 were recorded (Tables 3 to 6). This might be due to the reduction in temperature and less difference between day and night temperatures happened during September to November for the Kharif crop than Rabi Summer crop. Low wind velocity might have also contributed for the higher fruitset due to less desiccation effect to the pollens or stigmatic surface. The high rainfall, more rainy days with high relative humidity for Kharif crop cannot be ruled out for the increased fruitset.

It also depends on other factors such as fruiting dynamics and plant's age (Lenz 1970) as well as environmental conditions (Abney and Russo 1997). Again, it is evident that the flower development along with low auxin contents and low potassium level due to insufficient flow of nutrients may favour the production of short style flowers (Handique and Sarma 1995).

Table 7. Fruit weight and seed recovery of different styled flowers in brinjal cv. PLR 1 and PLR (Br.)2

Cultivar/flower styles	Kharif 2014			Rabi summer 2014-2015		
	Fruit wt. (g)	Seed wt. (g)	Seed recovery (%)	Fruit wt. (g)	Seed wt. (g)	Seed recovery (%)
Cv. PLR 1						
Long	318.8	16.9	5.3	330.4	17.1	5.1
Medium	229.0	11.4	5.0	225.0	11.3	5.1
Cv. PLR (Br.) 2						
Long	159.0	4.7	3.2	110.0	3.9	3.5
Medium	72.2	2.3	3.2	60.2	2.1	3.5
SEd	9.9	1.0	0.4	8.5	0.8	0.2
CD ($p = 0.05$)	21.5	2.0	NS	18.6	1.8	NS

The differences in matured fruit weight and subsequent seed weight were recorded in the fruits from long and medium styled flowers. The long styled flowers produced the biggest fruits (324.6 and 134.5 g) followed by the medium styled flowers (227.0 and 66.2 g), respectively in cv. PLR 1 and PLR (Br.) 2 (Table 7). This might be due to the largest ovary in the long styled flowers and supply of more nutrients to these first formed flowers in a cluster (Fig. 1c, d). However, no difference in seed recovery was observed in the fruits from long styled and medium styled flowers. An average seed recovery of 5.1 and 3.4% was recorded in cv. PLR 1 and PLR (Br.) 2, respectively. Also, there was no difference between the seed recovery of the cultivars due to the seasonal influence.

Brinjal is known to produce four types of flowers *viz.*, long, medium, short and pseudoshort styled flowers with polymorphic ovary. The highest fruitset was observed in the long styled flowers (82.9 and 86.5%) followed by medium styled flowers (78.2 and 77.2%) in cv. PLR 1 and PLR (Br.) 2, respectively. No significant difference in seed recovery was observed in the fruits from long and medium flowers. Also, high fruit set in both the cultivars was recorded in the Kharif season.

References

- Abney TD and Russo VM 1997. Factors affecting plant height and yield of eggplant. *J. Sustain. Agric.* **10**: 37- 47.
- George RAT 1985. Vegetable seed production. Academic Press, London. pp. 223-229.
- Handique AK and Sarma A 1995. Alteration of heterostyly in *Solanum melongena* L. through gamma-radiation and hormonal treatment. *J. Nuc. Agric. Biol.* **24**: 121-126.
- Kowalska G 2006. Eggplant (*Solanum melongena* L.) flowering and fruiting dynamics depending on pistil type as well as way of pollination and flower harmonization. *Folia Hort.* **18**(1): 17-29.
- Kowalska G 2008. Flowering biology of eggplant and procedures intensifying fruit set - Review. *Acta Scientiarum Polonorum Hortorum Cultus* **7**(4): 63-76.
- Krishnamurthy S and Subramanian D 1954. Some investigations on the types of flowers in brinjal (*Solanum melongena* L.) based on the style length and fruit set under natural conditions. *Indian J Hort.* **11**: 63-67.
- Lawande KE and Chavan JK 1998. Eggplant (Brinjal). *In: Handbook of Vegetable Science and Technology - Production, composition, storage and processing*, Salunkhe DK and Kadam SS (Eds.), New York, pp. 225-244.
- Lenz F 1970. Effect of fruit on sex expression in eggplant (*Solanum melongena* L.). *Hortic. Res.* **10**: 81-82.
- Panse VG and Sukhatme PV 1967. *Statistical Method for Agricultural Workers*, ICAR Publication, New Delhi.
- Rylski I, Nothmann J and Arcan L 1984. Different fertility in short-styled eggplant flowers. *Sci. Hort.* **22**: 39.

Manuscript received on 10 April, 2019; revised on 23 December, 2019)