



Studies on Improving Seed Set and Quality in Glory Lily Through Pollination Methods

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A field experiment was conducted to study the stigma receptivity and method of pollination in improving pod and seed quality in glory lily at Botanical Garden, Tamil Nadu Agricultural University, Coimbatore. Results revealed that, dusting of foreign pollen on the stigma (pollination) one day after anthesis resulted in higher pod set of 88 per cent, while pollination on the day of anthesis resulted in 80 per cent and bud pollination one day before anthesis resulted in 68 per cent pod set. These results clearly revealed that the stigma of glory lily flower was receptive even before anthesis and continued to attain the maximum receptivity one day post anthesis. Among different pollination methods, hand pollination was the best as revealed through the superiority in terms of pod and seed yield parameters such as maximum pod set (96 %), higher pod length (8.4 cm), pod girth (6.8 cm) and weight of pod (4.92 g) and higher seed weight per pod (3.04 g), number of seeds per pod (74.0) and shelling percentage (61.78 %) accompanied with better seed quality parameters such as higher germination (54 %) and vigour index (1252) of the seeds in glory lily.

Key words: Glory lily, Stigma receptivity, Pollination, Pod set, Germination, Vigour index.

Gloriosa superba L. of Liliaceae family commonly known as glory lily, superb lily, tiger lily or tiger claws, is an important medicinal plant of the Tropics (Ridley, 1924). Glory lily is native to both Asia and Africa. The genus derives its name from the Latin word 'glorious' referring to flowers. It is also used as an ornamental plant because of its large and beautiful flowers. In Tamil, it is referred as Kanvalikilangu (eye starts paining on staring at the flower for a while), Kalappai kilangu (the tuber resembles the shape of the country plough), Thanthonri kilangu (self-sustaining crop on natural fences) and Venthati kilangu. It is the state flower of Tamil Nadu and national flower of Zimbabwe. *Gloriosa* found in wild a decade back, has been domesticated for economic gain since all parts of the plant find diverse use in Indian system of medicine. The plants possess an underground which is traditionally used as anthelmintic, abortifacient, anti-inflammatory, antipyretic and antileprotic. It is considered useful in treating colic, chronic ulcer and piles. The white starchy powder obtained by repeated grinding and washing of tuber is used for treating gonorrhoea. Tuber pieces soaked in salted buttermilk for 3-4 days and then dried are given as an antidote against cobra poisoning. The Ulanga people of Tanzania burn the herb and apply ash on wounds to promote healing and also drink the plant juice as an antimalarial tonic. Macerated tuber is also taken against

smallpox, leprosy, eczema, itch and ringworm. If patients take an overdose of *Gloriosa superba* tubers, death occurs as a result of respiratory depression and cardiovascular collapse.

Paramasivam and Arumugam, (1991) reported that major problems in the cultivation of glory lily were scarcity of planting material and low productivity due to lack of good management and improper pod set resulting in the loss of produce. Being an important medicinal plant with high demand, few literatures is available on seed production aspects only. Keeping this in view, the present investigation was conducted to effect of pollination studies in glory lily.

Materials and Methods

To study the receptivity of stigma, five sets of 25 flowers buds each, which were to open next day (i.e., one day before anthesis) were emasculated and bagged. Pollen from the other flowers of same plant were collected and pollinated at different days viz., one day before anthesis (-1 DAA), on the day of anthesis (0 DAA), one day after anthesis (1DAA), two days after anthesis (2 DAA) and three days after anthesis (3 DAA). Pollination was done between 8.30 to 9.30 am by dusting the stigma with freshly dehisced anthers and the flowers were bagged immediately after pollination and the data on pods set were recorded and stigma receptivity in terms of pod set percentage was worked out as follows,

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$$\text{Stigma receptivity (Pod set \%)} = \frac{\text{No. of pods set}}{\text{No. of flowers pollinated}} \times 100$$

Assessment of the suitable method of pollination to improve pod and seed set and seed quality, the following pollination treatments were imposed. Open pollination (Tagging flower bud one day before anthesis and leaving as such), Self pollination (Bagging flower bud with out emasculation one day before anthesis), Hand cross pollination (Emasculation and bagging of flower bud one day before anthesis and hand cross pollination with pollen of other plants one day after anthesis and bagging again), Hand self pollination (Bagging of flower bud with out emasculation one day before anthesis and hand self pollination with pollen of the same flower one day after anthesis and bagging again) and Natural cross pollination (Emasculation of flower bud one day before anthesis and leaving as such with out bagging) Twenty five flower buds which were to open on the next day were selected for each treatment in five replication.

The field experiment was carried out with Randomized Block Design and the data obtained from different experiments were analysed by the 'F' test for significance following the methods described by Panse and Sukhatme (1985).

Result and Discussion

Studies conducted by Narain (1976) in glory lily showed that stigma became receptive after anthesis with stigmatic hairs becoming shiny at the time of receptivity. The receptivity was maximum between 9.00 to 10.30 A.M. and continued for the next 27 to 32 hrs. However, receptivity of stigma even before anthesis and continuance upto three days had been recorded by Mamtha (1989) in the same crop. In the present investigation, dusting of foreign pollen on the stigma (pollination) one day after anthesis resulted in higher pod set (88 %) while pollination on the day of anthesis resulted in 80 % pod set. It clearly revealed that the stigma was receptive even before anthesis, as bud pollination resulted in 68 % pod set (Table 1).

Table 1. Studies of stigma receptivity and method of pollination to improve pod and seed set and seed quality in glory lily.

Treatment	Stigma receptivity (Pod set %)
Pollination one day before anthesis	68 (55.55)
Pollination on the day of anthesis	80 (63.43)
Pollination one day after anthesis	88 (69.79)
Pollination two days after anthesis	76 (60.66)
Pollination three days after anthesis	60 (50.76)
Mean	74.4 (59.60)
SEd	1.151
CD(P=0.05)	2.441

The present study an different pollination methods revealed that, Hand cross pollination

recorded 96 per cent pod set followed by 80 per cent pod set in natural cross pollination, while open pollination gave 64 per cent, hand self pollination gave 44 per cent pod set and self-pollination gave only 24 per cent pod set (Table 2).

Table 2. Studies of stigma receptivity and method of pollination to improve pod and seed set and seed quality in glory lily.

Treatment	Pod set (%)	Days to pod maturity	Length of pod (cm)	Girth of pod (cm)	Weight of pod (g)
Open pollination	64 (55.13)	63.7	7.7	4.9	4.49
Self pollination	24 (29.33)	64.4	7.5	4.6	3.74
Hand cross pollination	96 (78.46)	62.2	8.4	6.8	4.92
Hand self pollination	44 (41.55)	66.3	7.4	4.0	4.37
Natural cross pollination	80 (46.14)	63.1	7.9	6.0	3.93
Mean	61.64 (51.70)	63.94	7.78	3.88	4.29
SEd	1.262	1.369	0.146	0.079	0.088
CD(P=0.05)	2.675	2.903	0.310	0.169	0.187

In *G.rothschildiana*, Krause (1988) found that pod set was superior in cross-pollination followed by self-pollination. Ehlenfeldt (2001) observed lower fruit setting and a longer period of fruit ripening in self pollinated blueberries, while there was no significant difference in the fruit setting of 'Bluecrop' while Mamtha (1989) observed good pod set with artificial cross pollination in glory lily. Similar results were also reported by Shafi Bhat et al. (1991) in carnation. The reason for low fruit set in self-pollination was indicated due to self-incompatibility. In glory lily as well, the poor pod set in self-pollination could be due to incompatibility mechanisms or deflexed nature of the anther and stigma thus preventing self-pollination as suggested by Le Roux and Robertse, (1997).

In the present study, the pods formed by hand cross pollination matured earlier (62.2 days) with maximum length (8.4 cm), girth (6.8 cm), pod weight (4.92 g) (Table 2) and higher number of seeds (74.4). Whereas, it was reverse in hand self pollination (66.3, 7.4 cm, 4.0 cm, 4.37 g, 3.04g and 59.0) respectively. Similar results due to the hand cross pollination on fruit characters was reported in blue berry (*Vaccinium corymbosum*) by Lyrene (1989). Similar observation with increased seed number and seed set was also reported by Krause, 1988 in *G.rothschildiana* and Shafi Bhat et al. (1991) in carnation. The weight of seed per pod was also maximum (3.04 g) in hand cross pollination. The same trend was also noticed in other seed yield parameters such as shelling percentage (61.78 %) (Table 3). Similar results were also reported by Vanangamudi and Palanisamy (1989) in bittergourd.

The present study also proved that, seeds produced by hand cross pollination had higher seed quality parameters such as seed germination (54 %) and vigour index (1252). However, the seedling length and dry matter production were on par with the seeds produced by other pollination methods (Table 3). In support to the present findings, Steven and Robert (1991) also reported that germination

Table 3. Studies of stigma receptivity and method of pollination to improve pod and seed set and seed quality in glory lily.

Treatment	Weight of seed pod ⁻¹ (g)	100 seed weight (g)	No.of seeds pod ⁻¹	Shelling percentage	Germination (%)	Vigour index
Open pollination	2.01	3.39	65.0	44.76 (41.99)	52 (46.14)	1170
Self pollination	1.60	3.41	62.0	48.40 (44.08)	51 (45.57)	1132
Hand cross pollination	3.04	3.35	74.0	61.78 (51.81)	54 (47.29)	1252
Hand self pollination	1.92	3.43	59.0	43.57 (41.30)	50 (45.00)	1100
Natural cross pollination	2.24	3.37	67.0	56.99 (49.01)	53 (46.72)	1213
Mean	2.30	3.39	65.4	51.10 (45.63)	52.00 (46.14)	1173
SEd	0.044	0.071	1.234	0.606	0.670	26.309
CD(P=0.05)	0.094	NS	2.616	1.285	1.398	54.880

percentage and vigour index were slightly lower for seeds produced from self-pollinations as compared with seeds from cross-pollinations in *Zephyranthes atamasco*.

The above results clearly revealed that hand cross pollination showed the superiority in terms of pod and seed yield parameters such as maximum pod set, higher length, girth, weight of pod and seed, number of seeds per pod and shelling percentage accompanied with seed quality parameters such as higher germination percentage and vigour index of the seed.

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