Indian J. Hort. 71(2), June 2014: 295-297

Short communication

Studies on floral biology of *Malva sylvestris* L.

Gunjeet Kumar*, G.B. Kadam, T.N. Saha, Girish K.S., A.K. Tiwari and Ramesh Kumar
Directorate of Floricultural Research, Pusa Campus, New Delhi 110 012

ABSTRACT

***Malva sylvestris* is a perennial herbaceous plant with hermaphrodite flowers. Its floral morphology revealed that under Delhi conditions its period of flowering ranges from 1st week of March to end of April end under Delhi conditions. It possesses 20-35 branches with 50-75 flowers per branch emerging from leaf axils on each node. Natural pollen transfer in the species is efficient and fruit set following open-pollination is quite high. Stigma is overlapped by stamens and anthers. At receptivity style protrudes out and forms umbrella-like structure over anthers. At anthesis, pollen viability was recorded highest (95.71%) but started declining as day progressed. The curvature of style branches in *M. sylvestris* eventually brings some un-pollinated stigmas down to touch unshed pollen, potentially resulting in delayed selfing. Due to this mechanism extended selfing in a flower was found to coexist in nature with cross-pollination. Selfing was also promoted by geitonogamous mode and delayed selfing occurred when pollinators are scarce. Seed setting were also affected by the breeding system and maximum seed set was observed when the flowers were emasculated and hand pollinated.**

Key words: Phenology, stigma receptivity, pollen viability, delayed selfing, protandry.

Malva sylvestris L., a native of southern Europe and Asia, commonly known as 'Blue or Common Mallow', is a prolific growing herbaceous perennial; belonging to the family Malvaceae and produces showy mauve-purple flowers with dark veins during spring and early summer. Its lush green young leaves are edible and used for salad and in culinary preparations. Its attractive flowers are also used to garnish the salad plates in restaurant/hotel. This plant has a perennial root and a juicy 60 to 90 cm high stem. Its leaves are large, soft, mostly seven-lobed, and are broadly heart-shaped. It is a potential ornamental and can be used in herbaceous border, for temporary screening in landscaping, along with paths, etc. It has been found to be cross- compatible with *Alcea rosea*, however, such studies have been limited to academic interest only. Present study was attempted to get insight of the phenological development of *Malva sylvestris*.

Studies were conducted from 2011-13 at the research farm of Directorate of Floricultural Research, Pusa Campus, New Delhi. The seeds were sown in nursery in November and seedlings were transferred in 3-4 weeks in prepared beds each year. During March April of each year five plants were randomly tagged. Fifteen flowers/ plant were chosen to measure the petal length, petal width, style length, number of style branches, date of first and last flower opening and total number of flowers per plant. At a 2 h interval from 07:00 AM to 7:00 PM every day the development of style curvature was observed on five flowers/ plant and measured the length of the portion of the style exerted out from monadelphous androecium and number of style branches began to curve. Stigma receptivity was studied every 4 h intervals from 07:00 am to 7.00 pm and scored as positive for peroxidase (3% hydrogen peroxide) activity by observing vigorous bubbling across their entire surface and considered as receptive. Pollen viability was also studied at every 4 h interval from 7.00 AM to 7.00 PM using acetocarmine staining method (Shivana and Rangaswamy, 5). To assess the breeding system five treatments were designed which include: (1) intact open flowers, (2) autonomous self-pollination: flowers were bagged at anthesis, (3) emasculated flowers with open pollination (4) intact flowers with hand self-pollination, and (5) emasculated flowers with hand cross-pollination. After 25-30 days of anther dehiscence the schizocarps were harvested and the number of mature seeds per fruit was counted. Differences in fruit set and the number of seeds per fruit among different treatments were worked out.

Germination of seeds of *M. sylvestris* occured after 7.6 days. After transplanting it took 67.6 days to flower bud initiation and 8.8 days from flower bud initiation to flowering. The first flower was noticed on 5th March 2013 and it continued for over 45-55 days with the peak flowering (50% of flowering individuals) during March 25 to April 23. The number of flower buds per node ranged from 15 to 22, whereas number of branches/ plant varied from 20-35. The studies

*Corresponding author's E-mail: kumar_gunjeet@yahoo.com

on floral morphology revealed that petal length and width were 18.5 and 10.3 mm respectively. These reasonably large size of bright mauve purple petals make the flowers attractive for pollinating insects. Style length was recorded to be 7.8 with 10.8 number of style branches (Table 2). It is clear from Fig. 1, which anthers dehisce before the flowers open; the pollen viability reached maximum at 11 am (95.71%) at first day and declined thereafter. Approximately 40% pollen remained viable till the evening of second day. However, it reached at negligible levels on third day. In contrast to pollen viability, stigma was non-receptive during first day after anthesis and it was found maximum (90.85%) at afternoon of second day and declined thereafter (Fig. 2). The pollen viability reaches maximum during first day, whereas the style receptivity is at maximum on second day which leads to chances of cross pollination. The style began to curl enough down and comes in contact with own dehisced anthers (Fig. 1). When curvature of style branches touches their own anthers at that time pollen viability is considerably reduced. In case of scarcity of pollinators the remaining viable pollen from same flower leads to delayed self-pollination. The similar process was also reported in *Hibiscus laevis* (Klips and Snow, 2) and *H. trionum* var. *vesicarius* Hochr (Seed *et al*., 4). The percent set in open flowers was higher (≈10) than that of self-pollinated flowers (≈6) indicating that the species is predominately cross-pollinated (Fig. 2). The seed set was at par irrespective of source of pollens. The seed set in emasculated and open pollinated flower was considerably lower than that of controlled pollinated flowers. It indicates that absence of reward for pollinisers affects the pollination. The study revealed that *M. sylvestris* is predominantly cross pollinated species because flowers have a large showy colourful corolla, nectar and pollen rewards, which are attractive to pollinators and secondly due to approach herkogamy (presence of the stigma above the level of the anthers.) phenomenon. This was also corroborated with studies of Lloyd and Webb (3), and Karron *et al*. (1). The study also showed that the protandry in *Malva sylvestris* and enhanced activity of pollinators leads to cross pollination.

In conclusion, *Malva sylvestris*, a potential ornamental herb is a predominantly cross pollinated species due to protandry. However, it also provide some reproductive assurance by delayed autonomous selfing if the pollinators are inadequate.

REFERENCES

1. Karron, J.D., Jackson, R.T., Thumser, N.N. and Schlicht, S.L. 1997. Outcrossing rates of individual *Mimulus ringens* genets are correlated with anther- stigma separation. *Heredity*, **79**: 365-70. http://dx.doi.org/10.1038/hdy.1997.169

2. Klips, R.A. and Snow, A.A. 1997. Delayed autonomous self-pollination in *Hibiscus laevis* (Malvaceae). *American J. Bot.* **84**: 48-53.

3. Lloyd, D.G. and Webb, C.J. 1986. The avoidance of interference between the presentation of pollen and stigmas in angiosperms I. Dichogamy. *New Zealand J. Bot.* **24**: 135-62. http://dx.doi.org/10.1080/0028825X.1986.10409725

4. Seed, L., Vaughton, G. and Ramsey, M. 2006. Delayed autonomous selfing and inbreeding

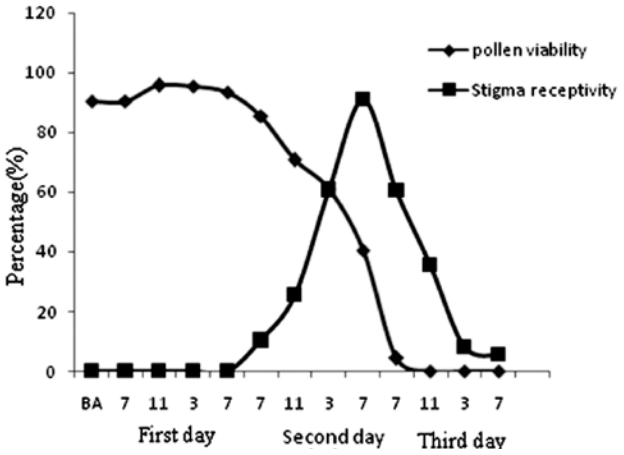

Fig. 1. Pollen viability and stigma receptivity in *Malva sylvestris* (BA: before anthesis).

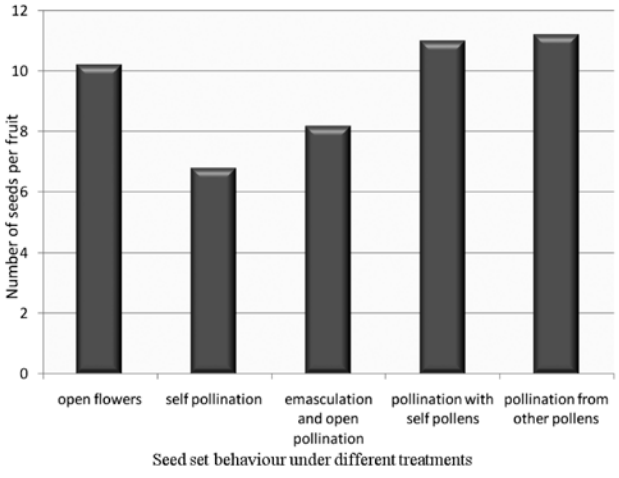

Fig. 2. Effect of pollination treatments on seed set *Malva sylvestris*.

Fig. 3. Flower developmental stages of *Malva sylvestris*. (a) flower bud initiation (b) flower bud formation (c) un-protruded style below pollen grains, (d) style emergence, (e) stigma emergence, (f) formation of style curvature, (g) receptive stigma, and (h) schizocarp formation after fertilization.

depression in the Australian annual *Hibiscus trionum* var. *vesicarius* (Malvaceae). *Australian J. Bot.* **54**: 27-34.

5. Shivana, K.R. and Rangaswamy, N.S. 1992. *Pollen Biology: A Laboratory Manual*, Springer-Verlag, Berlin, Germany, 119 p.

Received: July, 2013; Revised: February, 2014;
Accepted: April, 2014