Journal of Crop and Weed, 5(1):58-60 (2009)

Studies on flowering and receptivity of stigma in mulberry (*Morus* sp) germplasm

S. ROY CHOWDHURI, H. SAU, S. G. DOSS, M. K. GHOSH AND A. K. BAJPAI

Mulberry Breeding and Genetics Section
Central Sericultural Research and Training Institute,
Berhampore-742 101, West Bengal, India

ABSTRACT

Seven species of mulberry namely Morus indica (x, hp and black), M. rubra, M. alba, M. rotundiloba, M. cathyana, M. australis and M. multicaulis maintained in the germplasm bank of Central Sericultural Research and Training Institute, Berhampore, West Bengal, India were studied for flowering and reproductive behaviours specially receptivity of stigma during regular flowering season January to April. Days taken on flowering were 2.5 – 6 days and 2.6 – 5.7 days in exotic and indigenous, respectively. Receptivity period of stigma revealed that pollination index (PI) was significantly higher between 10th and 14th day of emergence of catkins from the scale leaves. PI was low before 8th and after 18th day of bagging in all the species. Significant positive correlation observed between the seed set and size of sorosis, seed set and weight of 100 seeds and seed set and seed germination indicated that the higher receptivity period of stigma lies between 10th and 14th day which increased the number of seeds per sorosis alongwith sorosis weight, size, seed weight as well as rate of seed germination. The information may be useful for the breeders for synchronizing of flowering in parents and creating heterozygous progenies in mulberry.

Key word: Flowering mulberry and stigma receptivity

Among the mulberry species available in India namely *Morus alba*, *M. indica*, *M. serrata* and *M. laevigata* are indigenous. Many mulberry germplasm viz. *M. multicaulis*, *M. nigra*, *M. rotundiloba*, *M. cathayana* and *M. tiliaefolia* introduced in India are promising ones. Mulberry being the sole food plant of silkworm (*Bombyx mori* L.), development of high yielding and qualitatively superior varieties is the aim of mulberry breeding. Selection of parents and their effective utilization in suitable combinations to obtain desirable genetic diversity among the progenies are the pre-requisite for mulberry improvement. The cross-pollinated and heterozygous perennial mulberry is propagated vegetatively through stem / shoot cuttings since propagation through seeds are not ideal as every individual seed is different from each other individual in the particular cross combination. For developing mulberry variety with high productivity and quality, like other crop plants, it is necessary to generate detailed information on parents to be utilized in breeding programmes. Among different characters, flowering behaviour of parents, efficiency of pollens, receptivity of stigma etc. are the important factors for synchronization of flowering. Information on the flowering, sex expression, receptivity etc. in mulberry though available for different varieties / cultivars, information on behaviours of stigma of different species are meagre. Since a number of mulberry accessions of different species are being conserved at germplasm banks, present study was undertaken in order to generate information on flowering, receptivity of stigma and pollination success in mulberry species for using them in breeding programmes.

E mail : csrtiber@rediffmail.com

MATERIALS AND METHODS

Mulberry species namely *Morus indica* (x, hp and black), *M. rubra*, *M. alba (Rangoon)*, *M. rotundiloba*, *M. cathyana*, *M. australis* and *M. multicaulis* maintained in the germplasm bank of Central Sericultural Research and Training Institute, Berhampore, West Bengal, India (24°6'N and 88°15'E) were studied during the flowering season i.e., January to April. Data of three plants of each species were recorded on size of inflorescence (catkin), number of florets per catkin, length of style and stigma, receptive period of stigma, size of fruit (sorosis), fruit weight, seed set, setting % weight of 100 seeds, and seed germination %. Female inflorescences were covered with the paper bags after their emergence from the scale leaves. Immature inflorescences and apical buds were clipped off to ensure uniformity in treatment. Ten bags each of ten catkins were covered for each treatment. Pollens of Mandalaya (S1) having more than 90% viability were collected in the Petri dish during the dehiscence of anthers between 10 AM to 11.30 AM.. Pollen fertility were tested with 0.5% aceto-carmine, and confirmed by pollen germination with 10% sucrose solution by hanging drop method. Pollination was done starting from 4th day of bagging and continued every alternative day upto 24th day. Few bags were left without pollination as control. Fruits (sorosis) were harvested at maturity. Seeds were collected from each sorosis and pollination index (PI), weight of 100 seeds

and seed germination were recorded and data were statistically analysed.

RESULTS AND DISCUSSION

Observation on development and blooming of inflorescence (catkin) in exotic accessions started during third week of January and continued unto the third week of April, while in indigenous, the period ranged between second week of January to third week of April. Days taken on flowering were 2.5 – 6 days and 2.6 – 5.7 days in exotic and indigenous, respectively (Roy Chowdhuri *et al*., 2004). Data on fruit (sorosis) characters, seed setting and seed weight revealed that among the species a significant variation exists in the fruit and seed characters. Maximum length and width of sorosis was observed in *M. multicaulis* (31.25 mm; 10.77 mm), number of achenes per sorosis and weight of 100 seeds in *M. indica* (hp) (31.40; 0.24 g), sorosis weight in *M. multicaulis* (1.08 g), seed germination in *M. indica* (x) and *M. indica* (black) (96.95%) and seed set in *M. multicaulis* (89.85%). The *M. alb* was found to have the lowest in all the parameters studied in fruit characters (13.95 mm, 8.20 mm, 15.42, 0.30 g, 0.16 g, 62.97 % and 78.57% respectively) (Table 1).

Receptive period of stigma for pollination study revealed that seed formation was observed only in the bags where pollination was done between the 6^{th} and 20^{th} day of emergence of the catkins from the scale leaves. The number of seeds per sorosis in the open-pollinated conditions showed highest in pollination index which might be due to repetition of pollination to the florets of different maturity (Das and Krishnaswami 1965; Visser and Marcucci 1983).

Analysis of variance done in respect of average weight of sorosis and seed settingshowed significant influence with the difference of day of pollination except in the case of weight of 100 seeds, which was *at par* with the days of pollination. The receptive period of stigma also showed significant difference with the species. Pollination index (PI) was significantly higher where pollination was done between 10^{th} and 14^{th} day of bagging but was *at par* in the previous and subsequent two days. PI was low when the catkins were pollinated before 8^{th} and after 18^{th} day of bagging (Fig 1 and 2). Low in PI was due to lack of receptivity of stigma in the early days due to their immaturity which either affected the pollens to germinate on the stigma or their subsequent penetration to the styler tissues. Further, the rapid decline of receptivity in the later days could be decaying of stigma tissues due to aging (Manivel *et al*. 2005).

A significant positive correlations were observed between seed setting and size of sorosis, seed setting and weight of 100 seeds and seed setting and seed germination indicating that higher receptivity of stigma not only increased the number of seeds per sorosis but also sorosis weight, size, seed weight as well as rate of seed germination (Table 2), which supported the findings of earlier workers (Dandin *et al*., 1987; Vijayan *et al*., 1997).

Confirming the higher seed setting coupled with maximum seed germination between the 10^{th} and 14^{th} day of emergence of catkin from the scale leaves, pollination in mulberry should be done within those days to obtain better success in hybridization as well as effective utilization of pollens of the short duration male flowering parents. The information will be of immense help for the breeders for intra- and inter specific hybridization with suitable parents for developing large number of progenies with desired economic characters to select the best one, and in turn benefit the sericulture farming community and the industry as a whole in the country.

REFERENCES

Dandin, S. B., Kumar, R. Rabindran, R. and Jolly, M. S. 1987. Crossibility studies in mulberry. *Indian J Seric*. **24** : 1-4.

Das, B. C. and Krishnaswami, S. 1965. Some observations on interspecific hybridization in mulberry. *Indian J. Seric.* **4**: 1-8.

Manivel, P., Vinod, Kumar., Thakur, K. C. and Pandey, S. K. 2005. Stigma receptivity and pollination success in potato (*Solanum tuberosum* L.). *Indian J. Genet.* **65** :149-50.

Vijayan, K., Tikader, A. Roy, B. N., Qadri, S. M. H. and Pavan Kumar, T. 1997. Studies on stigma receptivity in mulberry (*Morus* spp.). *Sericologia* **37** : 343-46.

Visser, T. and Marcucci, C.M. 1983. Pollen and pollination experiments. IX: The pioneer pollen effect in apple and pear related to the interval between pollination and the temperature. *Euphytica* **32**: 703-09.

Table 1. Fruit and seed characters in different species of mulberry

Species	Origin (country)	Sorosis length (mm)	Sorosis width (mm)	No. of achenes/ sorosis	Sorosis weight (g)	Wt. of 100 seeds (g)	Seed germina-tion (%)	Seed set (%)
Morus indica (x)	Indigenous	21.92	11.15	21.90	0.87	0.17	96.95	88.06
M. indica (black)	Indigenous	21.20	9.92	28.52	0.48	0.21	96.95	82.87
M. indica (*hp*)	Indigenous	29.82	10.30	31.40	1.03	0.24	86.97	78.84
M. rubra	USA	21.12	9.52	19.55	0.48	0.18	88.35	79.71
M. alba (Rangoon)	Burma	13.95	8.20	15.42	0.30	0.16	62.97	78.57
M. rotundiloba	France	22.00	10.00	21.47	1.02	0.19	86.67	79.99
M. cathyana	Indonesia	24.10	12.60	27.97	0.90	0.20	83.95	80.95
M. multicaulis	Indonesia	31.25	10.77	37.67	1.08	0.24	71.10	89.58
M. australis	Australia	18.82	9.45	20.47	0.48	0.16	83.77	84.10
LSD (P 0.05)		*0.927*	*0.398*	*1.059*	*0.044*	*0.003*	*1.953*	*4.286*
CV (%)		*9.337*	*8.852*	*9.660*	*13.619*	*4.260*	*5.273*	*11.805*
S.Em (±)		*0.287*	*0.080*	*0.367*	*0.016*	*0.001*	*0.708*	*0.873*

Table 2. Associationship of fruit and seed characters of mulberry.

Parameters	Fruit wt (mg)	Seed Setting (%)	Size of catkin (mm)	Wt of 100 seeds (g)	Seed germination (%)
Fruit wt. (mg)	1				
Seed set (%)	0.8738 ^{NS}	1			
Size of catkin (mm)	0.9392 *	0.9850 **	1		
Wt of 100 seeds (g)	0.9091 *	0.9853 **	0.8939 **	1	
Seed germination (%)	0.8639 ^{NS}	0.9074 **	0.9829 **	0.9768 **	1

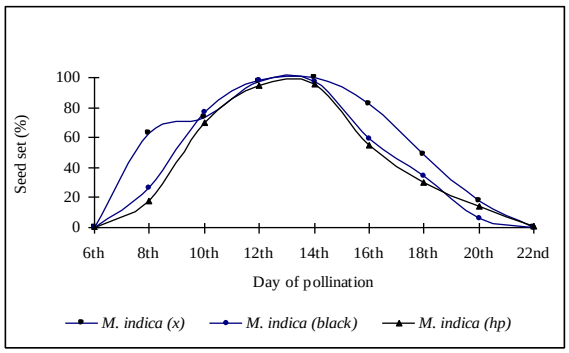

Fig 1. Receptive period of stigma (Indigenous)

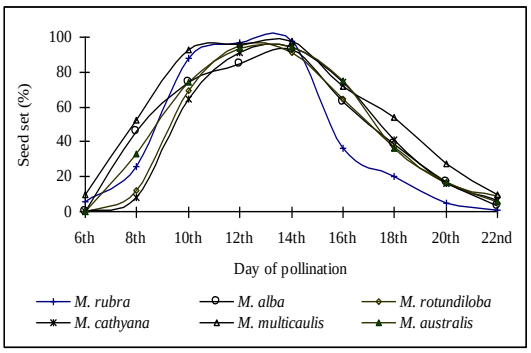

Fig 2. Receptive period of stigma (Exotic)