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Studies on anthesis and flowering pattern in mulberry germplasm

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Abstract

Mulberry (*Morus* sp.) dioecious (male) and monoecious germplasm accessions of different geographical origin showed anthesis period between January and April. Indigenous and exotic accessions of Asian countries flowered during January to February except few accessions from Japan, China, Burma and Turkey which flowered during March and April months, while rest flowered during March to April. The number of catkins per axis was more in exotic accessions with small size and less number of florets compared to indigenous one. Dehiscence of anther was highest during 10.00-11.30 AM and 3.00-4.00 PM in the day time, while the event occurred throughout the day and was restricted to 1-4 days (Indigenous 1- 3; Exotic 2-4 days) for a single catkin. The size of the pollen showed variation with two germpores irrespective of its origin, except in few cases where the germpores were 3-4. *In vitro* germination of pollen showed significant variation and did not relate with the origin of the accessions but declined with the increase of storage time.

Key words: Mulberry germplasm, anthesis, flowering

Introduction

The information on anthesis, sex expression and reproductive behaviour is a necessity for any breeding programme. Sexuality and flowering pattern in mulberry have been studied on commonly used breeding lines by the earlier workers [1, 2]. Therefore, information on anthesis and floral biology in a large scale number of accessions is scanty and there is urgent need to screen wide range of mulberry genetic resources and at first phase, anthesis of male donor parent have been studied for their suitability in breeding programme.

Materials and methods

Among 61 accessions, twenty were recorded as male in dioecious and forty-one as monoecious. These accessions belonged to different geographical origin (Indigenous 22; Exotic 39). Observations were made on three plants per accession on per day basis. Dehiscence of anthers was observed on hourly interval taking ten catkins from each accession. Time taken for complete opening of flowering buds, number of catkins per flowering bud, length and breadth of male catkin, number of florets per catkin, pollen diameter, germination and viability of pollens were recorded. Temperature and humidity throughout the observation period were also recorded.

Results and discussion

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 accessions, the period ranged between second week of January to third week of April. On an average, the accessions bloomed during mid January to April, irrespective of their origin. Two indigenous accessions, *viz.*, Nayadgami and White Badana, which were collected from Jammu and Kashmir, bloomed in the month of April. Rest of the indigenous accessions bloomed during January to February. The exotic accessions, collected from the neighbouring countries like, Bangladesh, Burma, Thailand and Australia, bloomed in the month of January and February. Out of 49 accessions originated from Asia continent, 32 bloomed in January and February. But few accessions collected from Japan (13), China (1), Burma (2) and Turkey (1) bloomed during March and April and did not show any regular pattern on the origin of the accessions. The possible reason might be the mono-genus origin of mulberry that was explored at different periods from the Sub-Himalayan region and their subsequent adaptation in different countries. Thus the accessions collected from Europe, North America and Africa bloomed during March and April except one accession from Italy which bloomed in the month of January (Table 1).

Observation on days taken for complete opening of the flowering buds showed variation among the accessions of different origin. The period ranged 2.5-6 days and 2.6-5.7 days in exotic and indigenous accessions, respectively. Number of catkins per flowering bud was 1-6 in exotic and 1-5 in indigenous accessions. Quantitative study on catkin and florets revealed that length and breadth of catkin and number of florets per catkin were higher in indigenous accessions than that

Table 1. Flowering seasons of mulberry accessions

Origin	No. of accessions	Months			
		Jan.	Feb.	March	April
Dioecious					
Asia					
India	9	9			
Japan	5		2	1	2
Thailand	2	2			
Turkey	1			1	
Africa					
Egypt	1				1
Europe					
Italy	2			1	1
Monoecious					
Asia					
India	13	11	2		
Burma	4	2		2	
Bangladesh	2	1	1		
China	2	1		1	
Japan	11	1		6	4
Australia					
Australia	1		1		
Europe					
Portugal	1	1			
France	2	1		1	
Italy	2	1		1	
Russia	1			1	
Spain	1			1	
North America					
Canada	1				1
Total	61	30	6	16	9

of exotic accessions (Table 2). Catkin length showed significant variation among the accessions. Larger catkins (43-51 mm) and higher number of florets (40-47) were recorded in the accessions-Kosen and Thailand (un-lobed) while the shorter catkins were recorded in Sosuke, Senmatso and China black-A (10-17 mm) of exotic accessions. In indigenous accessions, large catkins (50-53 mm) and higher number of florets (50-54) were recorded in the accessions-MS-7 and KPG-1.

Dehiscence of anther occurred throughout the day with maximum number during 10-11.30 AM and 3-4 PM of a day and the duration was restricted to 1-4 days for individual catkin (Table 3). Variation in anther dehiscence was recorded at different hours of the day corroborates the observation of Das *et al.* [1] who studied in other mulberry varieties. Anther dehiscence period was however, 1-3 and 2-4 days in indigenous and exotic accessions respectively. Inflorescence of three monoecious accessions-Berhampore-6, Kaliakotahi and Jatinuni appeared to be male dominating plants where the non-dehiscence nature of anther occured due to higher thickness of microspore cell wall [3]. The size of the pollen showed significant variation in both indigenous (11.2 to 36.4 µm) and exotic (11.2 to 30.8 gm) accessions with two germpores except in few accessions where number of germpores was 3 to 4. Pollens stored in refrigerated conditions at 5°C showed 42-45 % viability upto 10 days. *In vitro* germination of pollen revealed that the rate of germination declined with the increase of storage time from 96.4% to 42.3% recorded on the first and tenth day of refrigeration.

Table 2. Flower and reproductive characters of different mulberry accessions

Origin of accessions	Length of catkin (mm)	Breadth of catkin (mm)	No. of florets/ catkin	Days for dehis-cence of anthers/ catkin	Pollen germina-tion (%)
Indigenous	30.76	8.12	27.63	1.47	73.56
Exotic	27.39	7.68	25.99	2.01	76.47
± SD (CV%)					
Indigenous	2.45	0.83	2.37	0.45	2.14
	(7.95)	(10.23)	(8.56)	(30.62)	(3.41)
Exotic	1.91	0.76	1.88	0.53	1.79
	(6.96)	(9.76)	(7.22)	(26.39)	(2.34)
CD value					
Indigenous	3.50	1.03	3.76	0.27	2.63
Exotic	1.48	1.01	2.26	0.17	2.11

Data in parenthesis are the value of Co-efficient of variance; CD value -* $p < 0.05$,** $p < 0.01$

Table 3. Dehiscence of anthers at different hours of a day

Anthesis period	No. of florets	Percentage of florets					
		6-8 AM	8-10 AM	10-12 Noon	12-2 PM	2-4 PM	4-6 PM
Jan.-Feb.							
Indigenous	772	8.32	14.24	29.92	17.87	23.05	6.60
Exotic	603	6.96	16.91	29.85	14.92	21.89	9.38
Mar.- Apr.							
Indigenous	486	12.76	21.41	27.98	12.55	18.72	6.58
Exotic	519	14.27	19.84	31.02	10.59	18.89	5.39

The observation on *in vivo* pollination index supported the declined percentage of pollen germination and lower seed set with the stored pollen, though variation existed between the two. Rangaswamy *et al.* [4] suggested that a suitable medium remained in the stigmatic and style tissues that helped fertilization and made up of the differences, as declined due to storage of pollen. Das and Sarkar [5] reported that dusting of huge quantity of stored pollens on stigma caused effective fertilization and results higher seed set. The information generated from the present will help the breeders in selecting compatible donor male parent to synchronize the breeding programme as well as to ensure efficient pollination thereby gaining huge number of seeds from crosses.

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