

FLOWERING PHENOLOGY OF COTTON PLANT IN DIFFERENT CLIMATIC CONDITION

Sangole AA

Department of Botany, Shri. R.L.T. College Science, Akola, Maharashtra India

anjali5sangole@rediffmail.com

ABSTRACT

A phenological record depends on parameter chosen by the various investigators and depends on the research levels, the aim of the research, and the type of analysis. Plants reproductive characteristic can affect the flowering phenology, mode of seed dispersal and fruiting seed set efficiency. From the observations on flowering phenology, it is noticed that the flowering phenology is related with seasonal variations and environmental conditions and has an impact of different environmental factors. phenology are opening of flower, anther dehiscence, pollen presentation and stigma receptivity. Flower opening in all cotton varieties starts during 06.45 to 09.45 hours followed by anther dehiscence, which starts, from 07.00 hours depending on the weather conditions. During cloudy and rainy days flowers starts to open after 07.30 hours depending on prevailing temperature.

Keywords: Cotton varieties, Flower, climatic condition, Phenology.

1. Introduction

Cotton is one of the most commercial crops playing a key role in economic, political and social affairs of the world. Chiefly as a fiber crop cotton is cultivated in about 60 countries of world. India grows cotton on a commercial scale. Cotton belongs to mallow family, or Malvaceae, which has representatives in nearly all parts of the world, but its species are most abundant in the tropics and in warm regions. Cotton is a tropical and subtropical crop grown on a variety of soil. The predominant types of soil on which the crop is grown are the black cotton soil and red sandy loams to loams found in the state of Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamilnadu. The sowing season of cotton varieties differs considerably in different regions for obtaining maximum yield of cotton. The crop yield is depending on reproductive success of the plant. During the process of reproduction the pollen grains plays very important role.

Phenology is the study of timing of vegetative activities, flowering and fruiting and their relationships to environmental factors (Mori and Prance, 2005). "Flowering Phenology" refers to the seasonal timing of flowering.

A phenological record depends on parameter chosen by the various investigators and depends on the research levels, the aim of the research, and the type of analysis. The main

events are the timing, duration, sequence, intensity and timing of flowering, which can determined by the physical environment factors like temperature, rainfall and day-length (Dafni, 1992). Plants reproductive characteristic can affect the flowering phenology, mode of seed dispersal and fruiting seed set efficiency. A wide variety of environmental factors may select for one or more reproductive characteristic in plant population (Smith *etal*, 1986) and such factors include seasonal climatic events (Schemske, 1977).

2. Materials and Methods

For the collection of phenological data of selected cotton varieties, field trips were undertaken daily or on alternate days. Events and the changes of the single flower are recorded to study the flowering phenology in relation to geographical (latitudinal and altitudinal) and climatic variables, the time and duration of pollen exposure and the interrelations among environmental variables (temperature and humidity) and flower development were noted.

Plants were observed from the beginning of flowering stage up to the opening of last flower. Flowering period was taken as the period from the opening of first flower up to the opening of last flower. The timing of

onset, progress, termination and blooming of selected varieties under study were noted.

OBSERVATION

In all selected varieties of cotton, it is observed that the flowering starts during 1st to 19th of September and full blooming was from 9th October to 28th November (Table No.01). Full blooming in all cotton varieties was observed when the temperature was in the range of 23⁰C to 30⁰C and 21.1⁰C to 27.7⁰C. The range of % humidity during full bloom period was 74.6 to 82.0 and 55.4 to 87.7. In all varieties the flowering stands to terminate towards the end of month of December (Table No.01).

Flower opening in all varieties starts during 06.45 to 09.45 hours depending on the weather conditions. During cloudy and rainy days flowers starts to open after 07.30 hours depending on prevailing temperature. The anther dehiscence in all varieties was observed during 07.00 to 08.30 hours. The stigmas become receptive before anther dehiscence. The stigmas were viscid and shiny and remained receptive for about 8 hrs. After 03.00 hours it become blackish in color indicating loss of receptivity. The opened flowers start to withered by the evening on same day.

At the full bloom time the plants of cotton variety Ajeet-11 were with maximum height of 111 cm having up to 150 leaves per plant, however, in Ankur-651 height was 72 cm with 80 leaves. The number of leaves, more or less correlates with the height of plant. For each variety parameters like height, number of leaves, number of balls, number of flowers open per day, and number of anthers per flower showed variations for each parameter (Table No.02).

3. Result and Discussion

In all selected varieties of cotton, it is observed that the flowering starts during 1st to 19th of September and full blooming was from 9th October to 28th November during the year. Full blooming in all cotton varieties was observed when the temperature was in the range of 23⁰C to 30⁰C and 21.1⁰C to 27.7⁰C. The range of % humidity during full bloom period was 74.6 to 82.0 and 55.4 to 87.7 In all varieties the

flowering stands to terminate towards the end of month of December.

Flower opening in all varieties starts during 06.45 to 09.45 hours depending on the weather conditions. During cloudy and rainy days flowers starts to open after 07.30 hours depending on prevailing temperature. The anther dehiscence in all varieties was observed during 07.00 to 08.30 hours. The stigmas become receptive before anther dehiscence. The stigmas were viscid and shiny and remained receptive for about 8 hrs. After 03.00 hours it become blackish in colour indicating loss of receptivity. The opened flowers start to withered by the evening on same day.

From the observations on flowering phenology, it is noticed that the flowering phenology is related with seasonal variations and environmental conditions and has an impact of different environmental factors.

During the present investigations flowering in different varieties of cotton starts from the first or second week of September when the prevailing temperature was found to be in the range of minimum 21.1⁰ C to 24.2⁰ C and maximum 24.2⁰ C to 30.0⁰ C and the relative humidity minimum 55.4 to 87.7% and maximum 55.4 to 82% (Table No. 01). Number of flowers opened per day was 3-9 flowers on each plant in different varieties of cotton. Full bloom period was during the month of October to November.

Another events under phenology are opening of flower, anther dehiscence, pollen presentation and stigma receptivity. Flower opening in all cotton varieties starts during 06.45 to 09.45 hours followed by anther dehiscence, which starts, from 07.00 hours depending on the weather conditions (Table No. 01). During cloudy and rainy days flowers starts to open after 07.30 hours depending on prevailing temperature.

Moreover, Krishnaswamy and Mathuda (1954) have divided the factors influencing phenology into two, that is: Internal and External ones. Internal factors control the development of the species and in determining the pattern of its phenological behavior while external factors modify the influence of internal factors and accounts for fluctuation.

From the observations on flowering phenology, it is noticed that the flowering phenology is related with seasonal variations and environmental conditions and has an impact of different environmental factors (Table No. 01). Flowering phenology of different plant species studied by Subba Reddi and Reddi (1982), Herrera (1986), Shimida and Dafni (1989), Struck (1992) and Tidke and Dharamkar (2003) also supported the present findings.

Another events under phenology are opening of flower, anther dehiscence, pollen presentation and stigma receptivity. Flower opening in all cotton varieties starts during 06.45 to 09.45 hours followed by anther dehiscence, which starts, from 07.00 hours depending on the weather conditions (Table No. 01). During cloudy and rainy days flowers starts to open after 07.30 hours depending on prevailing temperature. Delay in flower opening and anther dehiscence due to weather conditions in other plant species is also

reported by Tidke and Dharamkar (2003), Tidke and Gawande (2005) and Tidke (2005). Das *et al* (2007) stated that the anthesis is delayed on cool and/or cloudy days; the length of delay from the scheduled time is subject to the degree of coolness and ranged from one to two hours. Overcast sky and/or rainy weather may delay the process of anther dehiscence for thirty minutes.

The anther dehiscence in all varieties of cotton was observed during 07.00 to 08.30 hours, synchronizing with the period of anthesis. Thus the pollen mass is made available to the flower visitors especially to bees. Tidke and Dharamkar (2003), Thorat (2007) and Dahat (2008) studied the flower visitors from this region, including several bees, butterflies bugs, birds etc. Amongst the flower visitors of cotton as the bees were frequent visitors; it is obvious that the pollen mass released will be made available for bees, consequently rendering their services as a dominant and faithful pollinators.

Table No. 01: Phenological data of cotton varieties.

| Sr. No. | Variety | Timing of flower opening (anthesis) | Time of anther dehiscence | Date of last flower | Time of stigma receptivity | Reward | Range of Temp. (°C) | Range of Humidity (%) |
|---------|------------|-------------------------------------|---------------------------|----------------------|----------------------------|--------|----------------------------|----------------------------|
| 1 | NHH-44 | 7.30 to 9.15 7.20 to 9.00 | 7.20 am 7.00 am | 29/12/03 20/12/05 | Before Anthesis | Pollen | 27.0 – 24.0 27.7 – 24.2 | 76.7 – 78.3 55.4 – 55.4 |
| 2 | Ankur-651 | 7.00 to 8.30 8.00 to 9.45 | 7.30 am 8.30 am | 15/12/03 18/12/05 | Before Anthesis | Pollen | 30.0 – 23.0 24.2 – 22.0 | 82.0 – 74.9 55.4 – 80.0 |
| 3 | AKH-081 | 7.00 to 8.30 7.25 to 9.15 | 7.30 am 7.30 am | 18/12/03 28/12/05 | Before Anthesis | Pollen | 30.0-24.0 27.0-24.0 | 82.0 – 78.3 76.7 – 78.3 |
| 4 | DHY-186 | 7.15 to 9.15 7.10 to 8.45 | 7.30 am 7.20 am | 18/12/03 26/12/05 | Before Anthesis | Pollen | 30.0-24.0 26.6-21.1 | 82.0 – 78.3 68.8 – 78.5 |
| 5 | PA-348 | 7.30 to 8.15 7.15 to 9.05 | 8.00 am 8.00 am | 15/12/03 20/12/05 | Before Anthesis | Pollen | 30.0 - 24.0 27.7 – 22.0 | 82.0 – 78.3 55.4 – 80.0 |
| 6 | Renuka-143 | 7.15 to 9.30 6.45 to 8.35 | 7.30 am 7.20 am | 29/12/03 17/12/05 | Before Anthesis | Pollen | 30.0 – 23.0 26.6 – 22.0 | 82.0 – 74.9 68.8 – 80.0 |

| | | | | | | | | | | |
|---|----------|------------------------------|--------------------|----------------------|--------------------|--------|------------------------------|------------------|------------------------------|------------------|
| 7 | H-10 | 7.05 to 9.00 7.30 to 9.00 | 7.45 am 8.00 am | 12/12/03 28/12/05 | Before Anthesis | Pollen | 27.0 24.0 24.2 22.4 | – – – – | 76.7 78.3 55.4 87.7 | – – – – |
| 8 | PKV-hy-2 | 7.15 to 9.30 7.15 to 9.00 | 8.00 am 7.35 am | 18/12/03 28/12/05 | Before Anthesis | Pollen | 27.0 24.0 24.2 22.0 | – – – – | 76.7 78.3 55.4 80.0 | – – – – |

Table No. 02: Plant morphology of cotton varieties.

| Sr. No. | Name of variety | Plant height | No. of leaves | No. of bolls | No. of flowers | No. of anther/flower |
|---------|-----------------|--------------|---------------|--------------|----------------|----------------------|
| 1 | NHH-44 | 92cm | 80 | 10 | 7 | 70 |
| 2 | Ankur-651 | 72cm | 80 | 15 | 7 | 95 |
| 3 | AKH-081 | 87cm | 50 | 5 | 9 | 82 |
| 4 | DHY -186 | 90cm | 79 | 16 | 8 | 86 |
| 5 | PA-348 | 101cm | 89 | 14 | 9 | 77 |
| 6 | Renuka-143 | 80cm | 60 | 12 | 4 | 89 |
| 7 | H-10 | 85cm | 86 | 15 | 8 | 93 |
| 8 | PKV-hy-2 | 90cm | 70 | 13 | 6 | 89 |

References

- Dafni, A. (1992). *Pollination Ecology: A Practical Approach*. I.R.L./O.U.P., Oxford.
- Krishnaswamy, V. S. and Mathuda, G. S. (1954). Phenological behaviour of a few forest species at new forest, Dehradun. *Ind. For.* 80: 124 - 153.
- Thorat, S. B. (2007). "Investigations on reproductive ecology and in vitro regeneration of some red listed medicinal plants". Ph.D. Thesis. Sant Gadge Baba Amravati University, Amravati.
- Mori, S.A. and Prance, G.T. (2005). *The New York Botanical Garden. Phenology 1*: 11.
- Schemske, D. W. (1977). Flowering phenology and seed set in *Clytona virginica* L. (Portulacaceal.). *Bull, Torrey Bot. Club.* 104: 254 - 263.
- Shimida, A. and Dafni, A. (1989). Blooming strategies, flower size advertising in the "Lily group" genophytes in Israel. *Herbertia* 45: 115 – 123.c
- Smith, B. H., Margaret, L., Ronshem and Swartz, K. R. (1986). Reproductive Ecology of *Jeffersonia diphylla* (Berberidaceae). *Amer. J. Bot.* 73 (10): 1416 - 1426.
- Subba Reddi, C. and Reddi, P. S. (1982). The pollination biology of *Ipomoea kentrokaulos* (Convolvulaceae). *Indian Bot. Repr.* 1 (1): 1 – 4.
- Tidke, J. A. and Dharamkar, R. O. (2003). Flowering phenology, pollen production and insect behaviour in some ornamentals. *J. Phytol. Res.* 16 (1): 73 – 76.
- Thorat, S. B. (2007). "Investigations on reproductive ecology and in vitro regeneration of some red listed medicinal plants". Ph.D. Thesis. Sant Gadge Baba Amravati University, Amravati.