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Angin N Konyak
Forest Biology and Tree
Improvement, Sam
Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

Dr. Afaq Majid Wani
Forest Biology and Tree
Improvement, Sam
Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

Corresponding Author:
Angin N Konyak
Forest Biology and Tree
Improvement, Sam
Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj,
Uttar Pradesh, India

Monitoring of vegetative and reproductive characters of *Cassia fistula*

Angin N Konyak and Dr. Afaq Majid Wani

Abstract

Study was conducted to observe the vegetative and reproductive characters of *Cassia fistula* in the Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj located at 25° 28'N latitude and 81° 55'E longitude. The new leaves emerged and their development continued up to the month July. Leaf fall was observed to begin from March till April. Flowering started during April, some simultaneously with new leaves. Peak flowering was observed from last week of April to third week of May. Anthesis took place at 8:30-10:30 a.m. and anther dehiscence around 12:30-14:30 hours.

Keywords: *Cassia fistula*, leafing, flowering, anthesis

Introduction

Cassia fistula belongs to the Leguminosae or Fabaceae family of the plant kingdom. It is more commonly known as Golden Shower tree or 'Amaltas' in Hindi. *Cassia fistula* is a medium sized tree of about 10- 20m. It is most famously and commonly recognized for its yellow flowers which covers the tree during its flowering period. The plants are vulnerable to frost. It prefers well drained, moderately fertile sandy loam soil with a pH of 5.5-8.7. The plants when established are fairly resistant to drought. The flowers are bisexual meaning, each of the flowers have both male and female reproductive structures.

C. fistula wood is hard, heavy and durable, and is well suited for making cabinets, agricultural implements, buildings and can also be used to make good quality charcoal. The leaves of *C. fistula* are deciduous and pinnate and each leaflet is about 7-21 cm long and 4-9 cm broad. They are bright green colored but are paler on the underside and are fed to cattle, sheep and goats together with low quality forages. They are also used widely to treat a wide array of skin problems while the bark is used in treating boils, leprosy, ringworm, etc. The bark of *C.fistula* is used for dyeing and tanning as well.

The flowers are of raceme inflorescence, 20-40 cm long and each flower is 4-7 cm in diameter with five yellow petals of equal size and shape, 10 stamens; 3 long, 4 medium and 3 short. The flowers attract pollinators like bees and butterflies. According to experiment conducted by Robert Scott Troup, Golden jackals also help in dispersal of seeds by feeding on the fruit. The fruits are cylindrical pods of about 20- 60 cm long and 1.5-2 diameters. When young the pods are dark green which later turn into dark brown.

It is crucial to have knowledge about the phenology of plants as it is a prerequisite in plant breeding and in formulating different tree improvement programs. This helps with the objective of tree breeding which is to develop fast growing and better yielding genetically improved superior trees in order to replace inferior quality plants so as to increase productivity per unit area and time. In this research article a successful attempt was made to find out the vegetative and floral characters of *Cassia fistula*.

Material and Methods

The present observations were made in the Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj, U.P. India, situated at 25° 28'N latitude and 81° 55'E longitude. The area is located at an altitude of 98 m and enjoys sub-tropical climate with an average annual rainfall of 1100 mm.

The investigation was carried out for vegetative and floral characters of *Cassia fistula*. A total of five trees were selected as sample trees for observation. Ten branches from each tree, totaling fifty branches in all were selected in all directions and tagged with a transparent tag. The data was recorded on initiation and completion of phenological events of vegetative character and reproductive character. In the vegetative character leaf bud swell, leaf bud burst, leafing and senescence were studied. In the reproductive character flower bud swell, flower bud burst, flowering, anthesis was recorded by making regular visits to the observation sites. The data was subjected to statistical analysis.

Results and Discussion

Upon close morphological observation, the leaf buds of *C. fistula* appeared in the axile. The buds are dark green in color. The leaf bud swell started in the last week of March and the leaf bud burst started right after i.e., the 1st week of April taking a total of 62.5 days (T3) and 32.8 days (T3) respectively. Leafing took about 103.2 days and leaf fall about 52.2 days. The flowers of *C. fistula* are in drooping raceme and are complete having both male and female reproductive parts. There are five petals that are bright yellow and sepals are light green. Peak flowering was observed in third week of April till last week of May varying in different trees and branches. Data given below reveal that maximum number of days for flower bud swell was 37.60 days (T1) and 44.4 days (T2) for flower bud burst. Flowering period took a maximum of 42.3 days (T5). Fruit formation initiated from last week of July to first week of August. This was after flowering period. There were little to no flowers on the trees during fruit formation. Flower bud development showed a total of twelve stages which took 34.1 days to Anthesis. (Nath and Randhawa, 1959; Josan *et al.*, 1979; Sharma, 2001) [3, 5] also reported similar findings in pomegranate cultivars and parallel results were obtained in *B. variegata* by (Wani *et al.*, 2008) [6]. The anthesis was observed between 8:30-10:30 a.m with anther dehiscence taking place in 12:30-14:30 hours.

Table 1: Total no. of days taken for various vegetative phytophases in *Cassia fistula*

Trees no.	Leaf Bud Swell	Leaf Bud Burst	Leafing	Leaf fall
T ₁	60.6	33.1	92.9	45.8
T ₂	58.2	32	96	50.5
T ₃	62.5	32.8	102.9	48.1
T ₄	58.5	31.1	103.2	52.2
T ₅	58.8	30.9	95.7	47.7
Mean	59.72	31.98	98.14	48.86
F- test	S	S	S	S
S. Ed. (±)	1.32	0.76	1.89	1.40
C. D. at 5%	2.69	1.55	3.84	2.86
C.V.	4.95	5.31	4.31	6.42

Table 2: Total no. of days taken for various reproductive phytophases in *Cassia fistula*

Trees	Flower bud swell	Flower bud burst	Flowering	Fruiting
T ₁	37.60	41.9	40.6	42.5
T ₂	37.30	44.4	42.1	44.1
T ₃	36.70	43.7	42	43.4
T ₄	34.40	41.5	39.9	44.2
T ₅	36.10	43.2	42.3	45.5
Mean	36.42	42.94	41.38	43.94
F-test	S	S	S	S
S.Ed(±)	0.619	1.048	0.788	0.89
C.D at 5%	1.26	2.11	1.60	1.82
C.V	3.80	5.40	4.26	4.54

Table 3: Mean values of different stages of reproductive bud development to anthesis in *Cassia fistula*

Plus tree		No. of days taken during different bud development stages										Anthesis time	Total no. of days
		I-II	II-III	III-IV	IV-V	V-VI	VI-VII	VII-VIII	VIII-IX	IX-X	X-XI	XI-XII	
D A Y S	T ₁	2.01	2.51	3.11	3.28	4.41	4.64	5.24	3.34	2.41	1.78	1.11	33.40
	T ₂	2.31	2.80	3.07	3.33	4.11	4.31	5.19	3.10	2.66	2.01	1.66	34.10
	T ₃	2.41	2.41	2.81	3.51	3.81	4.41	5.41	3.21	2.21	2.31	1.31	33.80
	T ₄	2.11	2.61	3.21	3.11	4.21	4.21	5.01	3.11	2.11	2.11	1.81	33.60
	T ₅	2.01	2.61	2.71	3.21	3.81	4.31	5.31	2.81	2.41	2.41	1.41	33.00
Mean	2.17	2.59	2.98	3.29	4.07	4.38	5.23	3.11	2.36	2.12	1.46	33.58	

Table 4: Average value for anthesis timing in *Cassia fistula*

Plus tree		No. of days taken during different bud development stages										Anthesis time	Total no. of days
		I-II	II-III	III-IV	IV-V	V-VI	VI-VII	VII-VIII	VIII-IX	IX-X	X-XI	XI-XII	
D A Y S	T ₁	2.01	2.51	3.11	3.28	4.41	4.64	5.24	3.34	2.41	1.78	1.11	33.40
	T ₂	2.31	2.80	3.07	3.33	4.11	4.31	5.19	3.10	2.66	2.01	1.66	34.10
	T ₃	2.41	2.41	2.81	3.51	3.81	4.41	5.41	3.21	2.21	2.31	1.31	33.80
	T ₄	2.11	2.61	3.21	3.11	4.21	4.21	5.01	3.11	2.11	2.11	1.81	33.60
	T ₅	2.01	2.61	2.71	3.21	3.81	4.31	5.31	2.81	2.41	2.41	1.41	33.00
Mean	2.17	2.59	2.98	3.29	4.07	4.38	5.23	3.11	2.36	2.12	1.46	33.58	

Table 5: Average value for anther dehiscence in *Cassia fistula*

Trees	Anther Dehiscence					
	6:30-8:30	8:30-10:30	10:30-12:30	12:30-14:30	14:30-16:30	16:30-18:30
T ₁	0.66	0.3	0.56	1.26	0.50	0.50
T ₂	0.2	0.8	0.27	1.13	0.50	0.09
T ₃	0.12	0.23	0.36	1.96	0.34	0.21
T ₄	0.1	0.2	0.23	0.83	0.20	0.18
T ₅	0.3	0.7	1.23	1.43	1.20	0.17
Mean	1.38	2.23	2.65	6.61	2.74	1.15



Fig A: Leaf bud swell in *C. fistula*



Fig B: Leaf bud burst in *C. fistula*



Fig C: Flower bud swell in *C. fistula*



Fig D: Flower bud enlargement in *C. fistula*



Fig E: Flower bud burst in *C. fistula*



Fig F: Flowering in *C. fistula*



Fig G: Fruiting in *C. fistula*

Conclusion

From the present study and observations made, it is concluded that the vegetative characters starting with leaf bud swell to leafing took place from the last week of March to May. Leaf fall initiation was seen from March and took maximum of 52.20 days. Synchronous flowering of *Cassia fistula* started from mid-April to July. Flower bud development took 34.1 days in T2. The longest stage was observed to be V I I - V I I I. Anthesis took place before noon and anther dehiscence took place after 12 p.m.

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