



Seasonal and Climatic Variations in Phenology of *Butea monosperma* (Lam.) Taub. in East Vidarbha, India.

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Abstract: -The reproductive biology is adjacent to the floral and phenology and floral biology, of *Butea monosperma* (Lam.) Taub. Phenology is the study of reproductive biology and intricated by seasonal variations in climate as well as habitat. A good-looking tree *B. monosperma* is commonly called as bastard teak or palash or flame-of-the-forest. *Butea monosperma* is a class of *Butea*, inhabitant to hot and sub-tropical chunks of the southeast Asia, and Indian subcontinent, ranging across India, Pakistan, Bangladesh, Sri Lanka, Nepal, Thailand, Vietnam, Myanmar, Laos, Cambodia, Malaysia, and western Indonesia.

This tree is protected in dry, dry thorn forest and paddy field area located in this region of Central India that is in east Vidarbha. Phenological studies shows that even though the species shows a regular flowering season but changing periodic events. Photoperiod / day length and temperature as climatic effective factor considered for three years in this study. Periodic events in biological life cycles of *Butea monosperma* is summarized for flowering season of three years, which are 2020, 2021 and 2022. It is found that flowering detected in the first / second week of March, 2021 only within seasons of three year of study.

Key words: - *Butea monosperma*, photoperiod, temperature, floral biology.

Introduction:

The reproductive biology of flowering plants is significant for defining barriers to seed and fruit set, intended for conservation, and for sympatric pollination and breeding systems that regulates the population's genetic structure.

Butea monosperma (Lam.) Taub. is a medium-sized tree of the Indian sub-continent, belongs to family *Fabaceae*. It is a chief species that relinquish several non-timber forest products, for instance a lac resin, water-soluble dye, fodder and leaves for serving dish or plate (Anon 1988)¹.

The plant has beautiful flowers, decorated leafless canopies during initial summer (month of February-March) and is suitably described as 'the flame of the forest'. Flowers are typically papilionaceous; the stigma is dripping papillate and the style is hollow. The flowers show characteristics of bird pollination being large and bright orange-red in color with plentiful amounts of nectar, and exhibiting diurnal anthesis.

¹ Anon. 1988. *Butea monosperma* (Lam.) Taub. The wealth of India ± raw materials revised, Vol. II: B. New Delhi: Council of Scientific and Industrial Research

The flower color has been variously described as crimson, red and orange-red (Anon.1988 & Anon.1983) but, according to the Royal Horticultural Society color chart (Anon.1946)², is most accurately termed Indian-orange. Although rare, yellow and white flowering trees have also been reported (Sanjappa M.1987)³. The tree is largely proliferated by seeds. Fruit set is very low and each fruit bears only one seed (hence the specific epithet designated as *monosperma*).

Generally, *B. monosperma* flowers once in a year but there are few exceptional trees which do not flower every year. Peak flowering occurs from March to April though sometimes also occurs in late February and lasts up to premature May (Zhao, J. et.al 2013)⁴. Additionally, a study (Zhao, J. et.al 2013) revealed that in successive years, peak flowering was in the first week in April and trees remained in bloom for 6-8 weeks.

Each plant has a fixed time period for flowering and fruiting, although, strongly controlled by climatic factors. Hence, the present work on *B. monosperma* covers the change in flowering duration as per intensity of sunlight/photoperiod and temperature in this area of east Vidarbha.

Materials and Methods

Study site:

The study site is located (between 21.329467 to 21.359037 latitude and 80. 201322 to 80.204482 longitude) around the Goregaon Taluka 1 KM away towards both the road side North and South.

Phenology and floral biology:

Trees were marked at two locations within the study area for phenological studies. Phenological events (shedding of leaves, bud break and flowering) were recorded over a period of three flowering seasons (2020 to 2022). To obtain the above information, observations were made regularly during the phenological events (February–March).

Elevation, Latitude, Longitude, average day length and average temperature recorded by using Redmi-NoteCam (android hand set) and internet site (<https://www.timeanddate.com>) from areas where the trees were marked. Developmental stages were recognized on the basis of morphometry, period of flowering. The details are presented in Table-1.

Years/ Season	Date of Observation	Elevation	Latitude	Longitude	Photoperiod from 15 th February to 15 th March	Average Temp. from 15 th February to 15 th March	Induction of flowering
2020 Site -A	08/03/2020	313.62m	21.329467	80. 201322	11:32:55- 12:01:49	Lo 16 °C - Hi 33 °C	Absent
2020 Site -B	08/03/2020	320.49m	21.359037	80.204482			
2021 Site-A	09/03/2021	402.21m	21.330545	80.20143	11:33:38- 12:01:34	Lo 16 °C - Hi 36 °C	Present
2021 Site-B	10/03/2021	380.53m	21.358402	80.204372			
2022 Site-A	08/03/2022	392.03m	21.329472	80.201388	11:33:24- 12:01:19	Lo 13 °C - Hi 36 °C	Absent
2022 Site-B	08/03/2022	378.13m	21.358483	80.204461			

² Anon. 1946. Horticultural colour chart II, Vols I and II. Wilson Colour Ltd and Royal Horticultural Society

³ Sanjappa M. 1987. Revision of the genera *Butea* Roxb. Ex Willd. and *Meizotropis* Voigt. (Fabaceae). Bulletin of the Botanical Survey of India 29: 199±225.

⁴ Zhao, J., Y. Zhang, F. Song, Z. Xu & L. Xiao (2013). Phenological response of tropical plants to regional climate change in Xishuangbanna, southwestern China. Journal of Tropical Ecology 29(2): 161–172; <https://doi.org/10.1017/S0266467413000114>

Table-1 Data is recorded for the study area at site-A & site-B

@ Site -A: Gondia-Kohamara Road towards South 1 KM away from Goregaon Dsit-Gondia(MS), India.

@ Site -B: Kohamara-Gondia Road towards North 1 KM away from Goregaon Dsit-Gondia(MS), India.







Photographs of flowering induction in 2020	
	
Site-A	Site-B
Photographs of flowering induction in 2021	
	
Site-A	Site-B
Photographs of flowering induction in 2022	
	
Site-A	Site-B

Fig-1 Flowering induction at both site of study area

Discussion: This paper reports the comprehensive study of the reproductive biology of *B. monosperma*. It has a regular flowering season, but all trees did not flower during the three years due to change of climate at marked sites of study. Each plant has a certain time period for flowering and fruiting, even though strongly controlled by

climatic factors and evolutionary processes (Borchert, R., et al 2005, Zhao, J. et.al 2013). These phenologic events ultimately determine their reproductive success (Carvalho & Sartori 2015). In the leaf axils of *B. monosperma*, the beginning of inflorescence primordia occurred at the end of February.

The flower buds were black and velvety, and commenced opening during the first/second week of March. Peak flowering time of *B. monosperma* in both years of study was the first week in April, trees remaining in bloom for 6–8 weeks. Like many other tropical trees, *B. monosperma* has a regular flowering season. However, all trees did not flower during the two years devoted to the phenological study. Out of 30 trees, three failed to flower in the first year and 12 in the second (Tandon, R., et. al. 2003).

Notably, during one of the field surveys in Sahyadri Tiger Reserve in Kolhapur, Maharashtra (consisting of Chandoli National Park and Koyna Wildlife Sanctuary), in the northern Western Ghats, the first author observed 10 fully-grown individuals of *B. monosperma* in full bloom during mid-November to late December in Chandoli NP (17.179–17.182 0N & 73.870–73.847 0E) and around 50 fully-grown individuals in Koyna WS (17.745–17.757 0N & 73.660–73.666 0E). Upon continuous monitoring of these individuals in the area, the authors confirmed unusual phenologic events that were not reported earlier in this species (Anurag Vishwakarma 2019). Ecology of a secondary deciduous tropical forest also affects the reproductive biology of plants in Venezuela (Zapata T.R. et.al, 1978).

Conclusion:

Periodic events in biological life cycles of *Butea monosperma* is summarized in this study. This paper reports the comprehensive study of the reproductive biology of *Butea monosperma* in this area. Like many other tropical trees, *B. monosperma* has a regular flowering season. However, all trees did not flower during the three years devoted to the phenological study. Trees marked for phenological observations showed variation with respect to leaf fall and flowering in all three years. The trees that flowered began to shed their foliage in December and were completely bare by January. However, those that failed to flower and retained their leaves. Occasionally, trees that flowered retained a insufficient amount of foliage, especially on the lower branches. The flower buds were black and velvety, and commenced opening during the first/ second week of March.

Flowering time in the years 2020 was delayed, not began to shed their foliage and induction of flowering not observed in the first/ second week of March. Flowering time in the years 2021 was not delayed and induction of flowering observed in the first/ second week of March. The commencement of inflorescence primordial in the leaf axils occurred at the end of February followed by began to shed their foliage as fig-1. Flowering time in the years 2022 was delayed, not began to shed their foliage and induction of flowering not observed in the first/ second week of March. It is concluded that flowering not delayed and induction of flowering observed in the first/ second week of March, 2021 as per optimum climatic condition having day length 11:33:38 to 12:01:34 and average temperature low 16°C to high 36°C as noted in table-01 as fig-1.

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