

**PHENOLOGICAL STUDY OF TREES SELECTED TREES IN
TELANGANABOTANICAL GARDEN
DR.BRR GOVERNMENT COLLEGE ,JADCHERLA
MAHABUBNAGAR ,509301, TELANGANA**



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SUBMITTED TO
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JADCHERLA,TELANGANA, JUNE -2022


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CERTIFICATE

This is to certify that the project work entitled "Flora of Dr. BRR Government College Campus, Jadcherla, Mahabubnagar District, Telangana." is a bonafide work done by the students of III BZC (TM) Miss. N.Anitha, Miss. P. Vasantha, Miss. K.Kavitha and Miss. V. Suvarna(E/M) under my supervision for the award of Project Work in Botany, Department of Botany, Dr. BRR Government College, Jadcherla and the work hasn't been submitted to any other College/University either in part nor in full, for the award of any degree.


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Examiner

DECLARATION

We hereby declare that the project work entitled with "Flora of Dr. BRR Government College Campus, Jadcherla, Mahabubnagar District, Telangana." is a genuine work done by us under the supervision of Dr. B. Sadasivaiah, for the Department of Botany, Dr. BRR Government College, and it has not been under the submission to any other Institute/University either in part nor in full, for the award of any degree.

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CONTEXT

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Chapter-1

INTRODUCTION:

Phenology is the study of periodicity or timing of recurring biological events and they can be understood with relation to climatic factors . Among the plants, the variations in phenological activities such as leaf flesh, leaf fall, and flowering were directly related to deciduous period, seasonal distribution of rainfall, soil moisture and temperature . Tropical

dry deciduous forest consist tree communities which growing in climates with marked pronounced dry and wet conditions in an annual period .

According to telangana botanical garden constitute high variations in vegetative and reproductive phenological patterns at both large scale and small scales. The phenophases of tree species were mainly found to be based on the seasonal changing events such as availability of soil moisture, stem water status, photoperiod, changes in temperature and irradiance and biotic factors like pollinators attraction, competition for seed dispersers and avoidance of herbivore have been proposed to influence different phenological patterns in tropical dry garden .Thus phenological events should be assessed by both abiotic factors and plant functional traits to achieve integrative understanding of tree community .

In seasonal tropical forests, plant phenological patterns were controlled by various interactions between biotic and climatic factors; especially seasonal variation in rainfall, dry periods which influence soil moisture, tree water status are considered as the principal factors influencing the timings of the periodic phenophases of growth and reproduction Further, tropical plant species feature distinct phenophase patterns that are intricately linked to seasonal changes in the abiotic environment conditions .

Based on this line of understanding, the study intends to test the hypothesis that different phenophases among the tree species do not show seasonality and seasonal rainfall has no role in the sequence of phenophases.

Phenological studies of plants are outcome of evolutionary plant responses to environmental conditions and quantitative phenological studies helps in understanding the implications of global change factors on plant response at local levels.

It was observed that in Dr. brr,government degree college jadcherla.(telangana botanical garden)peak the leaf flushing activity and flowering events occur during the dry period before the onset of first rains and fruit maturation period is high and fruit fall timing is in consequence to utilize the rains for germination. Thus, seasonal rains and extent of deciduous period (photoperiod) influence the leafing and reproductive phenological events in telangana botanical garden.

But no phenological studies were carried out in the garden of Telangana. Hence the present study was undertaken with an objective to examine the various phenophases for the selected tree species in relation to the prevailing climatic factors in telangana botanical garden of , Telangana.

Chapter-2

REVIEW OF LITERATURE:

Marques et al. (2004) studied the phenological patterns among plant life-forms in a subtropical forest in southern Brazil. The study attempted to see the patterns, examine how phenological patterns were associated with climatic variables. Thirty-seven plant species of four different life-forms (trees, shrubs, lianas and epiphytes) were monitored.

Leaf-fall, with its peak during the drier months (April to July), was the most seasonal. Flushing and flowering occurred during the wetter months (September to December), while fruiting occurred all year long. Phenologies varied among life-forms, and were strongly

associated with day length or temperature of preceding months which suggested that plants receive their phenological cues well in advance of their phenological response.

Phenologies appeared to be highly correlated with day length and temperature, the most predictable climatic variables, and least so with rainfall, which is unpredictable. Bendix et al. (2006) examined the flowering and fruiting as phenological events of 12 tree species in an evergreen tropical mountain rain forest of southern Ecuador.

Leaf shedding of two species was observed for 12 months. Parallel to the phenological recordings, meteorological parameters were monitored in detail and related to the flowering and fruiting activity of the trees. The study revealed that two groups of trees could be observed, one of which flowered during the less humid months (September to October) while the second group started to initiate flowers towards the end of that phase and flowered during the heavy rains (April to July), with the exception of one species that flowered more or less continuously. Huanjiong Wang et al.

(2020) worked on the interactive effect of chilling, photoperiod, and forcing temperature on flowering phenology of temperate woody plants of North American forest. The study indicates that varying effects of these three cues on the flowering phenology of woody species native to East Asia. In future climate change scenarios, spring warming is likely to advance the spring phenology of those woody species, although the reduced chilling and shorter photoperiod may partly offset this spring warming effect. Dorji et al.

(2020) Studied on Impacts of climate change on flowering phenology and production in alpine plants: The importance of end of flowering in United States of America. The study reported that Changes in the seasonal timing of plant flowering are hypothesized to alter the number of flowers plants produce, which contributes to reproductive success.

Shukla and Ramakrishna (1982) carried out phenological study on 122 tree species in a subtropical humid seasonal forest in north-east India. The study revealed that the forest had a high proportion of evergreen compared to deciduous species.

Leaf-fall of most of the tree species coincided with the dry season. Flushing started toward the end of the dry seasons for a majority of the tree species. The degree and period of leaflessness, proportionately more overstorey species flowered during the dry season and wet season flowering was more characteristic of understory species. A majority of the species produced fleshy fruits during the wet season.

Fruits, produced during the dry season, were mostly dry. Bhat (1992) studied the phenology of tree species in tropical moist forest of Uttara Kannad district, Karnataka, India, during the years 1983-1985 which revealed that there existed a strong seasonality for leaf flush, leaf drop and reproduction.

Kikim and Yadava (2001) studied on the phenology of 32 dominant tree species in subtropical forests at Kangchup hills in Manipur, North-eastern India. In the study, leaf drop, leaf flushing, flowering and fruit development in understory and overstorey tree species were monitored during the period of January 1993 to December 1994.

The study found higher number of evergreen tree species than that of deciduous tree species in all the forest sites. Majority of the species were reported to exhibit peak of leaf drop in cool dry period (January-February) and leaf flushing in the beginning of warm dry period (March-April) and another in rainy season.

(August) of the year. The study also revealed that both over and understory species showed a sharp flowering peak in April, while the peak period of fruit maturation was recorded to occur during September-October.

Leaf flush and flowering were simultaneous in both over and understory tree species whereas the fruiting of understory tree species was on month earlier than that of overstorey tree species as it was reported.

Mishra et al. (2004) analyzed the phenological pattern of tree species to understand their response to climatic factors and the periodicity of seasons in moist deciduous forest of Simlipal Biosphere Reserve, Orissa.

Joshi and Janrthanam (2004) observed the flowering phenology of the endemics and correlate factors that affect their phenological pattern in Goa region of the Western Ghats. The endemic species in the Goa region showed different peak and lean seasons of flowering depending on their life form type, habit and ecological factors like temperature and rainfall/moisture content in the soil.

Sundarapandian et al. (2005) studied the phenological behavior of selected tree species in tropical forests at Kodayar in the Western Ghats, Tamil Nadu. During the study, vegetative and reproductive phenology of 42 tree species was monitored through fortnightly visits for two years.

A considerable variation was found in leaf flushing, leaf fall, flowering and fruiting behavior that could be partly attributed to abiotic factors. They reported that peak activity of leaf fall and leaf emergence occurred in the early dry period as to take full advantage of the first rainy season reported to coincide with leaf fall or leaf flushing, possibly to attract pollinators as they suggested.

Their study also revealed that the activity of fruit ripening and fruit fall was at its peak in the first rainy season order to utilize the available soil moisture for seed germination and seedling establishment. They stated that phenological behavior displayed by the trees is an adaptation to the surrounding abiotic and biotic environment.

Sing and Kushwaha (2006) investigated the diversity of flowering and fruiting phenology of trees in a tropical deciduous forest in India. The study revealed that the variation in flowering (on foliated shoots), rainy-season flowering (on foliated shoots following significant rains),

autumn flowering (on shoots with mature leaves), winter flowering (on shoots undergoing leaf fall) and dry-season flowering (on leafless shoots). Duration of the fruiting phenophase was shortest (3-4 months) in dry-season and winter-flowering species, 6-9 months in rainy- and autumn-flowering species, and maximum (11 months) in summer-flowering species. Dutta and Devi (2015) studied phenology, population structure and regeneration status of six important tropical tree species namely, *Bauhinia variegata*, *Careya arborea*, *Dillenia pentagyna*, *Sterculia colorata*, *Sterculia villosa* and *Terminalia bellerica*.

The study was carried out in two forests of Assam, India, namely Luming Reserve Forest and Doboka Reserve Forest. Phenophases like –leaf fall, leaf initiation, flowering and fruiting were recorded monthly for one year. Phenophases were found to depend on environmental or meteorological conditions of the study area and were species specific.

Cool and dry winter period had largely associated with leaf fall of all the selected species, however, *Bauhinia variegata* and *Terminalia belleric* showed fruiting. The study revealed that all the selected six species indicated either “good regeneration” or “fair regeneration” Bajpai et al. (2016) studied on the periodicity of different phenophases in selected trees from Himalayan Terai of India.

In the study, the temporal phenology of leaf bud bursting, leaf initiation, leaf maturation, leaf fall, flower initiation, fruit initiation and fruit was recorded for eight tree species. The study revealed that a short low temperature dry period, sufficient winter rain and temperature rise were the triggering factors for summer leaf flushing, and the increased soil water availability for second leaf flushing in rains.

It was also reported that initiation of flowering with leaf emergence in the dry period supported higher rate of fruit setting due to maximum availability and activities of pollinators. In the study, the dispersal and post dispersal success of fruits increased by their ripening before and/or in the rainy season.

But, in *Terminalia arjuna*, no correlation was found between the fruiting and rains. *Mallotus nudiflorus* and *M. philippensis* initiated leaves and flowers with the first significant increase in temperature and photoperiod and were thus suggested as the potential tree species for climate change studies in tropics.

Wei (2016) conducted a study on the phenology of tree species in a tropical evergreen forest in Kemmanugundi, a part of Bhadra wildlife sanctuary in the Western Ghats region. In the study, forty –seven (47) tree species (> 30 cm girth at breast height) were identified and tagged with a unique number along a transect of approximately 5 km comprising of a hundred and seventy-seven (177) individuals. Observations were made at monthly intervals for leafing, flowering and fruiting phenophases in various tree species at community level.

The study revealed that rainfall had significant negative influence on both vegetative and reproductive phenologies. Except for leaf senescence, different phenophases of vegetative and reproductive phenologies were reported to be significantly seasonal.

Shiekh Marifatul Haq (2021) carried out a Case Study of Biological Spectrum, Phenology, and Diversity of Weedy Plants of High Altitude Mountains in District Kupwara of J&K Himalaya, India. The phytogeographical analysis revealed that the maximum 91 species collected were native, while a minimum of 67 species reported as alien.

Of the alien species, 25 were invasive, 35 naturalized, and 7 casual. The biological spectrum revealed the dominance of therophyte life form indicating the disturbed vegetation. The pheno-logical spectrum revealed the maximum flowering period of weeds is between April and September where about 73%.

Chapter-3

Study area:

Mahabubnagar is the largest district in telangana state in terms of area (5,285. 1 sq. km) covered. It is also known as palamoor. It is located between 15 55' and 17 29' N latitudes and between 77 15' and 79 15' E longitudes.

The area of the district is 5,285.1 sq. kms. It is bounded on the north by Ranga reddy district of telangana, on the east by Nagarkurnool district of telangana, on the south by Wanaparthy and Jogulamba – Gadwal districts of telangana and on the west by Raichur and Gulbarga districts of Karnataka state.

Dr. B.R.R Government College Jadcherla was established in 1963 by the merchants association under private management to center of the educational needs of the people Jadcherla and surrounding villages.

It was started with a great vision and mission to impart higher education to the poor and the transform it into a knowledge society. The college was taken over by the government in 1970 and named after the first chief minister of Hyderabad state.

It is located in a predominantly rural settings in the town of Jadcherla, 16 Kms. from the district headquarter mahabubnagar.

The campus is surrounding with cultivated fields of banana, papaya etc. the maximum temperature 42 degree centigrade is recorded in the month of april. Before establishment of college in 2018, the present college campus is under cultivation and is dominated by weeds, few shrubs and trees.

After the establishment of the college a good number of trees were planted in the campus by college authorities. Later in 2019 a botanical garden was developed in the campus with an area of 5 acres lawn and many plants were planted in the campus in several occasions.



Chapter-4

Methodology

The methodology pertaining to the present study is categorized into Quantification, regeneration and Phenology. The present study was carried out during February -2022 to April-2022. The study site name is Telangana Botanical Garden, Jadcherla, Mahabubnagar, Telangana.

In the fieldvisits, objectives undertaken were Phytosociological aspects of trees, shrubs and herbs; disturbance intensity, regeneration patterns of tree species and Phenology of selected tree species. This data was collected for February to april 2022(winter to summer) seasons.

Chapter-5

RESULT:

Number of days

S. NO	PLANT NAME	LEAF FLUSH	MATURE LEAF	LEAF FALL	LEAF LESS	FLOWERING	FRUITING	FRUIT FALL
1.	<i>Buteamonosperma</i>	90	88	92	62	84	82	68

2.	<i>Holopteliaintrifolia</i>	20	28	36	18	22	24	24
3.	<i>Tectona grandis</i>	46	80	76	40	16	46	82
4.	<i>Syayium cumini</i>	16	36	32	08	26	16	24
5.	<i>Buddliga arratica</i>	32	40	32	18	34	24	12
6.	<i>Wood fordia fruticose</i>	14	50	38	12	40	20	14

Plant phenology of *butea monosperma* ,*holpptliainterifalia* ,*tectona grandis* ,*syayium cumini* ,*buddigea rratica* ,*woodfordia fouticose* ,was recorded for 3 months (February to april)with an interval of 2-3 days. Leaf flushing activity was recorded in winter season remarkablyfrom February to april a period of 90 days.

In *buteamonosperma* the leaf flush phenophase (LF)observed during February month(2022) of the study, early-february to mid-april with the peak in end of the april. During thesecond year (2022) of the study, the leaf flush identified from early-february to –march withthe peak in april. During year (2022) of study the leaf flushing observed from mid-februaryto mid-march with the peak in late- April.

The relatively high period of leaf flush phenophasein May month took place just prior to the onset of the winter band could have been the result ofoccasional summer . Almost Leaf flush phenophase over by april month.

Leaf mature phenophase (LM) observed during first year (2022) of the study from mid –februaru to mid-april with the peak in march . During the month (2019) of the study the mature leaves recorded from early-february to mid-march 2 nd week with the peak in april.

During 2 nd month (2022) of study mature leaves occurred from mid-february to late-march with the peak in april . The relatively high period of Leaf mature occurred in march

The period of leaf maturation was from february to april with a peak in the april month.

Leaf fall *holppteia interifalia* (LF) observed during first year (2022) of the second month period from

mid –february to mid- april with the peak in april. During the year (2022)

of the study Leaf fall recorded from mid-february to late-april with the peak in early-
march.

Leaf fall activity got initiated before summer period from the third week of february.
The activity range was from February to april with a peak. Author unable to identify the
accurate Leaf Fall and Leafless phenophases in 60% of the individuals in Disturbed Site.

Leafless phenophase (LL)/deciduous phase observed during year (2022) of the study from
mid-february to Late march with the peak in april . During the month of april(2022) of the
study Leafless condition recorded from early-february to mid-March with the peak in march
.

During last month (2022) of study Leafless condition occurred from early-february to mid-
March with the peak in February. The relatively high period of Leafless occurred in January.

Deciduous period was observed during ----- . It represents the tree which shed its leaves
before the onset of dry period and figures extended period of leafless phase.

Flowering (FL) phenophase observed during first month (2022) of the study from mid-
February to mid-april with the peak in last week of april. During the second month
(2022) of the study Flowering recorded from late-march to mid-april with the peak in
first week of February .

During third month (2022) of study Flowering occurred from mid-
February to late-february with the peak in third week of february. The relatively high
period of flowering occurred in april.

No remarkable variation was not recorded in the flowering phased among the three
Months and the flowering activity was observed during February to april with a peak
period during. Flowering activity got synchronized with leaf mature phenophases.

Fruiting (FR) phenophase observed during first month (2022) of the study from mid
–march to late-april with the peak in February .

During the second month (2022) of the study it was recorded from mid –march to mid-april
with the peak in february During third year (2022) of study Fruiting occurred from early-

march to mid-april with the peak in late april. The relatively high period of matured fruits occurs in early-april (16 days).

Fruit bud was recorded in the mid-week of February and fruit maturation was extended till resulting in extended period of fruit maturation (28 days). Remarkable alterations in fruiting initiation and fruit maturation period was observed among the observed tree individuals.

was initiated Fruit fall (FrL) phenophase observed during first month (2018) of the study from early-February to late-May with the peak in April.

During the second month (2022) of the study it was recorded from mid-January to mid-May with the peak in April. During third year (2022) of study fruiting occurred from mid-December to late-April with the peak in April.

In woodfordia fouticose flowering initiated in autumn season

along with leaf mature condition. Flowers are developed along with leaf; it has brief

flowering period in the range round 25 to 32 days during the study period and fruiting occurring during cool dry session and synchronized with mature leaves and fruit maturation period was in the range 61 days.

Chapter-6

Conclusion

Occurrence of leaf flush events before the advent of dry period, flowering activity in the peak dry period, synchrony between leaf initiation and flowering in the late dry period, leaf expansion in the wet monsoon period and fruit fall in the post monsoon period and before rains indicates that seasonality prevails in the occurrence phenophases. Photoperiod seems to majorly influence the phenological patterns of the majority of tree species. Phenophases are found to relate with dry period and rainfall period either in the particular month or in the previous months of their occurrence making them prominent factors that influence the phenophases that occur in the dry forests.

Chapter-7

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