

Vegetational analysis and seasonal aspectation of tropical dry deciduous forest of Madhav National Park, Shivpuri.(M.P.) India

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Abstract- The present paper deals with the phytosociological diversity of Madhav National Park. During study 65 species, 59 genera belonging to 41 families were recorded. The results showed that Leguminaceae was the dominant family. Trees were dominant (50%) followed by shrubs (22.72%), Herbs (21.53%), Climbers (4.54%) respectively. Most of the plant species had flowering and fruiting in rainy season, followed by summer season and very few species in winter season. During the month of May maximum species showed no phenological activity while in the month of September maximum number of species showed phenological activity.

Index Terms- Madhav National Park, Seasonal Aspectation, Phanerogram.

I. INTRODUCTION

India is unique and rich in biological diversity and ranked tenth in the world and fourth in Asia in plant diversity, (Bal Krishnamurthy- 2008), with around 45,000 species of plants of which approximately 15,000 are higher plants (Lal 1989). The state of Madhya Pradesh is situated in the central part of India and falls in two biogeographical zones, semi-arid and the Deccan peninsular. Studies from Forest Survey of India showed that an average of 54.7% of forest is affected by fire and 72.1% of the forest area is subjected to grazing. Approximately 3.73 million hectares of the forest area are burnt annually resulting in economic losses of approximately 440 crores (MOEF, 1999). As per official statistics the forests of Madhya Pradesh are broadly classified into Reserved Forests (80, 996 sq. kms. i.e., approx. 61.7%), Protected Forests (69, 083 sq. kms. i.e., 37.4% approx.) and Unclassified Forests (5, 335 sq. kms. i.e., 0.9%). The per capita forest area is 2400 m² as against the national average of 700 m².

Madhav National Park is one of the oldest National park of Madhya Pradesh created in the year 1956. It is situated close to

Shivpuri town. Two national highways viz, (Agra-Bombay (NH-3) and Jhansi-Shivpuri (NH-25)) pass through the park. Physical and manmade features have divided the National Park into 3 zones, viz., North, Central and South.

Due to distinct variation in climate the district is very rich in plant diversity. Tropical dry deciduous forests are enriched with economically important species. Dry deciduous forests are among the most exploited and endangered ecosystem of the biosphere (Murphy and Lugo 1986, Janzen 1988, Gentry 1992).

The present work has been taken to study the vegetation and to prepare phanerogram to infer the existing phytoclimate of different sites along the climatic gradient in Madhav National Park, Shivpuri, India.

II. MATERIALS AND METHODS

Study Area

The study was conducted during 2010 and 2012 at Madhav National Park in Shivpuri District of State Madhya Pradesh (77°15' to 78°30' East longitudes and 24°50' to 25°55' North). The average temperature is 32°C-45°C in summer and 4°C-15°C in winter. The average rain fall is approximately 100 cm-125 cm/annum falling from July to October. The total area of National Park is approx 354.61 sq km at a height of 464 m above the msl.

Data Collection

The Survey of (Madhav National Park) was done every two month of the year and the site was divided into 10 sampling zones randomly on the basis of altitude, physiognomy, hill, slope, dry place, water body, road side. In each sample zone point centre quarter method was used at five places to study each zone. Thus a total of 50 sample points were laid down with sampling intensity based on random sampling method. Phenological observation were made and accordingly phanerograms of both trees and herbs were prepared as follows



Fig. A Fig. B

A) Phenogram of woody plants (Trees)

1. Incoming of new leaves
2. Vegetative phase
3. Flowering
4. Fruiting
5. Fruit fall
6. Leaf fall

B) Phenogram of Annual plants (Herbs)

1. Germination
2. Vegetative growth
3. Flowering
4. Fruiting
5. Fruit fall
6. Death

III. RESULTS AND DISCUSSION

The climatic study of the area clearly reveals that there is a monoxeric climate which shows dry phases followed by a wet phase. The dry phase extends for nearly eight months which projects that the climate is of semi- arid type. A total of 41 families, 59 genera and 65 species were recorded (**Table - 1**). Leguminaceae was observed to be dominant at all site with 7 species (**Table -2**). The floristic studies of adjoining areas of Shivpuri and Karera (Kaushik, 1973) and Kolaras (Verma, 1978) also show that Leguminaceae occupies the top position. Very

less plants have flowering during winter season. Majority of woody plants showed flowering in the month of July while in annual plants flowering occurs in the month of September.

Vegetation summary showed that the Dicot plant species are more dominant with 39 Family 54 genus and, 60 species while Monocot have 2 families, 5 genus and 5 species respectively (**Table 1**). The results also reveals that 33 plant species were trees (50% vegetation) and had dominance in the site followed by shrubs 15 species (22.72%), herbs 14 species (21.53%) and climbers 3 species (4.54%) respectively. No epiphyte has been found in the site. (**Table 3**)

Table -1: Plant Species Summary of Madhav National Park, Shivpuri

S.no.		No.	Dicot	Monocot
1	Family	41	39	2
2	Genus	59	54	5
3	Species	65	60	5

Table.2. Family distribution with no. of species and percentage at Madhav National Park, Shivpuri

S.NO.	FAMILIES	NO.OF SPECIES	% OF SPECIES
1	Leguminaceae	7	10.60 %
2	Moraceae	3	4.54 %
3	Anacardiaceae	3	4.54%
4	Combretaceae	3	4.54 %
5	Acanthaceae	3	4.54 %
6	Euphorbiaceae	3	4.54 %
7	Asteraceae	3	4.54 %

Table 3. Vegetation diversity of plant species at Madhav National Park, Shivpuri

S.no.	Habit	No. of species	% of species
1	Herb	14	21.53%
2	Shrub	15	22.72%
3	Tree	33	50.0 %
4	Climber	3	4.54%
5	Epiphyte	0	0

Table 4: Phenograms of various species in Madhav National Park, Shivpuri.

Species Name	Jan	Mar	May	July	Sep	Nov
<i>Acacia catechu</i>						
<i>Acacia nilotica</i>						
<i>Buteamonosperma</i>						
<i>Bauhinia racemosa</i>						
<i>Bauhinia variegata</i>						
<i>Cassia fistula</i>						
<i>Albzzialebeck</i>						
<i>Thespesiapopulnea</i>						
<i>Ficusglomerata</i>						
<i>Anonasquamosa</i>						
<i>Saccopetalumtomentosum</i>						
<i>Mangiferaindica</i>						
<i>Lanneacoromandelica</i>						
<i>Buchanialanzan</i>						
<i>Anogeissuspendula</i>						
<i>Terminalia bellerica</i>						
<i>Terminalia arjuna</i>						
<i>Emblicaofficinalis</i>						

<i>Brideliaretusa</i>						
<i>Mitragnaparvifolia</i>						
<i>Cephaluscadamba</i>						
<i>Eugenia jambolanum</i>						
<i>Balanitis roxburghii</i>						
<i>Grewiatiliifolia</i>						
<i>Diospyrosmelanoxylon</i>						
<i>Sterculiaurens</i>						
<i>Manilkarahexandra</i>						
<i>Ziziphusxylopyra</i>						
<i>Phoenix sylvestris</i>						
<i>Boswelliaserrata</i>						
<i>Madhucaindica</i>						
<i>Elaeodendronroxburghii</i>						
<i>Mimosa duteii</i>						
<i>Caricaindicus</i>						
<i>Lantana camara</i>						
<i>Vitexnegundo</i>						
<i>Myrtuscommunis</i>						
<i>Syzygiumheyneanum</i>						
<i>Neriumindicum</i>						
<i>Helicteresisora</i>						
<i>Ziziphusoenoplia</i>						
<i>Adhatodavastica</i>						

<i>Solanumnigrum</i>						
<i>Ziziphusnummularia</i>						
<i>Aloe vera</i>						
<i>Barleriaprionitis</i>						
<i>Myrsineafricana</i>						
<i>Ipomeacarnea</i>						
<i>Gymnemasylvestre</i>						
<i>Abruspreicatorius</i>						
<i>Opuntiasp</i>						
<i>Achyranthesaspera</i>						
<i>Oscimumbasilicum</i>						
<i>Convolvulus pluricaulis</i>						
<i>Eclipta alba</i>						
<i>Sphaeranthusindicus</i>						
<i>Trigonellasp</i>						
<i>Sidacordifolia</i>						
<i>Euphorbia thymifolia</i>						
<i>Partheniumsp</i>						
<i>Marsileasp</i>						
<i>Cynodondactylon</i>						
<i>Saccharummunja</i>						
<i>Cassia tora</i>						
<i>Peristrophebicalyculata</i>						

Table 5: Phenological Behaviour of Woody Plant (Trees) at Madhav National Park, Shivpuri

S. No.	Events	Number of species					
		Jan	Mar	May	July	Sep	Nov
1	Emerging of New Leaves	1	17	21	11	1	-
2	Vegetative phase	19	11	26	42	46	43
3	Flowering	3	20	19	21	10	5
4	Fruiting	18	7	15	19	23	22
5	Fruit fall	8	8	2	9	11	10
6	Leaf fall	10	25	5	-	-	3

Table 6: Phenological Behaviour of Annual Plant (Herbs) Madhav National Park, Shivpuri

S. No.	Events	Number of species					
		Jan	Mar	May	July	Sep	Nov
1	Germination	1	-	-	13	1	-
2	Vegetative Growth	4	-	-	13	7	4
3	Flowering	1	-	-	3	12	6
4	Fruiting	4	1	-	-	11	10
5	Fruit fall	5	3	-	-	2	8
6	Death	7	6	1	-	-	3

Ecological conditions witnesses the dry winter season followed by hot summer. The climate is marked by south west monsoon with rains from June to September. Such a climate affords a dry deciduous forest as climax. This forest type is dominated by *Anogeissus pendula* (Kardhai), *Boswellia serrata* (Salai), *Butea monosperma* (Palas), and *Lannea coromandelica* (Gurjan). From the standpoint of vegetational growth a smaller amount of rainfall distributed over larger period is more effective than the larger amount of rainfall within a very short period. Similarly number of rainy days is more important than the total rainfall.

The phenogramic results reveals that in the month of January *Saccharum munja* and *Lantana camara* showed maximum phenological activity followed by *Ipomea carnea*, *Emblia officinalis*, *Mimosa duteii*, *Solanum nigrum*, *Trigonella sp.*, *Cynodon dactylon* respectively. Species like *Bauhinia variegata*, *Cassia fistula*, *Thespesia populnea*, *Ficus glomerata*, *Saccopetalum tomentosum*, *Eugenia jambolanum*, *Manilkara hexandra*, *Phoenix sylvestris*, *Elaeodendron roxburghii*, *Carica indica*, *Myrtus communis*, *Nerium indicum*, *Aloevera*, *Myrsine Africana*, *Marsilea sp.*, *Abrus precatorius*, *Opuntia sp.*, *Sidacordifolia*, *Cassia tora*, *Peristrophe bicalyculata* showed no phenological activity during January. (Table - 4).

During the month of March *Syzygium heyneanum* showed maximum phenological activity followed by *Albizia lebeck*, *Thespesia populnea*, *Ficus glomerata*, *Ananas squamosa*, *Madhuca indica*, *Elaeodendron roxburghii*, *Nerium indicum*, *Helicteres isora*, *Solanum nigrum*, *Opuntia sp.* and *Saccharum munja*. The species with no phenological activity during the month of March are *Cassia fistula*, *Grewia tiliifolia*, *Barleria prionitis*, *Gynemasa sylvestre*, *Achyranthes aspera*,

Oscimumbasilicum, *Euphorbia thymifolia*, *Marsilea sp.*, *Cassia tora*, *Peristrophe bicalyculata*. (Table - 4).

In the month of May *Bauhinia variegata*, *Balanitis roxburghii*, *Elaeodendron roxburghii*, *Carica indica* showed maximum phenological activity while species like *cassia fistula*, *Lantana camara*, *Adhatodavasic*, *Solanum nigrum*, *Barleria prionitis*, *Myrsine africana*, *Ipomea carnea*, *Achyranthes aspera*, *Oscimumbasilicum*, *Convolvulus pluricaulis*, *Eclipta alba*, *Sphaeranthus indicus*, *Trigonella sp.*, *Sidacordifolia*, *Euphorbia thymifolia*, *Marsilea sp.*, *Cynodon dactylon*, *Saccharum munja*, *Cassia tora*, *Peristrophe bicalyculata* showed no phenological activity because of adverse climatic conditions like high temperature, high light intensity, dry climate etc. (Table - 4).

With the advent of July, plants like *Bauhinia racemosa*, *Cassia fistula*, *Buchananialanzan*, *Mimosa duteii*, *Syzygium heyneanum*, *Euphorbia thymifolia*, *Cassia tora*, showed maximum phenological activity. Only one species *Sphaeranthus indicus* did not have any phenological activity. (Table - 4).

During the month of September maximum number of species showed phenological activity. The species are *Acacia nilotica*, *Cassia fistula*, *Buchananialanzan*, *Anogeissus pendula*, *Lantana camara*, *Ipomea carnea*, *Convolvulus pluricaulis*, *Eclipta alba*, *Trigonella Sp.*, *Cynodon dactylon*, *Saccharum munja*, *Cassia tora*. No plant species during this period showed zero response regarding phenological activity due to favorable climatic conditions like moisture, low temperature, less light intensity, etc. (Table - 4).

Similarly, during November species like *Buchananialanzan*, *Boswellia serrata*, *Mimosa duteii*, *Lantana camara*, *Adhatodavasic*, *Solanum nigrum*, *Myrsine africana*, *Ipomea carnea*, *Oscimumbasilicum*, *Convolvulus pluricaulis*,

Ecliptaalba, *Trigonella Sp.* and *Saccharummunja* showed positive response regarding phenological activities. Only one species *Eugenia jambolanum* showed no phenological activity at all (**Table – 4**).

The optimum temperature and moisture conditions are obtained during rainy season (July and August) which in turn result in maximum canopy cover of the trees and causes a luxuriant growth of herbaceous vegetation. With onset of winter (December & January) there is an abrupt change in the face of vegetation due to low temperature. It is the time when some forest trees like *Sterculiaeurens* and *Lanneacoromandelic* show the sign of yellowing of their leaves and ground cover starts drying up. In March and April most of the tree species lose their leaves during summer season (May and June). During this period extremely high temperature and low humidity accompanied with acute shortage of soil moisture restrict growth of herbaceous layer. Khair occupies the open areas of the foothills in the park. It occurs at lower elevation and in pockets where soil is hard and shallow. Kardhai forests cover the western side of the park, on slopes facing the 'SakhyaSagar' the famous lake inside the park and towards Bhoorakho. Mixed forests is not very common in the park, but is found only in deep sheltered valleys or places where there is a permanent sources of water. Among woody plants the emerging of new leaves was found highest in the month of May followed by March, July, January and September respectively. The vegetative phase was found highest in September and lowest in month of March. While minimum was found during November. As far as leaf fall is concerned July and September showed no sign. (**Table- 5**). In case of annual plants, germination and vegetative growth occurs highest in the month of July because during this season moisture is available in the soil environment. Flowering and fruiting was found highest in the month of September. There was no fruiting and fruit fall during the month of May and July. With the onset of favourable climatic conditions no death of annual plants was observed during July and September. (**Table - 6**).

IV. CONCLUSION

Madhav National Park is rich in floral diversity and has the potential for conservation of ecosystem in its totality. Trees were dominated with maximum of dicot species. The phenological behaviour of plant species were good during monsoon season as it provides favourable climate for floral

diversity. The seasonal aspectation affects the plant diversity and phenological activity, in both trees and herbs. Because of the change in climate there is urgent need to address and correlate seasonal aspectation with phenological activity, on a recurring basis.

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