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PHENOLOGICAL STUDY OF GRASSES OF TIPPESHWAR WILDLIFE SANCTUARY, MAHARASHTRA STATE, INDIA

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ABSTRACT:

Tipeshwar Wildlife Sanctuary, located in Maharashtra, India, is known for its rich biodiversity and is a haven for various flora and fauna. The sanctuary covers an area of 148.7 Square Kilo Meters and is characterized by a basaltic hilly, undulating landscape. It is particularly famous for its tiger population and diverse wildlife, including leopards, sloth bears, and numerous bird species. A grass is taxonomically defined as any species within the large family (Gramineae or Poaceae) of monocotyledonous plants having narrow leaves, hollow stems, and clusters of very small, usually wind pollinated flowers. Grasses include many varieties of plants grown for food, fodder, and ground cover (Grass 2014). Phenological study of grasses includes the study of the timing of regular biological events, like grasses flowering, and the processes that alter their timing. Phenological stages: Stages during plant growth that are a distinct phase of the plant's development. The grasses of Tippeshwar Wildlife Sanctuary are annual, perennial, soft and course distributed in all natural and artificial man made grasslands after rehabilitation of villages. Tippeshwar Wildlife Sanctuary grasses are with 36 genera and 61 species. there are 06 grass genera and species which are wild relatives of grasses. The present study comprises phenological study of grasses includes germination of grass seeds, vegetative growth changes , flowering and fruiting of grasses of Tippeshwar Wildlife Sanctuary.

Keywords:- Phenolgy Grasses , Tippeshwar Wildlife Sanctuary.

INTRODUCTION :

Grasses are one of the largest and most valuable groups of flowering plants, consisting of 610 genera and 10,000 species (Cope, 1982). Clayton and Renvoize (1986) put the total number of grasses in the world about 10,000 species, 651 genera were recognized and assigned numbers indicating their phylogenic status based upon various evidences. It ranks third in number of genera after the Compositeae and Orchidaceae and fifth in number of species after the Compositeae, Orchidaceae, Leguminoseae and Rubiaceae (Good, 1953). Grasses are widespread than any other family of flowering plants. The great adaptability of different species has enabled them to thrive under the most varied conditions. They form the climax vegetation of the semiarid prairies of the American continent, the steppes of Asia and the savannas of Africa. Grasses exceed all other in the importance of its products. It provides food in the form of cereals for man and forage for most animals. Many species of native and introduced grasses are utilized in improved pastures (Salter, 1952). A grass is taxonomically defined as any species within the large family (Gramineae or Poaceae) of monocotyledonous plants having narrow leaves, hollow stems, and clusters of very small, usually windpollinated flowers. Grasses include many varieties of plants grown for food, fodder, and ground cover (Grass 2014). Grasses are often confused with sedges (Cyperaceae family) and reeds (Restionaceae family. However, sedges do not have a leaf

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sheath and their leaves are attached directly to the culm—a diagram of grass anatomy is provided in Appendix C. The culms of sedges are also angular, while grass culms are circular. The grass family is the fifth largest plant family on earth with over 700 genera and 9700 species. About ten percent of the grass species worldwide can be found in southern and tropical Africa; the major genera of which are *Eragrostis, Panicum, Sporobolus, Aristida, Digitaria, Setaria, Brachiaria,* etc (Van Oudtshoorn 2009).

Almost all animal species and food chains depend on grass because grass occurs across the world and is almost always edible. The groups of animals that depend most directly on grass for food are birds, insects, rodents, and grazers. There are many bird species, such as Quelea finches, the most common bird on earth with a population of over 1.5 billion in Africa alone, that solely eat grass seeds. Grass provides the only food source for seed-eating birds, and the birds play an integral role in seed dispersal. Insects use grass for both food and shelter. Disruption of these grassland ecosystems can cause a dangerous under or overabundance of insect species. Rodents consume grass seeds or the base of the plant where the most nutrients are stored. Grazers have the largest impact on grasslands and typically graze in large herds which makes spatially expansive impact. Grazers remove old plant material, stimulate new growth, and provide nutrients in the form of manure. Although predators and decomposers are also ultimately dependent on grass species, it is primary consumers specifically herbivores- that have the biggest causal relationship with grass species. Herbivores and grass species composition are highly interdependent. Evaluating a Grassland There are four main measures to evaluate a grassland: grazing value, ecological indicator status, succession stage, and perennially. Several factors that can help conservation managers determine whether their area is providing valuable grazing material. By identifying grass species in the area, grazing value can be determined. Grazing value is defined as the quality and quantity of material from an individual available for grazing (Van Oudtshoorn 2009).

Tipeshwar Wildlife Sanctuary, located in Maharashtra, India, is known for its rich biodiversity and is a haven for various flora and fauna. The sanctuary covers an area of 148.7 Square Kilo meters and is characterized by a basaltic hilly, undulating landscape. It is particularly famous for its tiger population and diverse wildlife, including leopards, sloth bears, and numerous bird species.

Flora:

- Tipeshwar's vegetation includes deciduous forests interspersed with grasslands and water bodies.
- It features bamboo forests, which are home to a significant number of medicinal and economically important plant species.
- The sanctuary also has a variety of herbs, grasses, and other plant life that supports the herbivores.

Fauna:

- **Mammals:** Tipeshwar is renowned for its tiger population, which has seen a recent increase. Other notable inhabitants include leopards, sloth bears, Indian gaur (bison), chital (spotted deer), sambar deer, nilgai (blue bull), wild boar, and various primates like langurs and rhesus macaques.
- **Birds:** Over 200 bird species can be found in the sanctuary, including the Indian peafowl, Indian pitta, and various raptors like eagles, hawks, and vultures.
- **Reptiles:** The sanctuary is also home to 26 species of reptiles.

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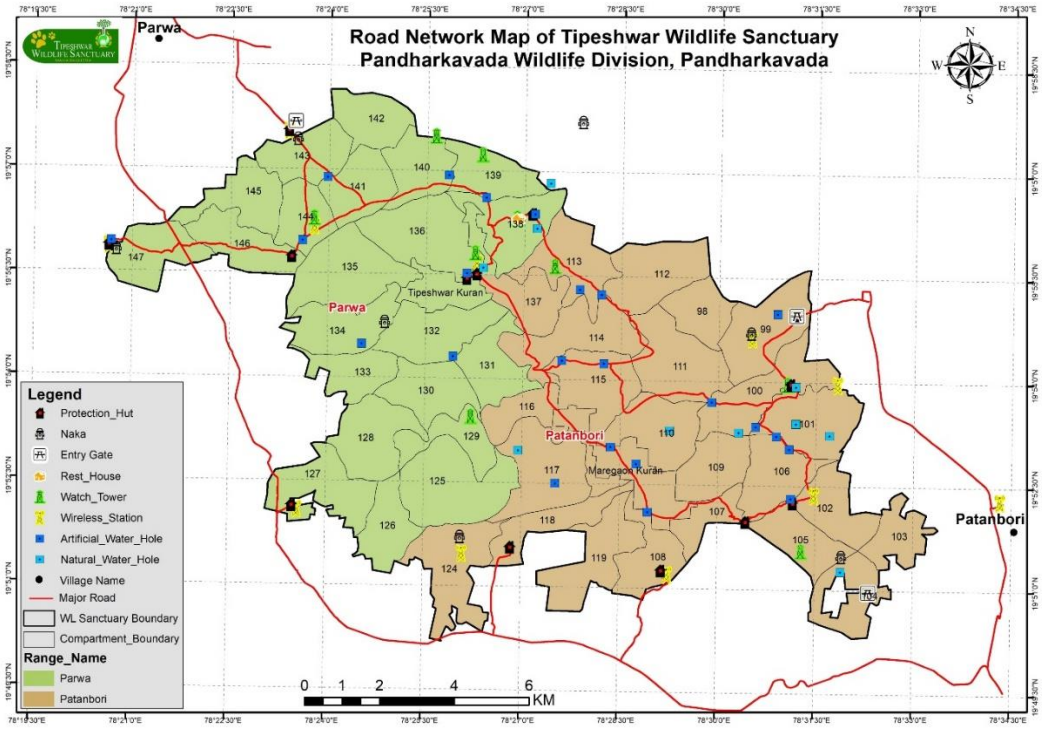
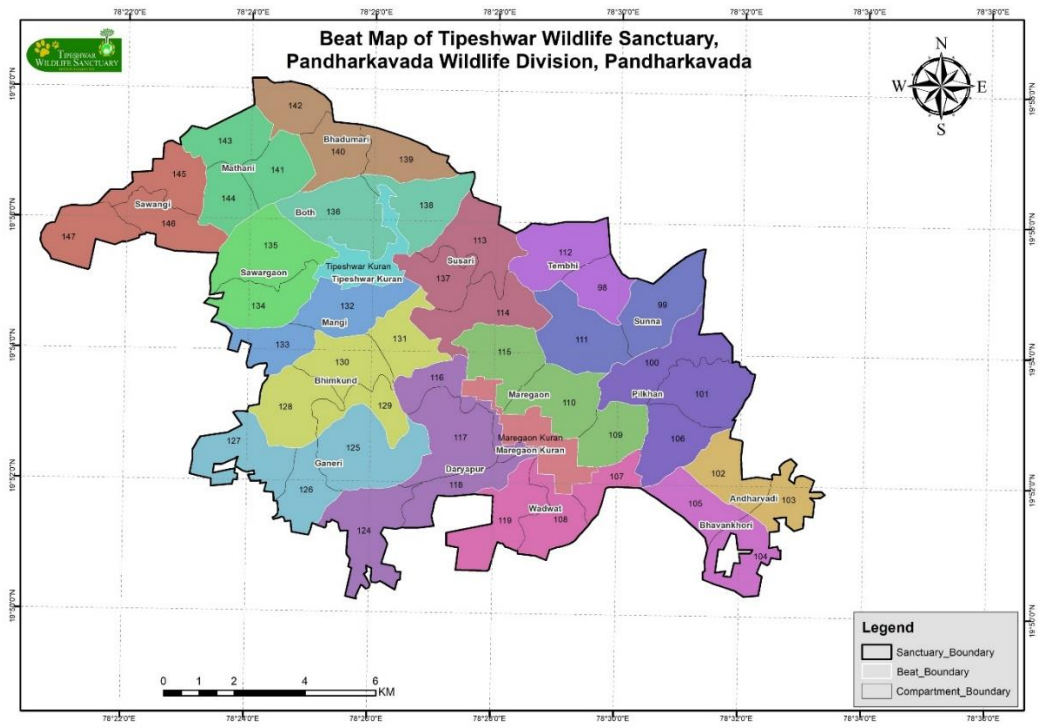
Map of TWL Sanctuary



Beat Map of Tippeshwar Wildlife Sanctuary :



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OBJECTIVES

- Identification and Enumeration of grass flora of Tippeshwar Wildlife Sanctuary..
- To identify the grass plants from open grasslands with the help of morphological study by using regional floras.
- Exploration of grass flora from Tippeshwar Wildlife Sanctuary.
- To determine diversity of grass plants and its ecological significance in forest ecosystem.
- Grasses association in grassland ecosystem .
- Enumeration and documentation of grasses with reference to GPS co-ordinates, phenological study.

  Study area : Tippeshwar Wildlife Sanctuary. All grasslands of Tippeshwar Wildlife Sanctuary.

MATERIAL AND METHODS

Data Collection: Floristic :Extensive and repeated field surveys are carried out in the study area, covering three predominant seasons and for a period of 02 year, from 2022-23 document the species richness of grasses from study area. The grasses plant species are photographed in the field using DSLR camera .A comprehensive list of grasses occurring in grasslands of Tippeshwar Wildlife Sanctuary prepared grasses classification into palatable and non palatable , annual , perennial , terrestrial and amphi-terresrtrial prepared. During field visits , focus given to document habitat, phenology and association on grassland , composition of grassland.. Morphological characters recorded of grass specimens. The morphological characters , of the grasses , arrangement of floral parts, habit, habitat and locality will be recorded carefully in field note book.

Nomenclature of each taxon will be checked under the rules of International Code of Botanical Nomenclature. A map of the area with the important places of collection is given detailed morphological studies carried down under dissecting microscope and different morphological characters observed and their identification confirmed by flora of Maharashtra (B.D. Sharma & S. Kartikeyan,2001) Flora of British India (J.D. Hooker , 1998).

Morphological study:1. Plants collection from selected sites 2. Morphological study under dissection microscope 3. Plants classification 4. Ecological study 5. Ecological significance 6.. Lat. long study with GPS. Herbarium samples examined through the conventional taxonomical procedure adopted by Bentham and Hooker (1873) and Prain (1903)

Tippeshwar Wildlife Sanctuary : diversity of grasses the phenological data of grasses

Sr.No.	Botanical name	Common name	Flowering season	fruiting season	Seeds germination period	Leaf primordia formation season
01	*Andropogon pumilus Rox*	Zinzu,	Sept	Nov	July	July
02	*Apluda mutica L*	Bhangoru	Sept	Nov	July	July -Aug
03	*Anthraxon lancifolius trin*	Chakarpati	Oct	Dec	July	July
04	*Arundinella setosa*	Bajariyu, Kotir	Oct .	Nov.	June	July –Aug.
05	*Bothrichloa bladhi*	Vaidya	Nov	Dec	Aug	Aug
06	*Brachiaria mutica*	Shimpi.	Sep	Dec	July	July
07	*Brachiaria ramosa L*	Shimpi.	Sep	Dec	July	July
08	*Brachiaria repans L*	Shimpi.	Aug-Jan	Dec	July	July

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09	*Brachiaria eruciformis (JESM)*	Shimpi.	**Aug-Dec**	Dec	July	July
10	*Chloris barbata Sw.*	Mindaliyu ghass	**Aug-Jan**	Nov – Feb	July	July
11	*Chloris dolichostachya Lag.*	Bada sika	**Oct**	Dec	July	July
12	*Chloris gyana Kunth.*	Chota sika	**Nov**	Jan	July	July
13	*Coix lacryma jobi-L*	Kahudo	**Nov**	Dec –Jan	Sept	Sept
14	*Cymbopogon martinae Wals*	Rosha grass, Pama- rosa, Roh	**Sept**	Dec	July	July
15	*Cynodon dactylon Pears*	Dharo, Dhrokhad	**Oct**	--	---	Propagate by rhizome/runner
16	*Dactyloctenium aegypticum L*	Crow foot grass , Dharo	**Nov**	Dec	July	July
17	*Dendracalamus strictus Nees*	Bans	**Dec**	March – April	Aug	Aug
18	*Dicanthium aristatum (Poir)*	Zinzvo, Marvel	**Oct**	Nov	July	July
19	*Dicanthium annulatum (Forssk)*	Zinzvo, Marvel	**Oct to Feb**	**Nov –Dec.**	July	July / vegetative propagation
20	*Dicanthium caricosum (L)*	Zinzvo, Marvel	**Oct to Feb**	**Oct to Feb**	July	July/ vegetative propagation
21	*Digitaria abludens(Roem & schult)*	Rai ghas	**Sept**	Nov.	July	July
22	*Dimeria blatteri Bor.*		**Oct**	Nov.	July	July
23	*Dinebra retroflexa Jacq.*	Lona ghas	**July**	Oct	Nov.	July
24	*Eleusine indica (L)*	Jangli nachni	**Oct**	Nov. –Dec.	July	July
25	*Eragrostiella biferia (Vahl)*		**Oct**	Dec	July	July
26	*Eragrostiella brachylla (Stapf)*	Bhurbhusi	**Sept**	Oct	July	July
27	*Eragrostris major (L)*	Bhurbhusi	**Sept**	Oct	July	July
28	*Eragrostris cillianensis (All.)*	Kalagi marmar	**Sept**	Oct	July	July
29	*Eragrostris japonica (Thunb)*		**Sept**	Oct	July	July
30	*Eragrostris tenella (L)*		**Sept**	Oct	July	July
31	*Eragrostris tenuifolia (A. Rich.)*		**Sept**	Oct	July	July
32	*Eragrostris unioloides (Retz)*		**Sept**	Oct	July	July
33	*Eragrostris viscosa (Retz)*		**Sept**	Oct	June	July
34	*Eragrostris Minor (Host)*		**Sept**	Oct	June	July
35	*Heteropogon contorpus (L)*	Kagadi, Ratad, Kusali	**Oct**	Dec	July	July
36	*Imperata cylindrica (L)*		**Jan**	Feb	July	July
37	*Iseilema laxum Hack.*	Ghavlu,	**Oct**	Dec	July	July

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		Shata, Dadhel				
38	*Iselima prostratum (L.)*	Achi-ghas	**Oct**	Dec	July	July
39	*Oplismenus burmannii (Retz)*	Futana	**Oct**	Nov	July	July
40	*Panicum antilotale (Rtz)*	Dhansado, Dhuns-ghas, Karkariyu	**Oct**	Nov	July	July
41	*Panicum psilopodium(Trin)*		**Oct**	Nov	July	July
42	*Panicum sumatrense (Roth ex.)*		**Oct**	Nov	July	July
43	*Paspalidium flavidium (Retz)*	Taman, Mor-kuba, Gunchi	**Oct**	Nov	July	July
44	*Paspalum canare (Stcut)*		**Oct**	Dec	July	July
45	*Paspalum distichum auct.*	Moti Kodari, Kodri	**Aug**	Oct.	June	June
46	*Paspalum paspalodes (Michx)*	Kodo	**Oct**	Dec	July	July
47	*Pennisetum pedicellatum (Trin)*	Deenanath gawat	**Oct**	Dec	July	July
48	*Rottbolia cochinchinensis (Lour)*		**Oct**	Dec	July	July
49	*Saccharum spontaneum (L)*	Kans, Thatch, Chia	**Oct**	Dec.	June	June – July
50	*Sacciolepis indica (Willed)*		**Nov**	Dec.	July	July
51	*Sehima nervosum(Rott)*	Shaniyar, Sheda	**Oct**	Nov.	July	July
52	*Setaria intermedia (Roem)*	Chikta	**Sept**	Nov.	June	July
53	*Setaria verticellata (Roxb)*	Chikta	**Sept**	Nov.	June	July
54	*Setaria italica (L)*	Ban bajra	**Sept**	Nov.	June	July
55	*Setaria pumilla (Poir)*	bajra	**Sept**	Nov.	June	July
56	*Sorghum haplense*	Bajru	**Oct**	Dec.	July	July
57	*Sporobolus coromandelianus (Retz)*	Bhurbhusi	**Aug**	Oct	June	July
58	*Sporobolus indicus (L)*	Velari-marmar	**Aug**	Oct	June	July
59	*Themeda quadrivalvis (L)*	Ratadun-ghas	**Oct.**	Dec	July	July
60	*Tripogon jacquemontii (Stapf)*	Tifati	**Aug.**	**Nov.**	**July**	**July**
61	*Vitivera zizanoides (L)*	Vetiver, Valo, Khas ghass	**Nov.**	Jan	July – Aug.	Aug.

RESULTS AND DISCUSSION:

Grasses flowering mostly started from August to September exceptionally some species of *Setaria* , *Sporobolus* and *Eragrostris* like *Setaria pumilla* , *S. italica.*The species of *Imperata* shows late flowering in January Flowering in grasses is the reproductive stage generally from observations environmental factors like temperature, humidity plays important role in flowering season of grasses. Mostly annual

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grasses show early flowering as compare to perennial grasses in Protected Areas of Central India. The grasses like *Cynodon and Saccharum* growing in amphiterrestrial habitat are perennial show variation in flowering . The grasses growing on hard strata of soil, sands , rocks shows early flowering. The phenological characters of grasses like growth – vegetative and reproductive growth , seeds germination , leaf primordia , leaf radical , culm formation , flowering , seeds formation , seeds maturity , seeds germination depends upon temperature , humidity and edaphic factors.

Conclusion:

The vegetative and reproductive growth of grasses in forest areas specially seeds germination, flowering and seeds maturation plays important role in grassland management. The seeds maturity, seeds collection of fodder grasses is useful for enrichment of desired grasses useful for herbivores and grass seeds are useful for ecological restoration of degraded and over grazed grassland. The phenological characters are important in Protected Areas for Wildlife habitat management.

Role of palatable grasses in wildlife habitat management : 1) Grazing habitat by Soft and course feeder herbivores 2) Nesting habitat by birds 3) Breeding habitat in taller grasses 4) Resting habitat in shade loving grasses 5) Hiding in taller grasses..

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