

पन्ना टाइगर रिजर्व

Grassland Vegetation of Panna Tiger Reserve



developed by

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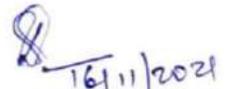
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FOREWORD

I must place on record my appreciation for the team of Panna Tiger Reserve (PTR) to have successfully bringing out this booklet on 'Grassland Vegetation of PTR'. In its first attempt to document the grasses found in PTR, 42 grass species have been identified and described in details. I understand the technical nature of this Booklet that demands massive effort in terms of time and energy.

As we all know documentation of forest wealth of MP is an ongoing exercise, considering its scale and complexity, and the team of PTR has done a commendable job in addressing this aspect. This is an ongoing work and must continue in future also. In the years to come, I expect more such Booklet from other Protected Areas and Forest Divisions which will further add on information on forest wealth and biodiversity of MP.

The entire team of PTR deserves my congratulations and appreciation for this excellent publication.



ALOK KUMAR,

PCCF & CWLW, MP.



FOREWORD

This is the first attempt by Panna Tiger Reserve (PTR) to gather information about grasses found in PTR along with their scientific and common names, description and distribution. 42 grass species have been identified and described in details. Grasses have been classified in palatable and un-palatable groups which will help for Park managers to manage grasslands.

Identification of grasses in the field is a difficult task specially when inflorescence is absent. This booklet gives some tips to identify grasses in the field along with pictures of grasses with inflorescence. Though almost all the pictures have been taken within PTR, still due to unavailability of good pictures taken and paucity of time, not all desired pictures could be gathered and hence certain pictures from internet have been used to fill this gap.

PTR presents this booklet to all those looking for some guidance in recognizing grasses. I am sure this will help field managers not only in identifying grasses in their region but also manage grasslands under their jurisdiction.


UTTAM KUMAR SHARMA,
FIELD DIRECTOR,
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FOREWORD

Grasses play a vital role in maintenance of prey base in Panna Tiger Reserve. Grassland management, in order to be scientific, needs proper identification of grasses, studying its property and utility to wild ungulates. Without which the management of grassland will be a futile exercise.

Our Panna Tiger Reserve's staffs, in the entire exercise of identification of grasses showed great enthusiasm. We got to know the local name of many grasses from them. But a proper scientific study like this helped them to increase their capacity in grassland management. Waiting for grasses to enter into inflorescence stage, walking miles to identify new varieties and clicking right pictures of grasses, the entire exercise, though laborious but a fruitful experience for entire Tiger Reserves' staffs. Here, I would like to mention names of our Forest guard Sh.Manoj Baiga and our Field Biologist Sh.Om Prakash for showing their enthusiasm in grass herbarium making and collection of high quality pictures of grasses.

This booklet, will give enriching experience to anyone who is interested in grasses and create awareness about the fact that, Tiger reserves are not only about Tigers but also the various species like grasses and other gene pools.


VEJAYANTHAM TR,
DEPUTY DIRECTOR,
PANNA TIGER RESERVE, MP.

PREFACE

This Note on Grassland Vegetation of Panna Tiger Reserve (PTR) is designed for: firstly, all those who wish to know about important grasses in PTR and secondly, to wildlife managers, who wish to improve grasslands for grazing by wild herbivores. As many as 42 species described in the text are common not only in PTR but also all over arid and semi-arid areas of Central India.

The main feature of this Note are that it enable the grasses to be identified either by their vegetative parts alone or by their general appearance in flower. The contents of the Note are as follows: A general introduction of grasslands, their categorisation and classification, introduction of grasses and their taxonomy along with identification tricks have been described. 43 species of grass are listed and described. The scientific name along with their common name, both in English as well as in Hindi, have been mentioned. Grasses have been classified in Palatable and Un-Palatable groups.

Efforts have been put to identify the area distribution of each grass in PTR, but this information may not be complete as further efforts are required to identify exact location/distribution of each grass species. Information regarding flowering and fruiting of the grasses have been collected which shall be useful for Grassland managers.

Information about grasses have been collected from different sources specially from internet. Herbarium pictures of few grass species, to bring more clarity in identification, have also been taken from internet.

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Glossary

Annual: A plant completing its life cycle within one year.

Ascending: Culms sloping or curving upwards from base.

Bristle: Stiff hair or single projection from tip of leaf-blade.

Collar: Whitish or yellowish zone at the junction of the leaf-sheath and blade.

Culm: Stem of grass.

Inflorescence: Flowering head terminating culm.

Internode: Portion of culm between two successive nodes

Keel: Fold or ridge at the back of a compressed, i.e. flattened, leaf blade or leaf-sheath.

Leaf-blade: part of the leaf above the sheath.

Leaf-sheath: lower part of the leaf surrounding stem.

Ligule: Outgrowth of the inner junction of the leaf sheath and blade, often membranous or represented by border of hairs.

Margin: the edge of leaf-blade and sheath.

Membrane: membranous, not transparent, thin and whitish.

Midrib: the central nerve, often ridge-like, of a leaf-blade.

Node: A point on stem, culm, at which leaf arises.

Opposite: Borne at same level on opposing sides of the axis.

Perennial: A plant surviving for more than one year.

Petiole: Thin stalk of leaf blade.

Stolon: Prostrate, creeping stem, rooting at the nodes and there giving rise to vegetative shoots.

Tufted: as applied to annuals, loose, compact or dense cluster of living vegetative shoots and culms.

Tussock: as applied to perennials, dense clump of dead and living vegetative shoots and culms.

Grasses of Panna Tiger Reserve

I. INTRODUCTION

Grasslands refers to vegetation community predominated by graminoids i.e, grasses and grass like plants, more specifically ‘graminoid vegetation having less than 10% tree and shrub cover’ (White, 1983; House and hall, 2000). The grasslands not only function as a major producer biome but also serve as habitat to a variety of micro and macro fauna. Grassland covers about 2/3 of the land masses of the world and makes up 1/4 of the earth's surface. Although grasslands contain mostly grass, they are actually areas of great variety since there are over 10,000 grass species, not to mention the 12,000 species of legumes that often grow with grasses.

Grasslands are usually divided into two categories: Tropical (grasslands located near the equator) and Temperate (grasslands located between the equator and the poles including those in North America, Europe, southern South America, Africa and Australia). Prairies, Savannas, Veldts, Steppes, Llanos, Campos, Downs, Meadows, Moors, Pamir, Pampas, Pantanals, Patanas, Punas, Pusztas, and Sahel all describe grasslands of the world. Although different countries and languages have different names for grasslands, all countries are learning that grasslands are crucial to civilisation.

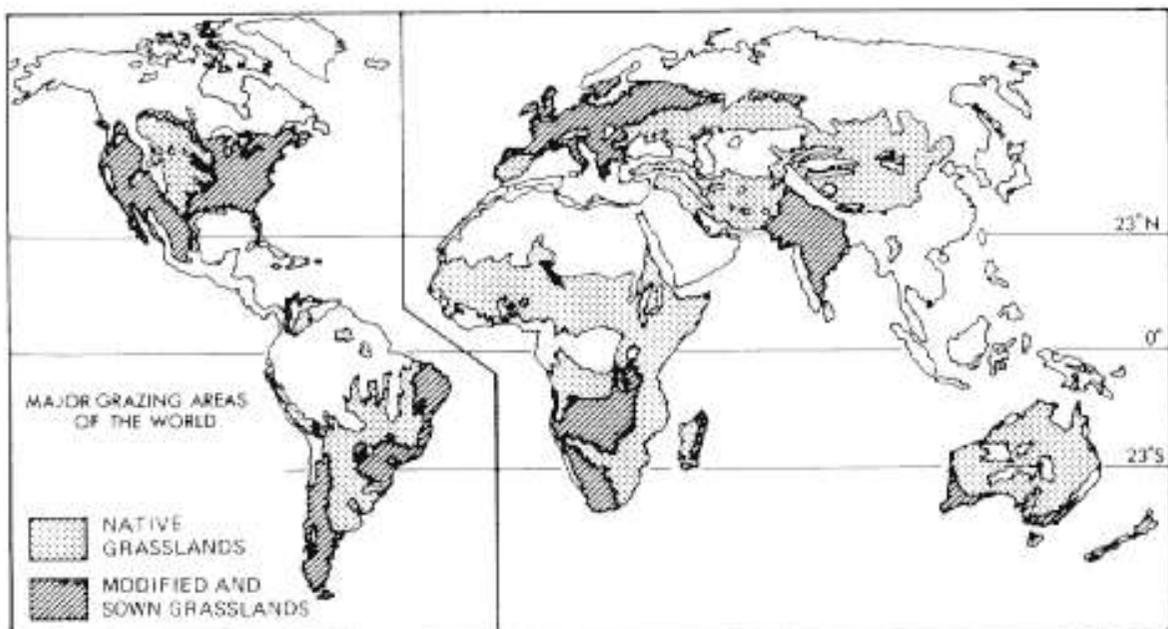


Fig 1: distribution of different Grasslands of the world

Grasslands near the equator produce plants that can withstand a hot climate through most of the year as well as drought and fires. The influences of drought and fire are important. Both sound devastating but they actually provide positive effects to the development of grasslands. The ability of grass to endure through periods of drought; to lie dormant in the soil or grow beneath the soil gives grass its greatest advantage. Fire can kill many plants and animals but this is a natural way to kill pests and weaker plants and replenish the soil with decomposed matter to form better soil. Fire has also been used to extend the boundaries of grasslands by removing trees to allow more grass to grow. Trees do not tolerate fire, drought or grazing as well as grasses.

A reconnaissance survey of grasslands of India conducted from 1954 to 1962 revealed 5 major grass covers based on distribution. The distribution of grasses is primarily governed by climatic factors, chiefly by latitudinal influence followed by altitude and topography particularly the soil moisture relationship. Later, Grassland of India have been classified by Dhadabgao and Sankarnarayan (1973) into five broad cover types in their book 'Grass Cover of India'. These five grass covers are: *Sehima-Dichanthium* type, *Dichanthium-Cenchrus-Lasiurus* type, *Phragmites-Saccharum-Imperata* type, *Themeda-Arundinella* type, and Temperate Alpine type.

Sehima-Dichanthium type: This cover type is spread over the whole of Peninsular India, including the central Indian plateau, the Chhota Nagpur Plateau and the Aravali ranges with a coverage of approx. 1,740,000 km² between 8° and 28°N and between 68° and 87° E. The cover is also found in the coastal region. Dominant perennial grass species are *Dichanthium annulatum*, *Sehima nervosum*, *Bothriochloa pertusa*, *Chrysopogon fulvus*, *Heteropogon contortus*, *Iseilemalaxum*, *Themedia triandra*, *Cynodondactylon*, *Aristida setacea*, *Cymbopogon* spp. etc. Important associated species are *Apludamutica*, *Bothriochloa intermedia*, *Arundinella nepalensis*, *Desmostachya bipinnata*, *Eragrostis* and *Eragrostiella* spp.

Dichanthium-Cenchrus-Lasiurus type: This type is associated with sub-tropical arid and semi-arid regions comprising the northern portion of Gujarat, the whole of Rajasthan, excluding the Aravalli ranges in the south, western Uttar Pradesh, Punjab, Haryana and Delhi State with a coverage of more than 436,000 km² between 23° and 32° N and 68° and 80° E. The principal perennial grass species are *Cenchrus ciliaris*, *C. setigerus*, *D. annulatum*, *Cymbopogon jawarancusa*, *Cynodondactylon*, *Eleusine compressa*, *Lasiurus indicus*, *Sporobolus marginatus*, *Dactyloctenium indicum*, *Desmostachya bipinnata* etc. Important associate species are: *Chloris*, *Desmostachya*, *Heteropogon contortus*, *Saccharum bengalense*, *Vetivaria zizanioides*, etc.

Phragmites-Saccharum-Imperata type: This grass cover occurs throughout the Gangetic Plain, the Brahmaputra valley and extends westwards into the plains of Punjab between 26° and 32°N and 74° to 96°E. The area comprises approx. 2,800,000 km² in north-eastern states, W Bengal, Bihar, UP, Punjab and Haryana. Principal perennialest species in drier regions are: *Imperata cylindrica*, *Saccharum arundinaceum*, *S. spontaneum*, *Phragmites karka*, *Desmostachyabipinnata*. Other important species of this grass cover are: *Bothriochloa intermedia*, *Vitevariazizanioides*, *Imperata cylindrica*, *Chrysopogonaciculatus*, *Panicum notatum*, etc.

Themeda-Arundinella type: This grass cover occurs in the entire northern and north western mountain tract, on an area of approx. 230,000 km² in the north-eastern states, West Bengal, Uttar Pradesh, Punjab, Haryana, Himachal Pradesh and Jammu and Kashmir. In the west, this type is found approximately between 29° and 37°N, and between 73° and 81°E, and in the east approximately between 22° and 28.5°N, and 88° and 97°E. This type is associated with undifferentiated forest and hill soils, and also with undifferentiated forest sub-mountain regional soils. The principal species of this grass cover are represented by *Arundinellabenghalensis*, *A. nepalensis*, *Bothriochloa intermedia*, *Chrysopogon fulvus*, *Cymbopogon jwarancusa*, *Cynodondactylon*, *Heteropogoncontortus*, *Themedaanathera*, *Euloliopsisbinata*, *Ischaemumbarbatum*. Associated perennial species are: *Apludamutica*, *Arundinellakhaseana*, *Pennisetum flaccidum*, *Chloris*, *Desmostachya*, etc.

Temperate Alpine type: This cover type occurs on the high hills of Uttarakhand, Jammu and Kashmir, Himachal Pradesh, West Bengal and North-eastern regions. The tract lies approximately between 29° and 37°N, and between 73° and 81°E in the western part of the country. On eastern side, it is situated approx. between 27° and 29.5°N, and 88° and 97°E. It essentially occurs at higher elevation, beyond timberline, approximately above 3,000 m in the west and above 2,000 m in the east. The principal perennial species are: *Agropyronconaliculatum*, *Chrysopogongryllus*, *Dactylis glomerata*, *Danthonia cachemyriana*, *Phleum alpinum*, *Carexnubigena*, *Poa pratensis*, and *Stipa concinna*. Associated species are: *Poa alpina*, *Festuca lucida*, *Eragrostis nigra*, *Bromus ramosus*, etc.

Recently, 'ENVIS' bulletin has been published in 2015 on the subject of 'Ecology and Management of Grassland Habitats of India'. In this bulletin an updated account of grasslands in India has been given by Manoj Chandran, in his article 'Grassland Vegetation of India: An Update'. He has classified grasslands broadly under: i) The Coastal grasslands; ii) The Riverine Alluvial grasslands; iii) Montane grasslands; iv) Sub-Himalayan tall grasslands of Terai region; v) Tropical Savanas and vi) Wet grasslands.

In grasslands, grasses form bulk of the fodder though they are not exclusively consumed by animals, but legumes, other forbs and sedges are also consumed. Grasses are an advanced group of monocot plants that produce high quantity of biomass in short life

cycle, and by this they play a vital role in food, fodder and economy of the world. Their high production of biomass is the result of a special photosynthetic pathway known as C4 adapted by majority of the grasses in addition to normal photosynthesis mode.

There are about 620 and 650 genera and 10,000 and 18,000 species of grasses (Poaceae) and legumes (Leguminosae) respectively, in the world. Grasslands are natural source of fodder for animals and occupy about 31- 43% of the total surface of the Earth, about 20% of Asia and more than 24% of India.

Palatability is consumption of plant or plant parts with relish by grazing animal. Generally palatability and preference are used as synonymous, though preference is essentially behavioural, which is totally depending on the choice of the grazing animals. The palatability of the grass is dependent on the chemical constituents and nutritional content such as carbohydrates, proteins, fibre etc. and their proportions, which are regulated by environmental factors like topography, climate etc. At the maturity of the grass, protein content decreases, while fibre, lignin, cellulose etc. increases, hence grasses are more acceptable when they are young (Heady, 1964; Mirza et al., 2002). Grasses require 7% crude protein to initiate voluntary intake by animals.

Some morphological modifications such as awns, leaf margins produced by grasses also affect the palatability of the particular grass species as these modifications cause injuries to oral cavities of grazing animals, so that by these modifications the grasses are avoided by cattle.

Grass yields more starch equivalent and protein per acre than any other crops. Good grasslands, if effectively grazed, may have a starch equivalent of 66 per cent and a protein equivalent of 15 per cent. These pastures will produce 900-1300 kg of total digestible nutrients per acre.

On the basis of following characters, the grasses are considered suitable as forage plants for grazing:

1. Grasses (members of Gramineae/Poaceae) have wider range of adaptability than the species of any other family, being found in humid tropics, arid areas and alpine peaks.
2. Reproduction of fresh shoots by tillering provides a means of recovery from grazing or cutting.
3. Many grasses maintain continuous vegetative growth interrupted only by drought or cold
4. Many grasses spread by rhizomes or stolons, which readily form adventitious roots and give rapid ground coverage.
5. New tissues produced during growth, arise chiefly at the base of the leaves where these are least to be damaged by cutting or grazing.

6. The root system binds the soil particles together forming a sod and brings to the surface layer nutrients, which have been leached into the sub soil by heavy rainfall.
7. In addition to above while selecting the species for pasture, the qualities desired are productivity, palatability, high nutritive value and adaptation of the species with local soil and climatic conditions.

II. GRASS: INTRODUCTION

⇒ Grasses belong to the Poaceae family which is also known as Gramineae. Grasses are usually herbaceous which indicate that they produce a seed, do not develop woody tissue, and die down at the end of a growing season. They are monocotyledonous which means one leaf sprouts from the seed, and often have jointed, slender, sheathed leaves. Grasses can be large, like bamboo or corn, or small like annual bluegrass. Grass plants develop fruit called grain which feed much of the world and yet have green leaves and stems not digestible for humans that are the main food source for animals. Grasses can also be used for building materials, medicines, and biomass fuels.

⇒ **Taxonomic Tree**

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Monocotyledonae
Order: Cyperales
Family: Poaceae

Grasses, whether annual or perennial, are mostly herbaceous (not woody), monocotyledon plants with jointed stems and sheathed leaves. They are usually upright, cylindrical, with alternating leaves, anchored to the soil by roots. Grasses have leaves (blades that narrow into a sheath), a stem (culm), a collar region (where leaves attach to the stem), roots, tillers, and during the reproductive stage an inflorescence or seedhead develops. Grasses may have rhizomes or stolons and the collar regions have differing variations of ligules, auricles, and blades (laminae). Inflorescences of grasses also vary widely so during vegetative stages, the collar and leaves help in proper identification and during reproductive stages the inflorescence is very helpful.

Inflorescences are an arrangement of many spikelets composed of individual florets. Grasses have three main inflorescence (seedhead) types: panicle, spike, and raceme.

⇒ **Growth Sequence**

A grass seed contains nutrients to help the plant begin to grow. In rainy season, soil temperature, moisture, planting depth and seed vigor contribute to a seedling (cotyledon) emerging from the seed. All grasses are hypogeal, which means the first leaf remains below the surface of the soil. Also from the seed, a primary root called the radicle emerges. Additional roots soon develop from the seed and are called seminal roots. These roots are crucial for the absorption of water and nutrients but are short-lived.

After the root growth is underway, the shoot (epicotyl) emerges and grows towards the surface. At first, since the development is underground (hypogeal) and since there is so little leaf material available to manufacture sunlight energy for growth, the plant uses stored carbohydrate reserves within the seed. But quickly a tube containing leaves (coleoptile) elongates toward the soil surface and emerges. It then stops growing, but leaves within unfurl and begin utilizing the sunlight. Since the primary root and seminal roots are short-lived, new roots (adventitious roots) develop if soil moisture is sufficient. With appropriate temperatures, leaf production then proceeds rapidly. Within a week, buds at the bottom of sheaths of lower leaves develop into new stems called tillers. Usually by the time three leaves appear, one or two tillers are visible.

For the first month or so, the plant is busy producing leaves and tillers. This will continue until climatic conditions trigger the plant to focus on reproduction. Then the plant will elongate and send up a flag leaf and then a peduncle which is a stem that will support a reproductive inflorescence. The goal of forage production is to utilize grass growth before the reproductive stage when stems thicken and quality and palatability decrease. Managers must learn to use leaf material wisely and, if possible, postpone the reproductive stage.

⇒ **Regrowth**

When a grass plant has been defoliated (grazed or mowed) and some leaf material remains, the plant can continue growth because leaves will utilize sunshine and so photosynthesis continues. If defoliation severely reduces the leaf material, stored carbohydrates must be used for new growth because there is not enough leaf surface to support photosynthesis. The plant stops root growth and other functions to focus on replacing leaf tissue. Managers need to encourage leaf growth without using carbohydrate reserves and stopping root growth. This requires managing defoliation so that enough leaf surface remains to continue the photosynthesis process.

Once defoliated, grass will grow back from several ways but there are variations in how that is done. Grasses grow back because the base of the leaf blade, if not removed, expands and grows. Or regrowth can come from new leaves, tillers and buds. Some plants also have corms, which are carbohydrate reserves that look like bulbs near the surface of the soil.

Another factor involved in regrowth is that all grasses produce some tillers that do not flower. They are sterile tillers. Some grasses have many sterile tillers while others have a

low percentage of sterile tillers. The sterile, nonflowering tillers maintain a low growing point so are less vulnerable to defoliation. The growing point may be affected by long periods of dry conditions and long rests may cause the leaf blade base to extend and be removed by grazing. But, generally, grasses with many sterile tillers will respond well to intensive grazing.

Grassland managers can produce much more forage and have forage stands persist much longer when they understand how grasses grow and regrow. Though most grasses grow similarly in initial growth and when left undisturbed, grass species vary in regrowth mechanisms. This is crucial since the greatest benefit of forage is its ability to regrow many times in a growing season.

⇒ **Managing grassland for forages**

Forages are plants or parts of plants eaten by wildlife and livestock and the variety of plants that are eaten is amazing. It is helpful, therefore, to classify those plants into groupings. The major group of forages are grasses (75%), but there are also legumes, forbs, shrubs and some trees. Ten of the fifteen crops that keep mankind from starvation are grasses. Only orchids and daisies have more species than grasses. There are grasses for almost every temperature and precipitation range. Only lichens and algae extend to wider climate zones.

Different grasses have different palatability, digestibility, and sometimes harmful effects on certain animals. Animals do have preferences and will be choosy, so careful management is necessary to ensure the best animal nutrition and pasture longevity and yield.

Whether a grass is an annual or perennial will determine many forage-related decisions. Annual species usually have inflorescences on more stems. Annual species typically require annual re-establishment. Perennials have inflorescences on some stems but also produce vegetative tufts which will wait for two years or more to produce an inflorescence.

Each grass has its own list of environmental characteristics as well. The following traits should be considered by grassland managers: winter hardiness, drought tolerance, salinity tolerance, soil pH tolerance, production potential, and animal suitability.

Although animals eat all year round, there is no "all season" plant to use as forage. Knowing that some plants are C₃ (cool season) and some plants are referred to as C₄ (warm season) is a basic key to having quality forage all year long. But understanding the physiology (internal chemical changes) of both can even further improve the management of forages.

C₃ plants have an optimum temperature range of 18-23 degrees C. Growth may begin when the soil temperature is 5-7 degrees C. C₃ plants become less efficient as the temperature increases but have higher protein quantity. C₃ plants can also be annual or perennial. The degradation of C₃ grasses in the rumen of an animal is often faster than

C₄ grasses because of the thin cell walls and leaf tissue and they are therefore often of higher forage quality.

C₄ plants are often called tropical or warm season plants. C₄ plants are more efficient at gathering carbon dioxide and utilizing nitrogen from the atmosphere and recycled N in the soil. They also use less water to make dry matter. They grow best at 32-35 degrees C. They begin to grow when the soil temperature is 15-18 degrees C. Forage of C₄ species is generally much lower in protein than C₃ plants, but the protein may be more efficiently used by animals since a portion of the protein may bypass degradation in the rumen where microbes would utilize some of the protein. Post-rumen degradation of protein (bypass or escape protein) is an important part of ruminant nutrition and production. C₄ plants can be annual or perennial.

All of the information about warm and cool season plants provides a foundation to forage management decisions. With this understanding, managers can know when they will have peak pasture growth, what and when to plant supplemental crops, how to prepare the grasslands for winter and drought, and how and when plant regrowth can be best utilized.

III. IDENTIFYING GRASSES

Many people have difficulty identifying grasses because they claim grasses all look alike. Unlike plants that have splendid colors, fragrances, or nectar to attract insects for pollination, grasses are often wind-pollinated and seem very much alike.

Here is a typical (composite) drawing of a mature grass plant with the various features labelled (Fig 2):

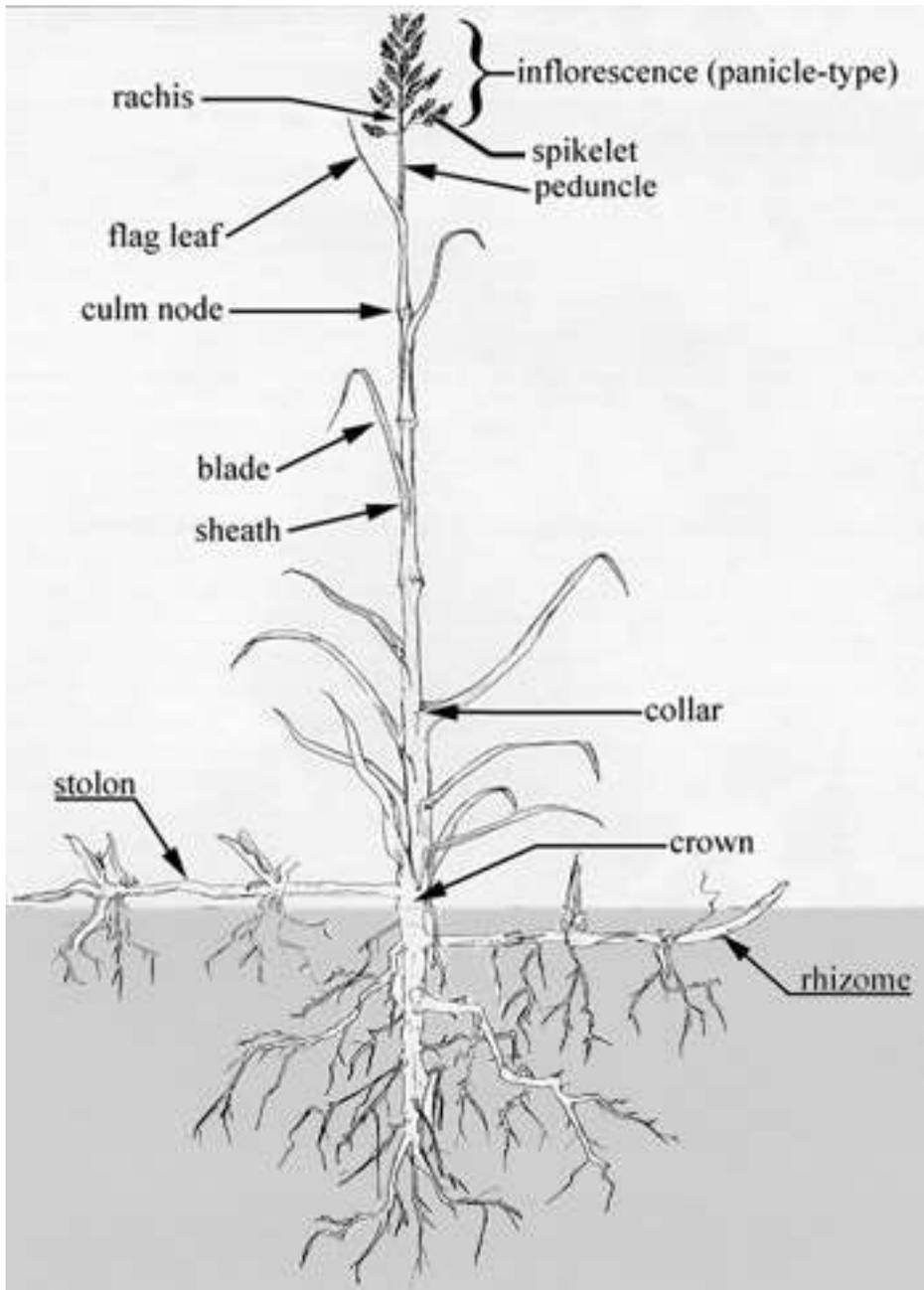


FIG 2- MORPHOLOGY OF GRASS PLANT

The two main areas to focus on in grass identification are: i) the Collar region (leaf attachment to stem); and ii) the Inflorescence (flower).

- i) **The collar region (Fig 3)** contains the auricles and a ligule sometimes called a rain guard because it is said to keep dirt and rain from fouling the sheath. Auricles are appendages at the opening of the sheath. Various grasses have an amazing but differing combination of these features. Just as humans have a face with eyes, nose, mouth, and ears yet are very distinct, grasses have a collar

region to help distinguish them. The collar region is important because it can help in identification soon after emergence. Inflorescences are distinct but only appear during the reproductive stage of growth.

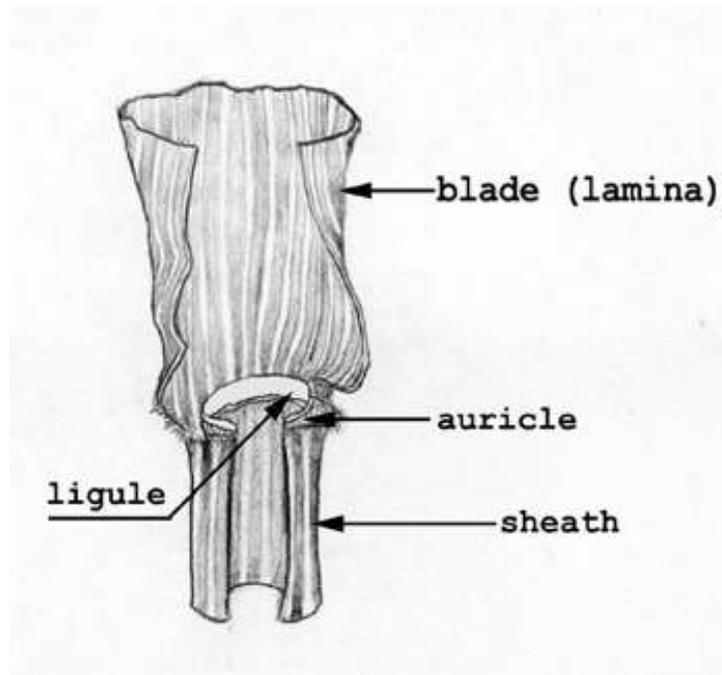


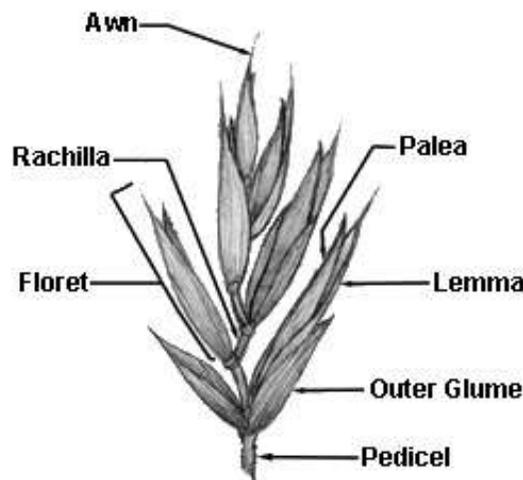
Fig3- Collar region

Most grass species have a ligule but ligules can be hairy or smooth, of many different shapes and heights, and membraneous to papery.

Many grasses do not have auricles so focus first on the ligule's physical characteristics. Then look to see if auricles are present and, if so, what characteristics do they have: clasping extensions, wavy folds, pubescence. Grasses also have some variety in the sheaths where the leaf wraps around the stem. Some sheaths are overlapping and tight while others are open like a man's suit jacket. Various shaped auricles or lack thereof, differing ligules, the presence or absence of hairs, and differing sheaths, are the ways thousands of grasses can be distinguished.

- ii) **Inflorescence:** As the grass plant matures and is ready to reproduce, the inflorescence or seedhead is more helpful for identification because it can be readily seen. Inflorescences are arrangements of many spikelet (**Fig 4**) which are composed of individual florets. When a floret matures it produces the seed. Grass inflorescences can be panicle, spike, or raceme. Although inflorescence color is not as helpful in identifying grasses as it is in legumes, each grass can be identified by noticing the following:

- a. the presence or absence of awns (a prolonged, sharp extension on the lemmas of the florets that often attaches the seed to livestock hair which spreads the seed)
- b. how the spikelet attach to the peduncle (stem that holds the inflorescence)
- c. the spikelet arrangement
- d. type of inflorescence.



Spikelet

Fig 4- Spikelet

The other two areas to focus on in grass identification are: iii) grass seedlings; and ii) grass leaves.

- iii) **Grass Seedlings (Fig 5)** can be very similar. But a new grass seedling can also be identified by digging up the seed. Grass seeds differ although they do not have as many dramatic characteristics. Yet seeds retain their color, shape, and other characteristics well even when buried for a long time. Generally, grass seeds are long, slender, beige to tan, and translucent. Some grass species have awned lemmas.

One seed characteristic that may clearly identify grass species is the shape of the rachilla joint still present on the seed. The rachilla is the axis that connects florets to the spikelet. Different grass species have different rachilla joint shapes. The first is of perennial **ryegrass** and the second photograph is of a **meadow foxtail** seed. The bent awn is quite noticeable as is the pubescence (hairs).

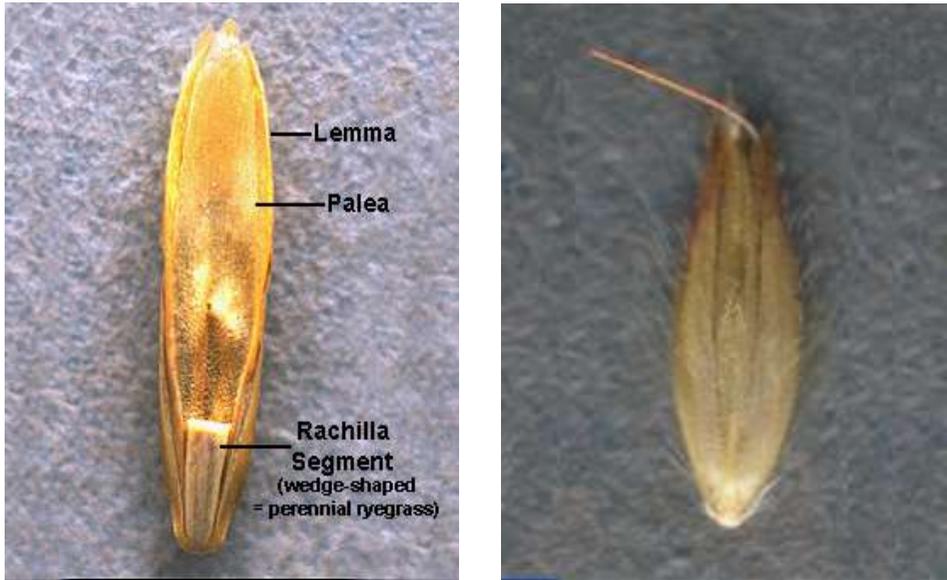


Fig 5- Grass Seedling

- iv) **Grass leaves (Fig 6)** may seem very similar but they actually have a wide range of green colors, textures, markings, and surface characteristics. When learning to identify grasses notice whether leaves are ribbed, veined, keeled, or tapered. Some grasses have "V" or "W" markings and leaves can be smooth, jagged, glossy, dull or a combination since tops of leaves often vary from the bottoms. New leaf blades are either rolled or folded within the stem waiting to be pushed up to unfurl. Some species are identified specifically by their rolled or folded leaf buds.

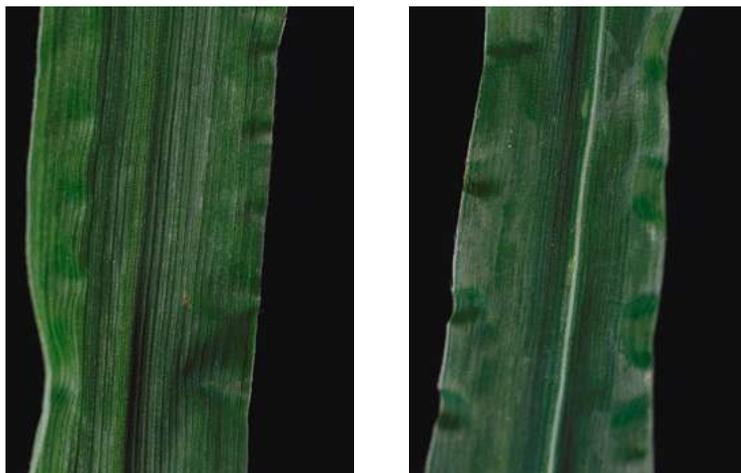


Fig 6- Grass leaves

When learning to distinguish grasses, determining whether the grass has stolons or rhizomes can also help. Stolons are modified, propagating stems above ground creeping and

rooting or curved over and rooting at the tip. Rhizomes are underground stems, or rootstocks. The rhizomes of grasses are usually slender and creeping, with scales at the nodes. Many forages grow with stolons or rhizomes, eventually developing a thick stand. Plants can have stolons, or rhizomes, or both, or neither.

GRASSES FOUND IN PANNA TIGER RESERVE

More than 60 grasses species are found in Panna Tiger reserve (PTR). Out of these 42 grass species have described in detail. These 42 grasses have been categorised in palatable and un-palatable grasses and are listed in **Table 1**.

It is an accepted fact that most of the grasses are palatable in the initial stage of growth, and some grasses which are un-palatable for small herbivores like Sambhar, Chital or Chinkara, may be palatable for big herbivores like Elephant or Bisons. Some animals may have liking for grasses which are un-palatable for most, for example *Chrysopogon zizanoides* (*vetiver*), considered as un-palatable grass, is favourite feed of Hog deers. Also in times of scarcity, herbivores may feed on leaf tips of un-palatable grasses. Following classification of grasses into palatable and un-palatable have been done for PTR.

TABLE 1
Palatable and Un-Palatable grasses

Sr no.	PALATABLE GRASS	Annual (A)/ Perennial	Sr No.	UN-PALATABLE GRASS	Annual (A)/ Perennial (P)
1	<i>Apluda mutica</i>	P	1	<i>Aristida setacea</i>	P
2	<i>Bothriochloa</i>	P	2	<i>Aristida adscensionis</i>	A
3	<i>Bothriochloa pertusa</i>	P	3	<i>Arthaxon hispidus</i>	P
4	<i>Brachiaria ramosa</i>	A	4	<i>Arundinella setosa</i>	A
5	<i>Chloris gayana</i>	P	5	<i>Chrysopogon</i>	P
6	<i>Chloris virgata</i>	A	6	<i>Cenchrus ciliaris</i>	P
7	<i>Chrysopogon fulvus</i>	P	7	<i>Desmostachya</i>	P
8	<i>Cynodon dactylon</i>	P	8	<i>Eleusine indica</i>	A
9	<i>Dactyloctenium aegyptium</i>	A	9	<i>Eragraostiella bifaria</i>	P
10	<i>Dichanthium</i>	P	10	<i>Eragrostis tenella</i>	A
11	<i>Dichanthium</i>	P	11	<i>Eulaliopsis binata</i>	P
12	<i>Digitaria decumbens</i>	P	12	<i>Imperata cylindrica</i>	P
13	<i>Digitaria ciliaris</i>	A	13	<i>Ischaemum rugosum</i>	A

14	<i>Echinochloa colona</i>	A	14	<i>Paspalidium flavidum</i>	A
15	<i>Enteropogon dolichostachyus</i>	P	15	<i>Perotis indica</i>	A
16	<i>Eragrostis pilosa</i>	A	16	<i>Phragmites australis</i>	P
17	<i>Heteropogon contortus</i>	P	17	<i>Saccharum</i>	P
18	<i>Iseilema laxum</i>	P	18	<i>Setaria pumila</i>	A
19	<i>Panicum antidotale</i>	P	19	<i>Sorghum halepense</i>	P
20	<i>Pennisetum</i>	A			
21	<i>Sehima nervosum</i>	P			
22	<i>Setaria sphacelata</i>	P			
23	<i>Themeda quadrivalvis</i>	A			

**SUMMARY OF PHYSICAL CHARACTERS, DISTRIBUTION AND USEAGE OF
GRASSES FOUND IN PANNA TIGER RESERVE**

I. PALATABLE GRASSES

1. *Apluda mutica* (L.)

Common name :

Fulera (H), Mauritian grass (E)

Description:

Perennial grass, Culms scandent, or decumbent, or prostrate; 30-300 cm long; very long inter nodes; rooting from lower nodes. Ligule a ciliolate membrane. Leaf-blade base tapering to the midrib. Leaf-blades 5-25 cm long; 2-10 mm wide. Leaf-blade apex attenuate; filiform.

Habit:

A perennial Herb

Habitat:

Moist deciduous and scrub forests also in plains and waste lands

Flowering and Fruiting:

October-November

Distribution:

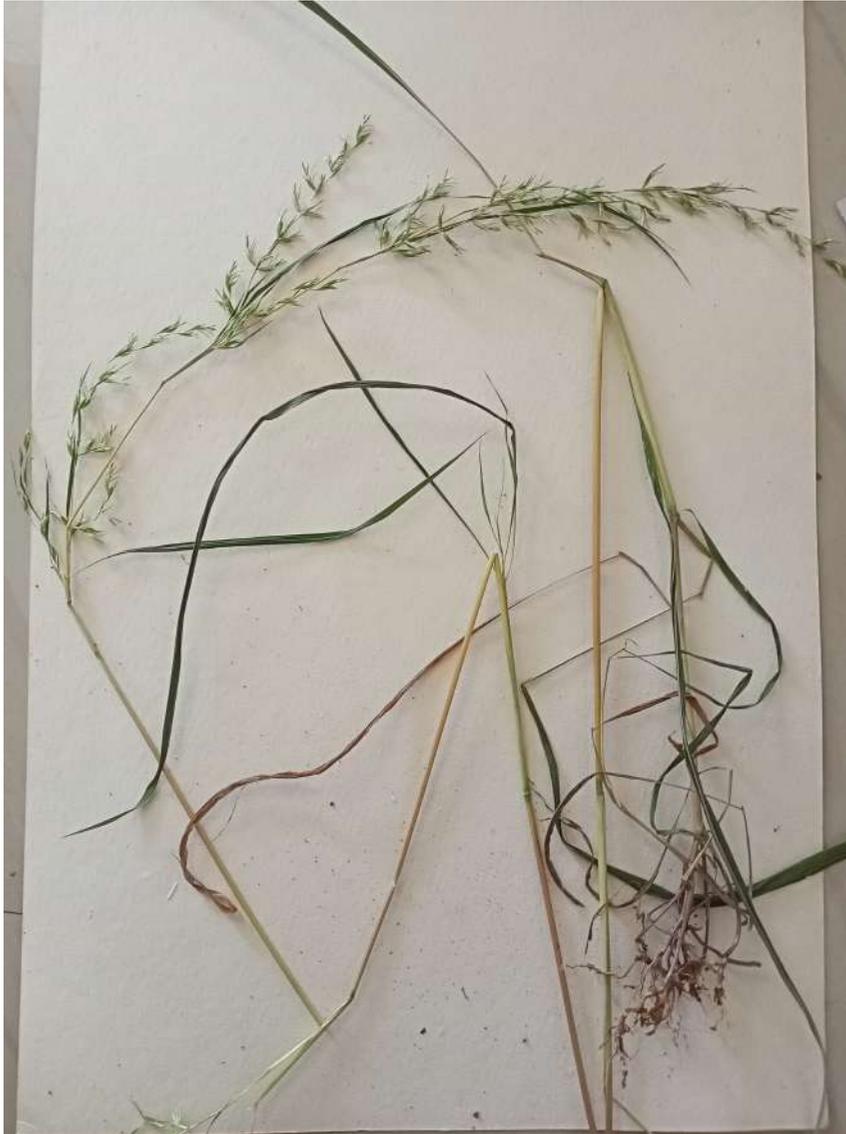
All state of India. In PTR, it is spread in all areas near the small nalas and prefers areas of shade. It is present in all the 13 grasslands near wet areas.

Utilisation:

Fairly good forage grass and is readily eaten by animals when young.



Apluda mutica (L.)



Apluda mutica (L.)

2. *Bothriochloa intermedia*

Common names:

Forest blue grass (E), Bada Phulwa, Fulkara (H)

Description:

Perennial, tufted, erect, 2 m tall, 5-7 noded, nodes glabrous or upper bearded. Blade linear, 30 cm long tapering. Panicles narrow, 10-25 cm long. Racemes 12-38 mm long. Pedicelled spikelets.

Distribution:

Distributed throughout tropical to sub-tropical parts from Punjab to West Bengal. In PTR, it is spread in all areas. It is sparsely distributed in all the 13 grasslands of PTR.

Climate:

It is a grass of semi-arid regions and prefers 900 mm average annual rainfall.

Flowering and Fruiting:

July - October

Soil:

It occurs mainly on heavy clay loam to clayey soils and heavier alluvial soils.

Cultural Practices:

After proper land preparation the seed is broadcasted @ 4kg/ ha or seedlings/ rooted slips are transplanted at a distance of 50 cm from plant to plant and 75 cm from row to row preferably in a drizzly day.

Nutritive value:

It contains 6.0 per cent crude protein (CP) at flowering stage in natural condition.

Utilization:

It provides good hay to animals.



Bothriochloa intermedia

3. *Bothriochloa pertusa*

Common names:

Sour grass, Indian blue grass (E), Phulwa (H).

Description:

Perennial, bunchy grass, 1 m tall, nodes bearded with spreading hairs, inter-nodes smooth and shiny. Inflorescence purplish, aromatic, made up of a cluster of 3-8 spikes. Spikelet are in pair, one sessile and awned and the other pedicelled and awn less. The glume of the spikelet has one prominent pit. Seed count is about 12,10,000/kg.

Distribution:

It is found widely distributed in U.P. and other northern and southern states up to 2000 m altitude. It prefers drier habitats in the rainfall zones ranging from 300 to 1200 mm in arid and semi-arid climatic conditions.

In PTR, it is spread in all areas but is not as a dominant grass.

Flowering and Fruiting:

August - February

Soils:

It grows well on coarse sand to fine textured sandy loam to loamy soils.

Cultural practice:

It can easily be established on poor soils with minimum tillage through broadcasting seeds @ 4 kg/ha.

Nutritive value:

C.P. value under zero fertiliser ranges from 7.1 to 2.4 per cent in July and November respectively.

Utilization:

It is utilized mainly for forage purposes.



Bothriochloa pertusa

4. *Brachiaria ramosa*

Common name :

Basin

Description:

Annual up to 70 cm high; leaves broadly linear. Inflorescence of 3-15 racemes on an axis 3-10 cm long; racemes 1-8 cm long, simple or the longest with branchlets at the base, base, bearing mostly paired, loosely contiguous spikelets appressed to the triquetrous rachis; pedicels shorter than the spikelets, 1-2mm long.

Distribution:

Widely distributed in Tropical areas. India: Assam, Madhya Pradesh, Maharashtra. In PTR, it is present in the plain areas with black soil. Present in grasslands along the Ken river banks of Madla and Chandrapur range.

Flowering and Fruiting:

July - October



Brachiaria ramosa

5. *Chloris gayana*

Common name:

Rhodes grass (E),

Description:

It is fine stemmed, leafy, **perennial**, erect, rhizomatous or spreading, stoloniferous grass. Culms are 0.6 to 1.2 m tall with long and stout internodes. Leaf blades are 15-30 cm long and 3-5 mm wide, tapering to fine pointed tips. Inflorescence is spreading with 10-15 cm long, spikelet crowded, straw coloured on ripening. It produces profuse amount of seeds. Seed count 7250000 to 9500000/kg.

Distribution:

It is a native of South Africa and was named after the famous Cecil Rhodes, who popularised it. The species was introduced in India through USA and later on in Karnataka in 1920. Being drought resistant it is found in semi- arid parts of the country and low lying areas.

In PTR, it is found in open woodlands and grasslands, in road margins and along the Ken river banks.

Flowering and Fruiting:

August - November

Climate:

It grows well in warm-moist conditions.

Soils:

It prefers loamy to sandy loams and can grow even on a fair degree of salinity but can not withstand stiff clayey or water-logging conditions.

Cultural practices:

It can be established by seeds as well as by rooted slips. A firm seed bed is prepared on well ploughed land and seeds are broadcast @ 5 kg/ha at the onset of monsoon by mixing the moist soil. Rooted slips can be transplanted in the lines at a distance of 50x50 cms for which nearly 40000 slips are required for one hectare.

Seed yield:

The seeds of this grass mature after monsoon and are collected in October- November. The well fertilized pasture produces 100 kg seeds in one hectare.

Nutritive value:

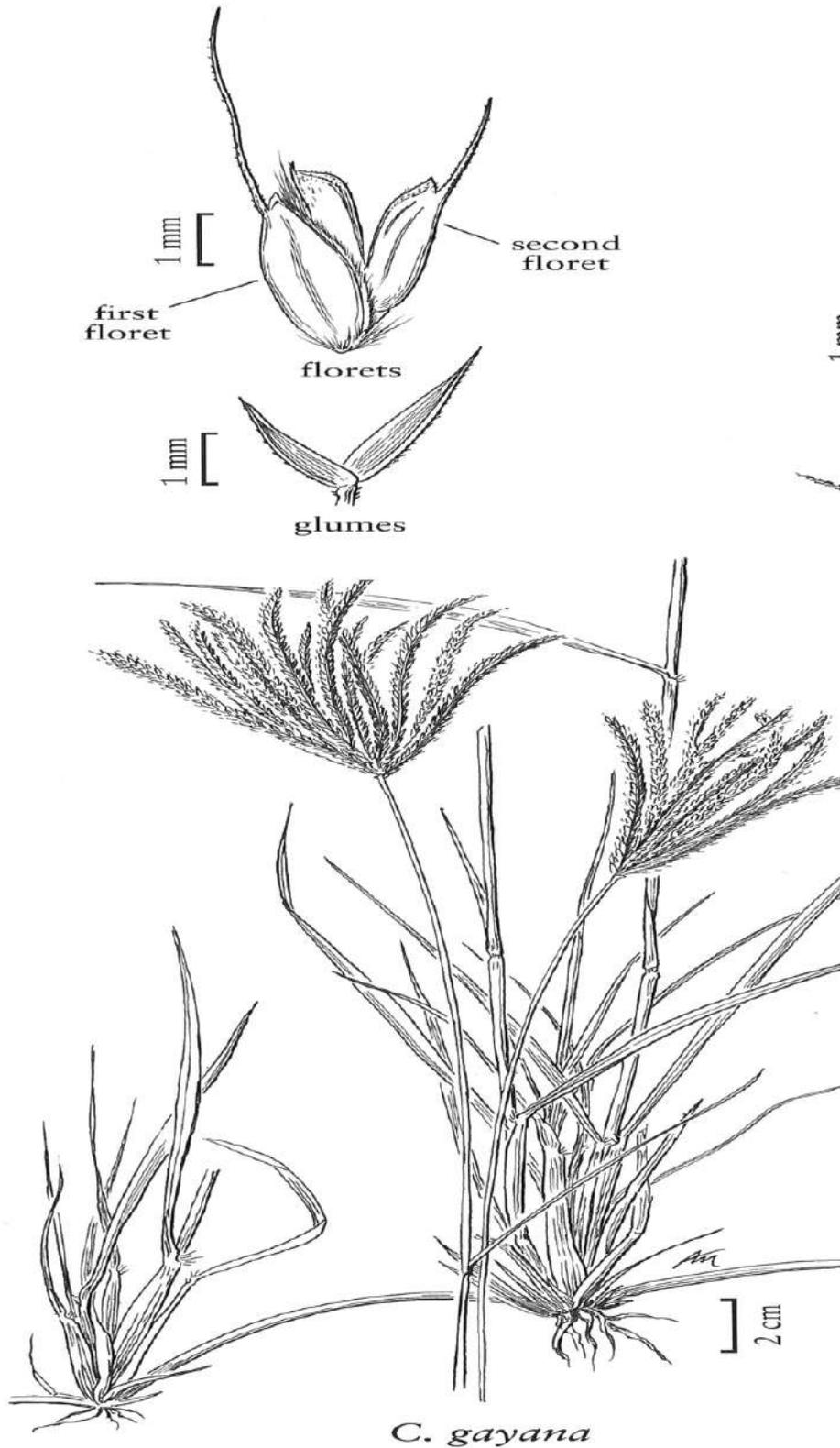
At pre flowering stage C.P. is nearly 5 per cent with a balanced content of Ca (0.5 per cent) and P (0.3 per cent).

Utilization:

The grass is suitable for pasturage, silage and hay but it is generally used for soiling. Even after severe trampling it provides grazing upto September and could be utilized for hay thereafter.



Chloris gayana



Chloris gayana

6. *Chloris virgata*

Common name:

Feather finger grass, feathery Rhodes grass (E),

Description:

Annual grass, culms tufted, erect or geniculately ascending, slightly flattened, 15–100 cm tall. Basal leaf sheaths strongly keeled, glabrous; leaf blades flat or folded, 5–30 cm, 2–7 mm wide, Spikelets with 2 or 3 florets, 2-awned;

Distribution:

C. virgata is a widespread species that grows in many habitats, from tropical to temperate areas with hot summers .

In PTR, it is present in all the areas, stony slopes, sandy river-side, and grasslands.

Flowering and Fruiting:

At few places in the PTR, it is found flowering throughout the year. Generally it produces fruits and flower from July to October.

Climate:

C. virgata grows in arid, dry, and moist habitats from sea level to 2500 m in elevation with mean annual temperatures around 25-30°C.

Soils: It prefers heavy soils, but has a wide soil range including saline, alkaline, and dark clay soils.

Seed yield:

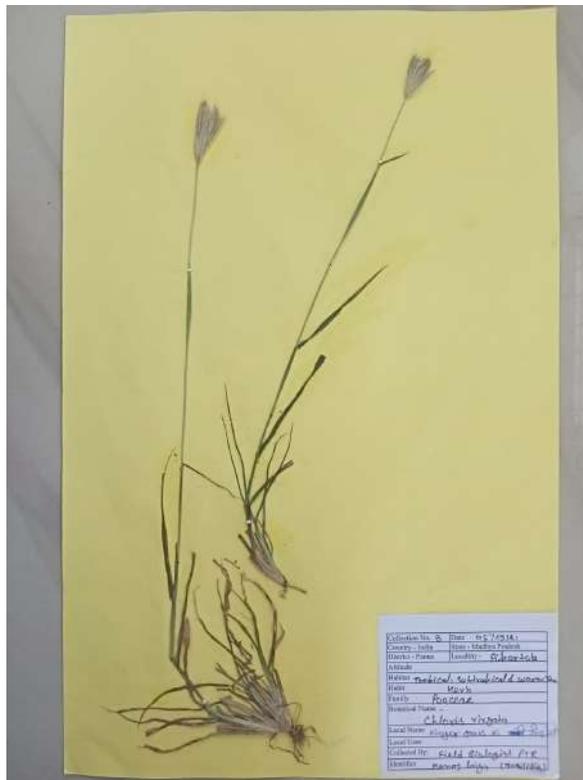
The seeds of this grass mature after monsoon and are collected in October- November. The well fertilized pasture produces 100 kg seeds in one hectare.

Nutritive value:

At pre flowering stage C.P. is nearly 5 per cent with a balanced content of Ca (0.5 per cent) and P (0.3 per cent).

Utilization:

It is one of the first grasses to colonize bare ground. It is a good forage for animals.



Chloris virgata

7. *Chrysopogon fulvus*

Common names:

Dhwalu (H)

Chrysopogon is derived from *chrysos* means 'gold' and *pogon* which means 'beard'.

Description:

It is highly variable, tufted, **perennial** and 1.8 m tall grass. Culms are slender and glabrous. Leaves are 25-30 cm long. Upper leaves are short (7.5 to 10 cm). Panicles are 3-13 cm long with several whorls of flexyous branches, with groups of 3 spikelets at their apexes. Out of these 3 spikelets one is sessile, bisexual, awned and other two are awnless and pedicelled.

Distribution:

Throughout India especially in hilly areas upto 1830 m altitude in the gravelly land of Central Plateau, Aravalli hills in Rajasthan, as well as lower ranges of Himalaya.

In PTR, it is present in all the areas along both sides of the forest roads, on the fire lines.

Flowering and Fruiting:

October

Climate:

It is found in arid to semi-arid regions with 250 to 850 mm rainfall.

Soils:

It thrives well on eroded, shallow and gravelly/stony soils of medium texture.

Cultural practices:

Its habitat being stony or gravelly with shallow soils, ploughing of any sort is not advisable. Spot sowing/planting on sloppy lands and broadcasting of seeds in fairly plain areas, as well as transplanting of rooted slips during drizzly days of monsoon, have given best establishment of pasture.

Seed yield:

The seed yield is upto 100 kg/ha.

Nutritive value:

It contains about 4.6 to 5.1 per cent C.P. during the growth period (Aug.- Sept.). (Aug-Sept). However, the C.P. decreased with the age of plant.

Utilization:

If it is cut before flowering the grass makes good green fodder or may be grazed directly from 2nd year onwards upto 6th year. Suitable for hay. It is a good soil binder also.



Chrysopogon fulvus

8. *Cynodon dactylon*

Common names:

Bermuda, Lawn, Wire and Devil grass (E), Doob and Hariyali (H).

Cynodon is derived from *kyon* means a dog and *odous* means tooth. Thus, it means Dog's tooth. *Dactylon* comes from a Greek word *dactylos* means finger which refers to the shape of the inflorescence.

Description:

It is a profusely much branched, leafy **perennial** stoloniferous with a large number of runners. Each stolon when cut is capable of becoming a separate plant, hence easiest and earliest in establishment. Culms are highly variable in length. Leaves are short and soft. Spikes are 2-8 in number and 2-5 cms long, digitally arranged on the tip of erect peduncles. Spikelets are one flowered and awnless. Fruit is caryopsis. Seed count 4489000/kg.

Distribution:

Doob is native to India. It is found in almost all the tropical and subtropical countries of the world from sea level to 2,130 m elevation.

In PTR, it is found in all ranges, in all grasslands.

Flowering and Fruiting:

Throughout the year.

Climate:

It grows well in semi-arid conditions between 300-2000 mm rainfall but does not survive in low rainfall areas.

Soils:

This grass thrives best on heavier silt and clayey soils not subjected to water logging or flooding. Sandy soil also does not suit to this grass. It is resistant to a great extent to drought and tolerant to salinity and alkalinity.

Cultural practices:

After proper land preparation by 2-3 ploughing, the best establishment of this grass can be achieved through planting of cut pieces of stolons with 2- 3 rooting nodes (runners) during monsoon season at 30-50 cm distance. After planting the field needs to be pressed by a light roller or feet. Establishment through seeds is not very successful, because the seeds are very minute and their germination is very slow. Moreover by the time small seedlings emerge from seeds they are smothered by other

weed species. In sandy soils the rooted slips are to be planted 10 to 13 cm deep in rows, taking care to leave their tips above the ground.

Nutritive value:

It contains 11.1 per cent C.P. in young stage and about 7.0 per cent at maturity and least crude fibre (18.6 to 28.2 per cent).

Utilization:

Being most nutritive, the grass is readily eaten by all animals. In addition to this, it is extensively used for checking soil erosion, gully plugging on check dams, embankments of rivers, canals and slop stabilisation of reservoirs etc.



Cynodon dactylon

9. *Dactyloctenium aegyptium*

Common name:

Mathni, Crowfoot grass (E)

It belongs to the tribe Eragrostideae. The genus *Dactyloctenium* comprises 12 species distributed primarily across Africa and Asia. It is a C₄ grass. In warm regions it flowers all year round.

Description:

D.aegyptium is a grass, with characteristic 'bird's foot' digitate inflorescence, up to 50 cm tall. **Annual**, never stoloniferous. Culms up to 50 cm tall, up to 5 noded, geniculately ascending, usually rooting from the lower nodes, thus giving the plants a pseudo-stoloniferous appearance, branched from the lower nodes; internodes cylindrical, glabrous, smooth, striate, exerted above, variable in length; nodes thickened and glabrous.

Young shoots cylindrical or rounded. Leaf-sheaths keeled, up to 5 cm long, rather lax, striate, tuberculately hairy on the keel or quite glabrous; ligule membranous, about 1 mm long, ciliolate along the upper edge; leaf blades flat when mature, rolled when in bud, linear, tapering to a fine point, up to 20 cm long and 12 mm wide, with 3-5 primary nerves on either side of the midrib, glaucous, usually more or less densely tuberculately hairy along the margins and the keel, less conspicuously so on the adaxial surface towards the tip.

Inflorescence digitate, composed of 4-8 spreading spikes. Spikes 1.5-6 cm long, on maturity often somewhat recurved, greenish-yellow or pallid; rachis keeled, smooth near the base, scaberulous towards the apex, tip mucroniform and curved.

Spikelets 4 mm long, strongly compressed, ovate, solitary, sessile, patent alternately left and right on the ventral side of the axis; dense, forming a very flat comb, usually 3-flowered; lower florets bisexual, the upper florets rudimentary; axis without terminal stipe.

Distribution:

D. aegyptium grows as a weed in arable lands and waste places. It prefers light sandy soils in open sunny places that are dry or somewhat moist. It becomes established in disturbed areas, open grounds, and roadsides.

In PTR, it is found in all ranges, in almost all areas including degraded areas, also sparsely present in all grasslands.

Flowering and Fruiting:

Throughout the year.

Reproductive Biology:

D. aegyptium is an annual grass that produces spikelets with flowers pollinated by wind. One plant can produce up to 66,000 seeds with 5% germination. This species spreads mainly by seeds but also has creeping or spreading stems that root at the lower nodes.

Uses:

D. aegyptium is relished by all types of ruminants. Although *D. aegyptium* is a palatable pioneer grass that can quickly colonize disturbed areas, it seldom forms an important component of natural grassland.

10. *Dichanthium annulatum*

Common names:

Marvel grass (E), Kail, Kared and Apang, Choti kandi (H)

Dichanthium is a genus of 21 species that grow in habitats ranging from sub-deserts to marshlands in tropical areas. The genus name derives from the Greek *dicha*, in two, as in two separate things, and *anthos*, flower, a reference to the presence of homogamous and heterogamous spikelets. Species within this genus are frequently found in disturbed areas, and some species are cultivated to provide good forage.

Description:

It is an erect tufted, fine stemmed, **perennial** grass and 1.2 m tall. Culms are purplish red or bluish in colour, distinct rings of whitish hairs at each node. Leaves are green to bluish green, 23-45 cm long. Inflorescence is a compound raceme, made of a cluster (2-8) of purplish false spikes, arising nearly from the terminal tip of the culms. Each false spike is a raceme of paired spikelets, one sessile and the other pedicelled. Most distinguishing character of its spikelets is the absence of pits on the glumes.

Distribution:

It grows on the plains and upto 900 m on hills in India except in northern mountains.

In PTR, it is found in all grasslands.

Flowering and Fruiting:

Throughout the year.

Climate:

It grows well in the areas of 350 to 2000 mm rainfall of arid and semi-arid regions.

Soils:

It can grow on a wide range of soils but moist, well drained, medium black or red alluvial soils are preferred. It can tolerate a fair degree of drought as well as salinity but does not thrive on acidic soils.

Cultural practices:

In well levelled land the sowing is to be done in lines using 4-6 kg seed/ ha after first shower in monsoon. But established pastures gave best results for which 5 weeks old seedlings/rooted slips can also be transplanted in a drizzly day at 50 cm row spacing and 30 cm plant to plant.

Nutritive value:

Its crude protein content varies from 5 to 7 per cent.

Utilization:

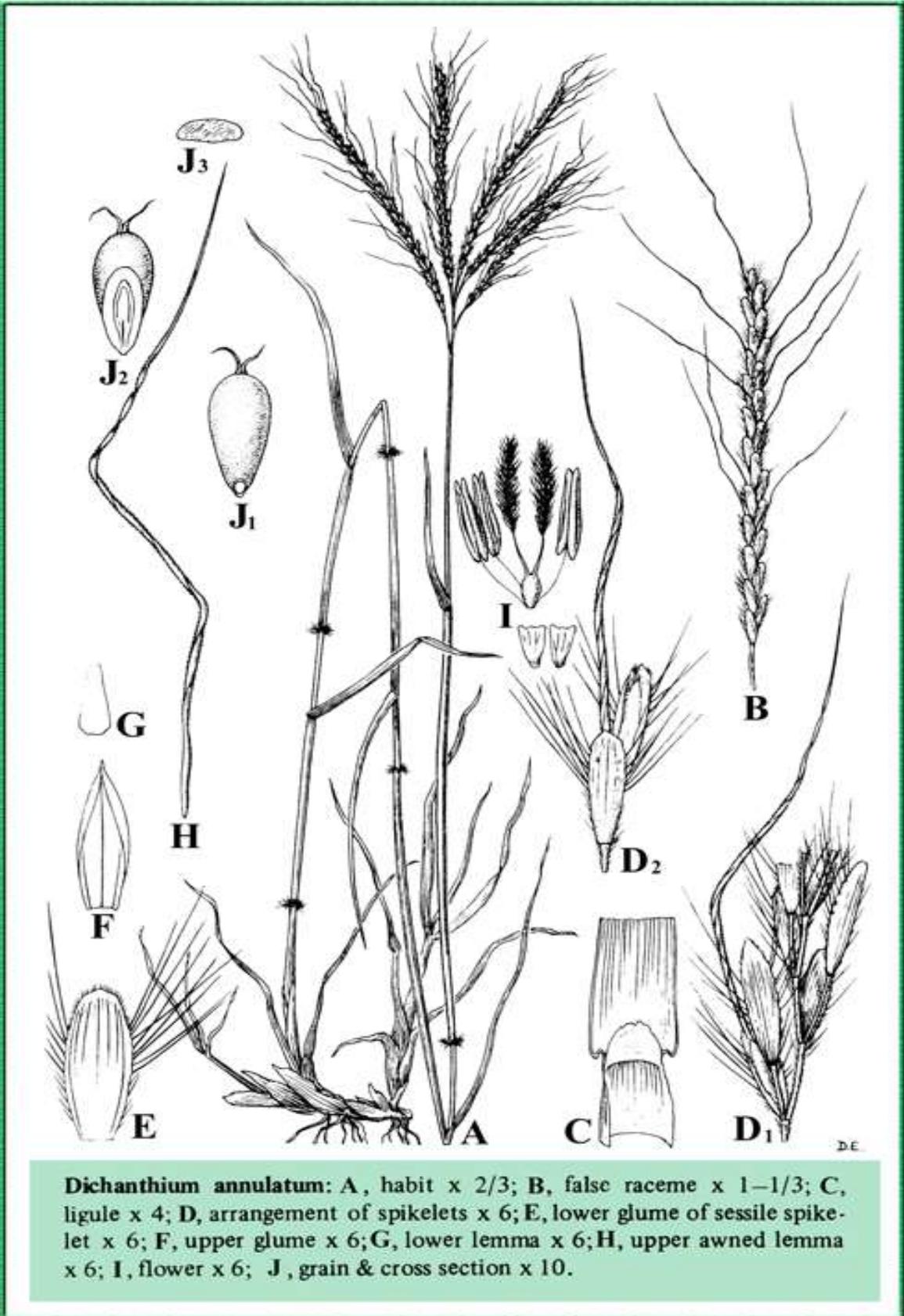
Even having low C.P. the species is considered as one of the best grass for forage and is utilized as hay as well as for grazing purpose. This is also good for soil conservation.

Compatibility:

Siratro or stylos are the appropriate legumes and may be maintained in 2:1 ratio i.e. two rows of grass and one row of legume. For this the legume should be sown first in prepared land at a distance of 1.5 m and grass seedlings may be transplanted after the germination of legume species.



Dichanthium annulatum



Dichanthium annulatum: A, habit x 2/3; B, false raceme x 1-1/3; C, ligule x 4; D, arrangement of spikelets x 6; E, lower glume of sessile spikelet x 6; F, upper glume x 6; G, lower lemma x 6; H, upper awned lemma x 6; I, flower x 6; J, grain & cross section x 10.

11. *Dichanthium caricosum*:

Common name:

badi kandi (H)

Description:

D. caricosum is a **perennial**, stoloniferous grass. Culms tufted at nodes of stolons, geniculately ascending, 30–60 cm tall, nodes glabrous or pubescent. Leaf sheaths compressed, keeled, shorter than internodes; leaf blades flat, 15–20 cm × 2.5–5 mm, glabrous or with a few hairs at base, margins smooth or scabrid, apex acuminate; ligule less than 1 mm, margin ciliate. Inflorescence terminal; peduncle glabrous; racemes (1–)2–4, 2.5–5 cm, with 1–3 pairs of homogamous spikelets. Sessile spikelet 3–3.5 mm; lower glume obovate-elliptic or obovate-oblong, papery, 8–12-veined, glabrous or often sparsely hirsute on lower back, slightly glossy, margins shortly ciliate, keels winged, apex rounded; upper glume ciliate above middle, apex obtuse; awn 1.5–2.5 cm, weakly geniculate. Caryopsis obovate-oblong. Pedicelled spikelet many-veined, resembling sessile.

Distribution:

D. caricosum is native to tropical Asia from India to China and Malaysia. It has been introduced across tropical areas and now it can be found widely naturalized elsewhere. *D. caricosum* is fire and drought tolerant, which are features helping this species to colonize and invade new areas.

D. caricosum grows in dry, sandy and moist habitats. It is common in dry zones, waste places, swampy places, open humid woodland, hill slopes, pastures, and along roadsides. It can be found growing at elevations from 600-1000 m. It is well adapted to moist habitats (i.e., 1500-2500 mm rainfall) with a moderate dry season of 5-6 months. It prefers full sunlight but will grow under moderate shade.

In PTR, it is found in all grasslands, prefers damp places.

Flowering and Fruiting:

July to December.

Soil:

Commonly found on heavier (black) clays of moderate fertility. Such soils are generally slightly acid to alkaline. *D. caricosum* is quite tolerant of water logging and is suited to the waterlogged black clays. It has been reported growing on sandy soils in southern India. This species has poor salt tolerance.

Means of Movement and Dispersal:

D. caricosum spreads by seeds and vegetatively by stolons. It can also be dispersed as a seed contaminant. It is intentionally spread by stolons to establish permanent pastures.

Uses:

D. caricosum is often planted for permanent pastures and erosion control. It is tolerant of heavy grazing and fire and it is cultivated to be used as animal forage and fodder. It is palatable and readily eaten by cattle, sheep, goats and horses.



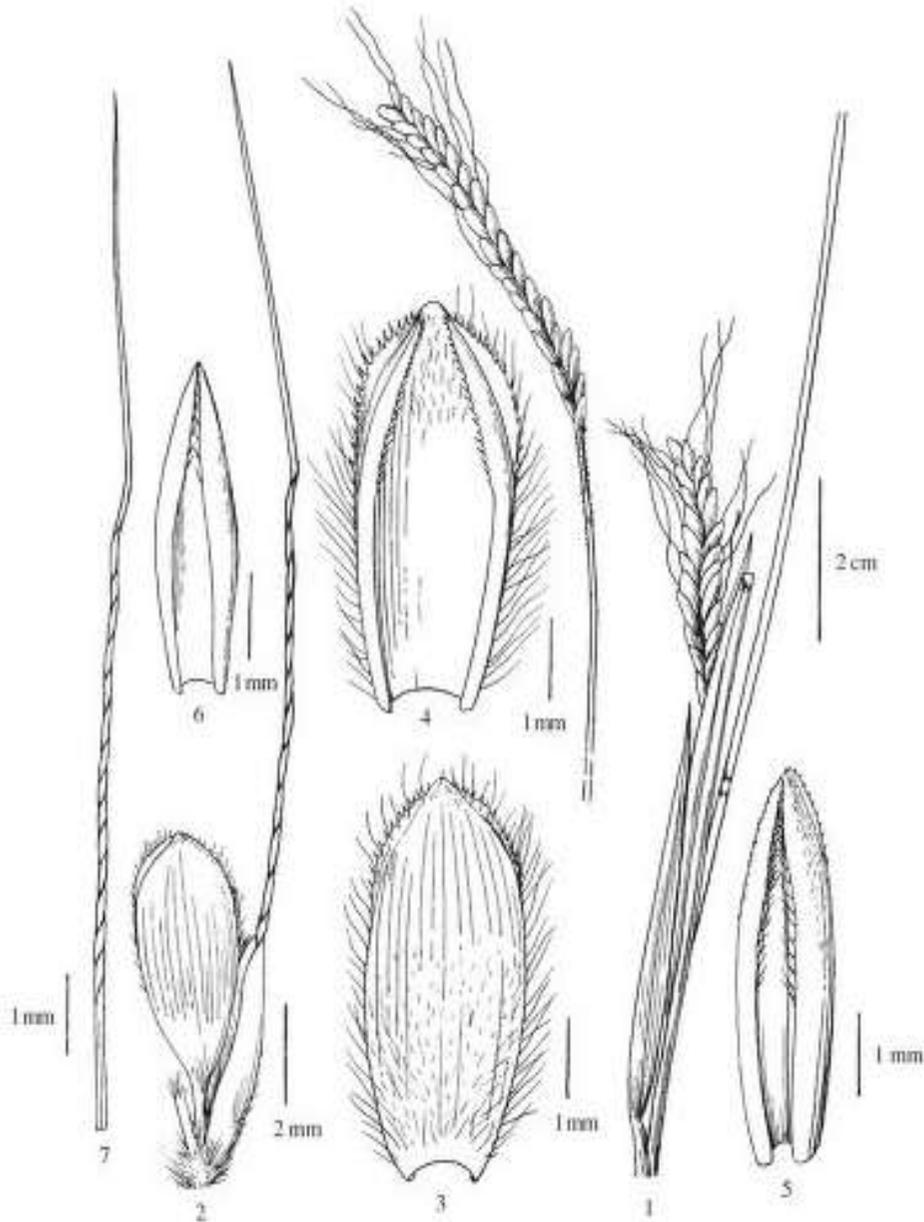


Figure 847. 1-7. *Dichanthium caricosum* (Linnaeus) A. Camus, 单穗草 dan sui cao. —1, Inflorescence. —2, Spikelet pair. —3, Abaxial view of lower glume of sessile spikelet. —4, Adaxial view of lower glume of sessile spikelet. —5, Upper glume of sessile spikelet. —6, Lower lemma of sessile spikelet. —7, Upper lemma of sessile spikelet. (FOC 605; FRPS 10(2): 138, 1997. —史渭清 Shi Weiqing; redrawn and modified by 李怡霏 Li Yifei from 耿

Dichanthium caricosum

12. *Digitaria decumbens* (synonyms – *Digitaria eriantha*)

Common names:

Pangloa grass, Digit grass (E)

There are about 200 species of *Digitaria*, all superficially similar with digitate or sub-digitate inflorescences. Some species are perennial, have distinct growth habits or have spikelets in groups of three rather than two. Otherwise annual species are mainly distinguished on the basis of the shape, lengths and hairiness of the glumes and lemmas.

Description:

Pangloa grass is of creeping habit. It is densely tufted, branched and stoloniferous **perennial** grass. It gives the roots from lower nodes. It grows to a height of 0.6-1.2 m. The spikelets are 2.5-3 mm long, glabrous. It does not produce viable seeds.

Distribution:

It is distributed in most part of country.

In PTR, it is found in all grasslands, prefers open places.

Flowering and Fruiting:

June to October.

Climate:

Humid climate with 7-26 °C average temperature and annual rainfall in excess to 1000 mm favours the grass for higher growth.

Soils:

It is adaptable to wide range of soils from extremely poor and shallow to heavy clays of low fertility.

Nutritive value:

Its analysis at floral stage revealed 11.8 per cent C.P., 30.2 per cent crude fibre and 9.2 per cent ash.

Utilization:

At young and vigorous stage it is most palatable and is used for hay, silage and grazing purposes but it is usually neglected in comparison to other grasses when it becomes old and stemmy. It is successfully grown for controlling the erosion through water and wind both.

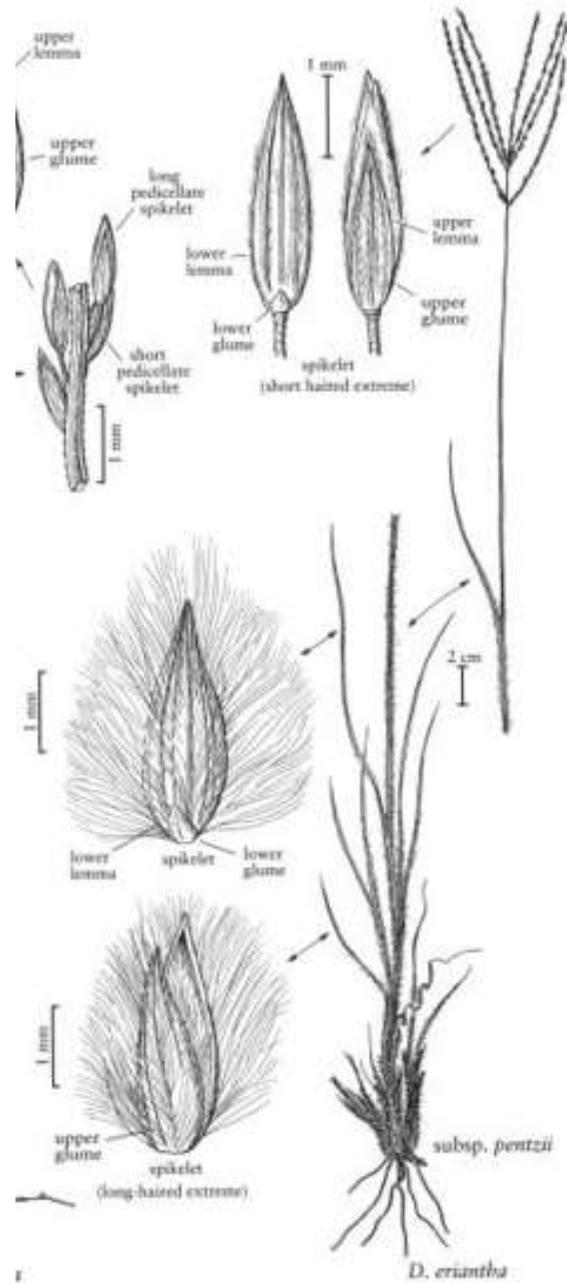
Cultural practices:

This species is mainly propagated vegetatively and establishes easily from stem pieces containing a few nodes. For its establishment, freshly mowed stem pieces with

nodes and stolons are spread over a well prepared field and then these are covered with a medium weight disc harrow. One meter distance is maintained from one piece to another. All this is done during rainy season when adequate moisture is available in soil. About 500 to 2000 kg planting materials is required for 1 hectare area.



***Digitaria decumbens* (synonyms – *Digitaria eriantha*)**



Digitaria decumbens (synonyms – *Digitaria eriantha*)

13. *Digitaria ciliaris*

Common names:

Crabgrass (E), Suruwari (H)

Description:

D.ciliaris is an **annual** grass, typically decumbent, rooting at the nodes and spreading to form untidy patches up to 1 m across and 50 cm high, although under crowded conditions it will grow more erect with culms up to 1 m high. The leaves are up to 25 cm long and 1 cm wide. Sheaths and lower parts of leaves loosely hairy on both surfaces. Grain 1.5-2 mm long.

Distribution:

It is distributed in most part of country, flourishing mainly in disturbed, open areas, with full sun or partial shade. As a C4 plant, it is favoured by full sunlight and growth is suppressed by shading.

In PTR, it is found sparsely in few grasslands, prefers open places.

Flowering and Fruiting:

June to October.

Climate:

15-40 °C average temperature and annual rainfall in excess to 500 mm favours the grass for higher growth.

Soils:

It is adaptable to wide range of soils from extremely poor and shallow to heavy clays of low fertility.

Utilization:

It is very good forage grass.



Digitaria ciliaris

14. *Echinochloa colona*

Common name:

Jungle rice, awnless branyard grass

Description:

Jungle rice is an **annual** grass 30-60 cm high. It is green to purple, tufted and shortly stoloniferous. Its culms are glabrous, cylindrical, erect and decumbent. Leaf linear 10-15 cm long, basal portion often tinged with red; ligule absent. Inflorescence simple, ascending racemes, green to purple about 5-15cm long; spikelets sub-sessile 1-3 mm long.

Distribution:

Habit *E.colona* a summer weed species, is considered native to tropical and subtropical India, Japan etc. but its origin still remains uncertain. It is annual grasses. low altitudes between 30N and 30S.

In PTR, it is found sparsely in few grasslands, prefers open places.

Flowering and Fruiting:

Throughout the year.

Climate:

E.colona thrives in the temporarily wet site in environments receiving 15-47 in. of precipitation. It requires high soil moisture to enable establishment. It is adapted to full sunlight or partial shady conditions.

Soils:

Suitable for light, medium and heavy soils and prefers well-drained soil. Suitable PH acid, neutral and basic soils. It prefers moist soil.

Nutritive value:

E. colona uses as a highly appetising forage that is relished by animals and is thought to be one of the best for aggresses. Nutritive value of Jungle rice: Calories 171g, total fat 1g, Cholesterol 0mg, Sodium 10mg, Carbohydrates 36g, Protein 3g, Iron 10% etc.

Biology and ecology

Echinochloa colona flowers throughout the year and is propagated by seeds. Seeds have a short dormancy period. It can be present in large numbers and responsive to nutrients. Prefers moist but un-flooded conditions and is a problem mainly in upland and rain-fed lowland rice fields rather than in flooded fields.

Utilization:

Often used in times of food shortage as a famine food. In Rajasthan in India the seeds are used as rice hence India barnyard millet a cultivated crop in India.



Echinochloa colona

15. *Enteropogon dolichostachyus*

Common name:

Bada Sikka (H)

Enteropogon has traditionally been separated from *Chloris* on the basis of inflorescence form. *Enteropogon* has a single raceme, whereas *Chloris* has several digitate racemes. Thus this species has frequently been placed in *Chloris*. However, this inflorescence character is unreliable for separating the two genera, and a better separation is achieved on the basis of lemma and caryopsis compression, in which case this species falls within *Enteropogon*.

Description:

Perennial. Culms erect or geniculately ascending, sometimes rooting at lower nodes, (0.5–)1–1.5(–2) m tall. Leaf sheaths glabrous or tuberculate-hispid, especially on margin, pilose at mouth; leaf blades linear, flat or rolled, 15–45 cm, 4–15 mm wide, scabrous, often tuberculate-hispid near ligule, apex setaceous; ligule ca. 0.4 mm. Racemes digitate, 3–10, ascending at first, later divaricate or drooping, 10–20 cm; rachis triquetrous, scabrous. Spikelets with 2 florets, 5–7 mm; lower glume linear-lanceolate, 2–3 mm; upper glume lanceolate, 3–5 mm, awn-pointed; lemma of fertile floret oblong-lanceolate, 3.5–5 mm, glabrous, scabrous along either side of mid-vein and toward apex; awn 8–16 mm;

Distribution:

River valleys, fields, banks, roadsides, and thicket on hills; 200–1000 m.

In PTR, it is found in the shady areas, under the trees. Sparsely spread in most of the area of the PTR

Flowering and Fruiting:

November-December.

Uses:

Good for forage. Turf grass for difficult to cover areas with moist, shady conditions. Also good in mixtures for meadows and pastures.



Enteropogon dolichostachyus

16. *Eragrostis pilosa*

Common name:

India lovegrass

Description:

Eragrostis is the largest genus in the subfamily Chloridoideae, with approximately 350 species. Members of *Eragrostis* are generally characterized by paniculate inflorescences, multi-floreted spikelets, glabrous three-nerved lemmas and ciliate ligules. The genus is considered monophyletic but is morphologically and anatomically diverse, and exhibits a wide range of variation in many characteristics. It uses C4 pathways in photosynthesis.

E. pilosa is an annual; caespitose. Culms erect, or geniculately ascending; 8–70 cm long. Ligule a fringe of hairs. Leaf-blades 2–20 cm long; 1–4 mm wide. Inflorescence a panicle. Panicle open; elliptic, or ovate; 4–25 cm long. Primary panicle branches whorled at lower nodes.

Distribution:

In PTR, it is found in the shady and moist valleys of hills. Found in limited area.

Flowering and Fruiting:

May to August.

Uses:

Good for forage. Turf grass for difficult to cover areas with moist, shady conditions. Also good in mixtures for meadows and pastures.



Eragrostis pilosa

17. *Heteropogon contortus*

Common names:

Spear grass, Tangle head (E), Lampa, Parwa, Kusul (H).

Description:

It is densely tufted, **perennial** and highly palatable, 0.9 to 1.0 m tall, erect or decumbent grass. It is leafy mainly at base. Leaves are firm, linear upto 60 cm long and 3.7 mm broad, often hairy with bulbous base. Racemes are terminal, erect, 4.8 cm long with prominent dark brown awns (3-12 cm long) which are jointly twisted together to form a bundle at maturity. Sessile spikelet 7 mm long, hidden by the pedicelled spikelets.

Distribution:

It is found all over the world in Tropics and subtropics. It is indigenous to India and occurs in all arid and semi-arid regions and upto an elevation of 2000 m from North Himalaya and in the grasslands of east to west and whole of the south. In drier areas it dominates even by suppressing other grasses especially on poor and rocky soil.

In PTR, it is spread throughout the Reserve, present in all grasslands. It is the dominant grass in poor soil areas of the Reserve.

Flowering and Fruiting:

October to December.

Climate:

It grows well in arid and semi-arid conditions in the rainfall zones ranging from 180 to 1200 mm.

Soils:

It is highly variable and adaptable to all types of soils ranging from pure gravelly sand to sandy loam.

Nutritive value:

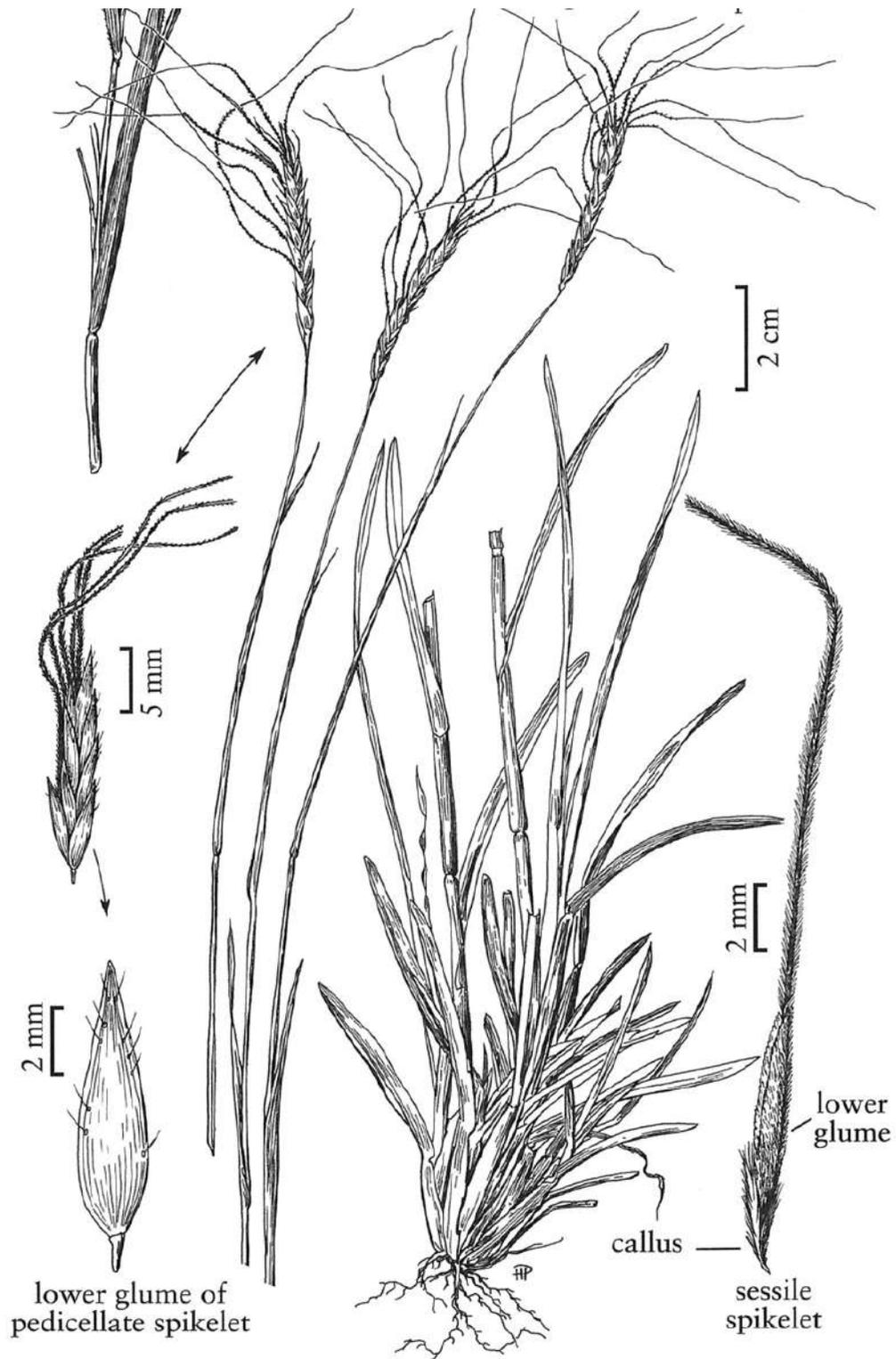
At early stage it is a highly nutritive grass and even 10 per cent C.P. is found in July which decreases regularly and only 3 per cent is found in December on dry weight basis. Ca and P content of the species are 1.14 and 0.19 per cent respectively.

Utilization:

It is very good forage grass but due to presence of sharp awns or spears at maturity it is grazed accordingly to its carrying capacity or may be cut at pre-flowering stage for hay or silage. It is also used in soil conservation programme. Light burning is beneficial to the species.



Heteropogon contortus



H. contortus

Heteropogon contortus

18. *Iseilema laxum*

Common names:

Musiyal, Machhauri (H).

Description:

It is short, erect to decumbent or some what spreading tufted **perennial** grass with stout short, creeping rootstock. Stems are slender branched upto 0.97 m high. Base diameter of tussock is about 7.5 cm. Leaf blade is linear, obtuse, glabrous, ciliate near the base, 5 to 15 cm long. Inflorescence is narrow long panicle with a group of spikelets seated on the panicles in a boat shaped bract.

Distribution:

Throughout tropical part in moist areas from sea level to 760 m elevation in M.P.,Maharashtra, Gujarat, Kerala, Tamil Nadu, A.P.and part of U.P.

In PTR, it is spread sparsely in the Reserve, found around Nalas, water bodies, in moist places.

Flowering and Fruiting:

October to January.

Climate:

It is found in the semi-arid regions of 450-1500 mm rainfall zones.

Soils:

It thrives best in black clayey soils and heavy loams, though it can grow on almost all types of soils in low lying areas, ditches, ponds along canals and river banks.

Cultural practices:

The land is to be prepared properly by ploughing it well and the seeds to be sown @ 5-6 kg/ha by broadcasting or in lines at 50 cm distance by mixing it with soil. Rooted slips are preferable over seedlings where seed is not available. Seed loses viability quickly after 12 months.

Nutritive value:

The grass is most nutritious and contains over 9.6 per cent C.P. at pre-flowering stage (July) which comes down to 5.2 per cent in September on dry weight basis.

Utilization:

The grass being nutritious is highly acceptable and palatable at all stages of its growth for grazing animals.



Iseilema laxum

19. *Panicum antidotale*

Common names:

Blue panic, Giant panic, Sudan grass, Gramna, (E), Bansi (H).

Description:

It is an erect deep rooted, thin stemmed, tufted **perennial** grass with smooth and solid culms. Leaves are 45 cm long. Inflorescence is panicoid panicle, terminal, loose and pyramidal. The whole plant gives a bluish appearance. It is profuse seeder and seed mature and shed easily in acropital manner. Seed count 1445000 per kg.

Distribution:

It was recognised first in Australia and then was brought to India. It is widely distributed in arid and semi-arid regions. It is generally found with xerophytic bushes like *Caparis decidua*, *Calligonum polygonoides*, *Ziziphus nummularia* and *Mimosa*.

In PTR, it is spread in drier and degraded areas. Not prominent in grasslands.

Flowering and Fruiting:

May to December.

Climate:

The grass is highly adapted and grows well in dry areas to low hills. The rainfall ranging from 100 to 1000 mm is quite favourable for its growth.

Soils:

All soils from light sandy to heavy clay as well as saline soils are quite suitable.

Cultural practices:

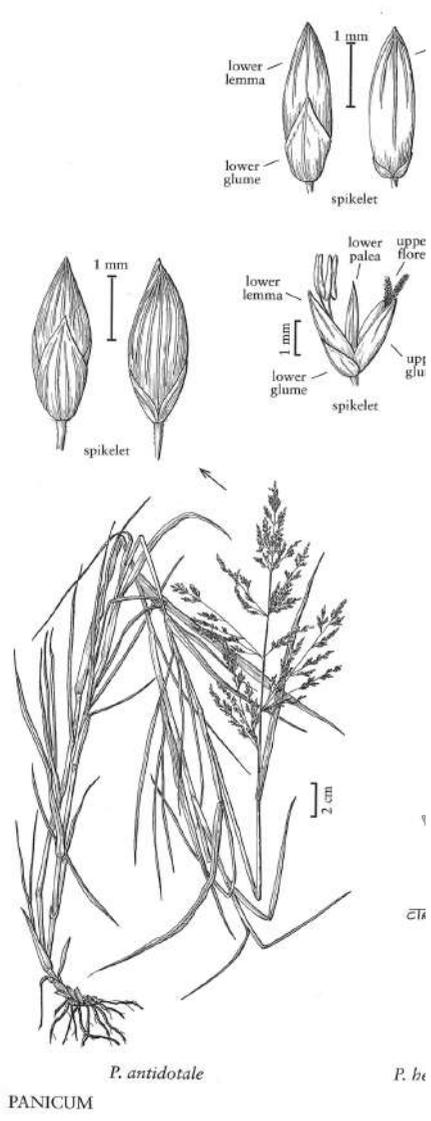
Like other grasses, its pasture can be established easily by line sowing of seeds at 50 cm apart on well prepared land at the onset of monsoon. The seed rate is 6-7 kg/ha.

Nutritive value:

The C.P. is quite high (7.3 per cent) with low P (0.09 per cent) and Ca (0.39 per cent).

Utilization:

The grass being nutritious is highly acceptable and palatable at all stages of its growth for grazing animals. This is also used for hay.



Panicum antidotale

20. *Pennisetum pedicellatum*:

Common names:

Kaysuwa (E), Dinanath ghas (H).

Description:

It is an erect, **annual** grass of 0.7-0.9 m height. Culm is bright with light reddish at base. Leaves are 45-60 cm long and light to dark green in colour. Inflorescence is pink in beginning but becomes white at maturity. It is a heavy seed producer.

Distribution:

It is distributed in M.P., Bihar, West Bengal, Haryana, Punjab and U.P.

In PTR, it is spread in limited areas. Found in Bhadar, Pipertola and Badgadi grasslands in limited area.

Flowering and Fruiting:

September to December.

Climate:

It prefers warm climate and is found in regions of rainfall ranging from 800 to 1250 mm.

Soils:

It grows well on medium textured light soil and can grow on poor soils by giving sufficient fertilizer.

Cultural practices:

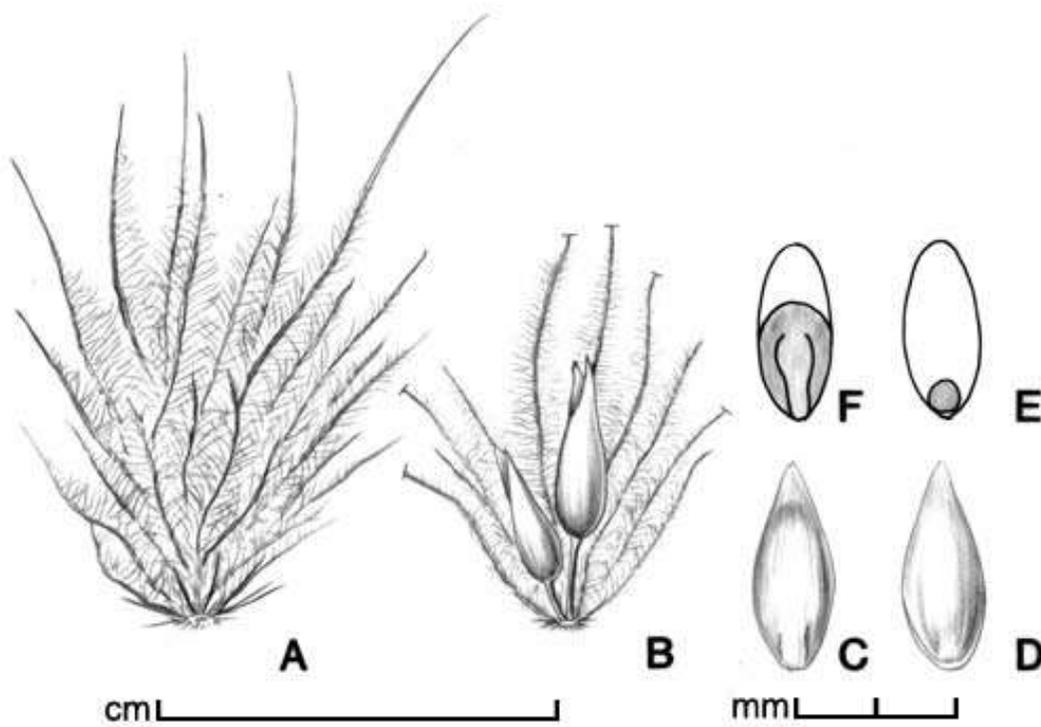
At the onset of monsoon the sowing should be completed either in line or broadcasting using 4-5 kg seeds for one hectare area. Before sowing the soil should be mixed with seed. The pasture may be established by transplanting six weeks old seedlings at 50 cm distance from row to row and same for plant to plant. Thus 33000 seedlings are needed for one hectare, planting 2 seedlings per hull.

Nutritive value:

It contains 7.4 per cent CP, 0.42 per cent Ca and 0.21 per cent P.

Utilization:

It is used as fodder crop and is relished by all kind of livestock for grazing.



A, fascicle of bristles enclosing spikelet(s); B, cluster of two spikelets in fascicle (some bristles removed); C–D, floret in two views; E, caryopsis in ventral view; F, caryopsis in dorsal view; drawing by Lynda E. Chandler

Pennisetum pedicellatum

21. *Sehima nervosum*

Common names:

Rat's tail grass, white grass (E), Sain, Poona and Suekai (H).

Description:

It is a **perennial** grass forming dense tufts with numerous tillers, upto 1 m and above in height. Stems/culms are erect, hollow, slender, pale straw yellowish and bright on ripening. It has abundant and soft foliage. Leaves are 15-40 cm long, 0.8 to 1.5 cm wide with linear leaf blade. Racemes are solitary 7.5 to 15.0 cm long and erect or slightly flexed. Both sessile and pedicelled spikelets are awned. The awns are slender and twisted at base.

Distribution:

It is distributed in undulating areas of M.P.

In PTR, it is found in sandy areas specially near the river beds of Ken river. Spread in not very much.

Flowering and Fruiting:

October to December.

Climate:

It prefers hot and dry climate in the rainfall zones of 250 to 1500 mm with an optimum upto 1000 mm.

Soils:

Eroded, red gravelly/stony to medium sandy loamy soils are common of its availability. It is also seen on rock crevices of undulating topography and on hill slopes. The soil pH of its habitats is 6.5.

Cultural practices:

In a well prepared land the pasture is established either by seed sowing @6-7 kg/ha in lines at 50 cm apart broadcasting or transplanting of seedlings/rooted slips at the onset of monsoon. Among these, transplanting of seedlings is more successful and for this about 1.33 lakhs seedlings are required for 1 hectare.

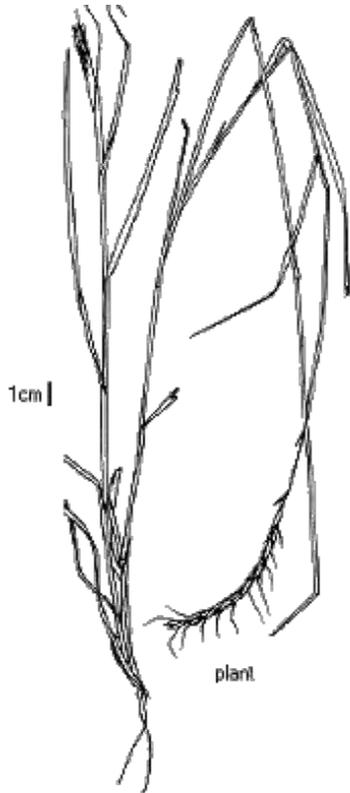
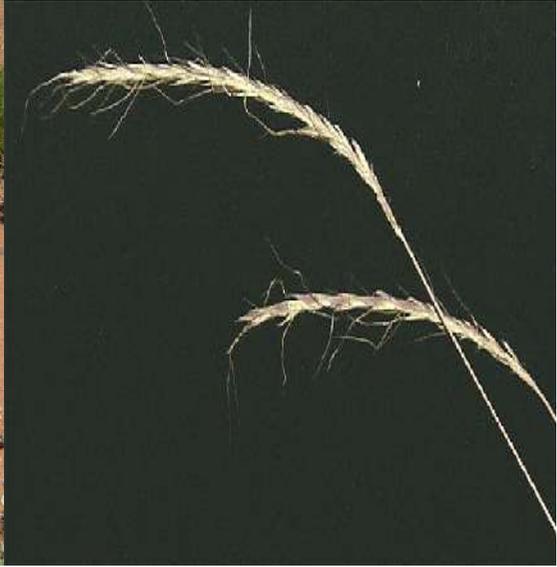
Seed yield:

Under well managed condition this grass produced about 110 kg seed/ha.

Nutritive value:

It contains maximum CP(6.9%) in July and minimum (2.3%) in December. The calcium contents of the grass is highest (0.68%) among other forage grasses. The phosphorus content of the species ranged from 0.05 to 0.18 per cent.

Utilization: It is a good forage grass and may be utilized for grazing as well as for hay too.



Sehima nervosum
(S.T.Blake 8731, BRI)

Sehima nervosum

22. *Setaria sphacelata*

Common names:

Setaria, Golden timothy, Golden bristle grass (E) and Nandi (H).

Description:

It is an erect, bunchy **perennial** grass growing to a height of 1.2 to 1.5 m with flattened culms. Leaf blades are flat, 30-45 cm long, 6-10 mm wide, linear and lanceolate. Inflorescence is terminal, compressed panicle about 15 cm long, appearing as a dense cylindrical spike and orange to purple in colour. Seeds count 1.4 to 1.7 million.

Origin and distribution:

The name of this grass 'Setaria' is derived from Latin 'Seta' the meaning of this is numerous bristles on the inflorescence. It is native to tropical Africa and was introduced in India in 1950.

In PTR, it is present sparsely in Grasslands. Spread in not very much.

Flowering and Fruiting:

August to December

Climate:

This is a grass of warm climate and is found in the rainfall zone of 1500 mm in plains.

Soils:

It thrives well on fertile loamy soils and comes even on light soils (sandy-loam).

Cultural practices:

It can be established by planting seedlings/rooted slips in furrows of 50 cm apart and 30 or 50 cm distance from plant to plant at the onset of monsoon. In case of establishment by seed, seed rate is 1.5 kg/ha for mixed pasture.

Seed yield:

112 kg seeds/ ha.

Nutritive value:

The grass is very leafy and quite palatable and highly nutritive. It contains 5.3 per cent CP.

Utilization:

The grass can be used for soiling, hay or grazing particularly due to its good winter growth which ensures its sustained forage supply round the year, especially if legumes such as stylos and siratro are present.



Setaria sphacelata



***Setaria sphacelata* :**
 1, habit; 2, ventral view of spikelet with bristles; 3, lower glume; 4, upper glume; 5, lower lemma; 6, lower palea; 7, dorsal view of upper fertile floret; 8, joint of leaf sheath and leaf blade.

23. *Themeda quadrivalvis*

Common name:

Gunher (H), Bhond

Taxonomy and Nomenclature:

The genus *Themeda* comprises 18-27 species, all of which are native to tropical and subtropical regions of primarily South East Asia. *Themeda* species are annual grass, drought tolerant and exhibit considerable ecological and morphological diversity. Within this genus, two sections are recognized based on the characters of the raceme: section *Primothemeda* with homogamous spikelet pairs arranged at different levels and section *Themeda* with homogamous spikelet pairs arranged at the same level in the raceme base.

Description:

T. quadrivalvis is an **annual** grass, though in tropical areas it may grow as a short-lived perennial. Growth is rapid under favourable conditions and plants may reach a height of 2 m within 6-8 weeks. Flowering begins 5 to 6 weeks after germination and ripe seeds are present at 10 weeks. It flowers from October to January. It is a prolific seeder, producing ca 633,000 seeds/kg. Seed may remain viable for at least five years.

Culms moderately robust, erect or geniculate at base. Leaf sheaths glabrous or with tubercle-based bristles at mouth; leaf blades flat or folded, up to 30 x 0.3-0.9 cm, glabrous, abruptly acute to acuminate; ligule 3 mm. Compound panicle large, dense; spathes and spatheoles lanceolate-caudate, glabrous, innermost 1.3-1.7 cm. Raceme composed of a triad of 1 sessile and 2 pedicelled spikelets above the involucre of 2 homogamous pairs. Homogamous spikelets all sessile, arising at same level, barren, both glumes present, 4.5-6 mm, lanceolate, stiffly setose in upper half with 3-4 mm, tubercle-based bristles. Sessile spikelet 4-4.5 mm; callus 0.8-1 mm, subacute, brown bearded; lower glume dorsally rounded, dark brown at maturity, pubescent, often thinly or glabrous on lower back; awn 3.5-4 cm. Pedicelled spikelet 4-6 mm, barren.

Distribution:

T. quadrivalvis is native to the Indian subcontinent. Habitat includes grasslands, coastal thickets, grassy woodlands, riverine areas, dry slopes, wastelands, roadsides and disturbed. It also grows as a weed on agricultural land. It is able to grow in a wide range of moisture regimens at low to medium elevations. It prefers areas receiving between 500 and 1250 mm of rainfall annually, but it can persist in areas receiving as little as 375 mm or more than 3500 mm.

In PTR, it is present throughout the Reserve, in all grasslands, as dominant grass.

Flowering and Fruiting:

October to January.

Soil:

It is also adapted to a wide range of soil types including sandy loam soil, clay loams, and lateritic soils with pH in the range 7.0-8.5. Burning encourages seed germination.

Means of Movement and Dispersal:

T. quadrivalvis spreads by seed. Seeds are transported over long distances by both humans and animals as they adhere to fur or clothing.

Environmental Impact:

T. quadrivalvis can significantly reduce the biodiversity of native grasslands, savannas, woodlands, coastal forests and rangelands, particularly in areas that are overgrazed or disturbed. It is a fast-growing grass that replaces native plants and forms tall, dense thickets that can cover large tracts of land. These dense thickets exclude almost all other species by preventing seedling establishment. It also alters the fire regime due to its greater biomass and hence its higher fuel load.

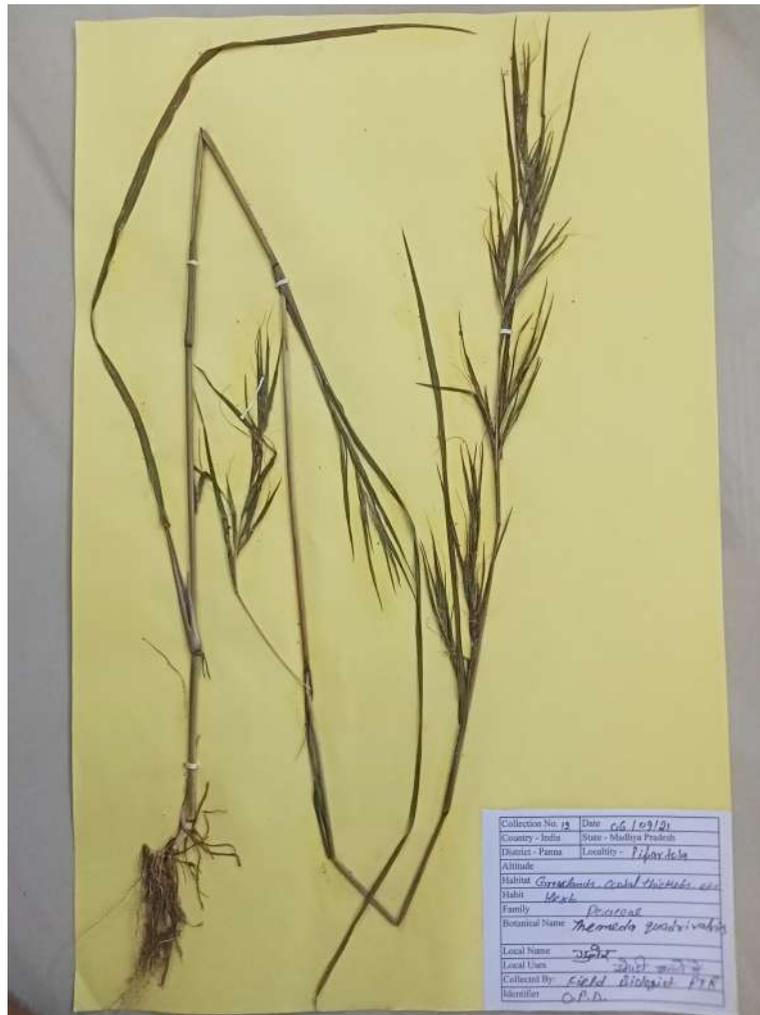
Uses:

It is palatable in early stages of its growth.

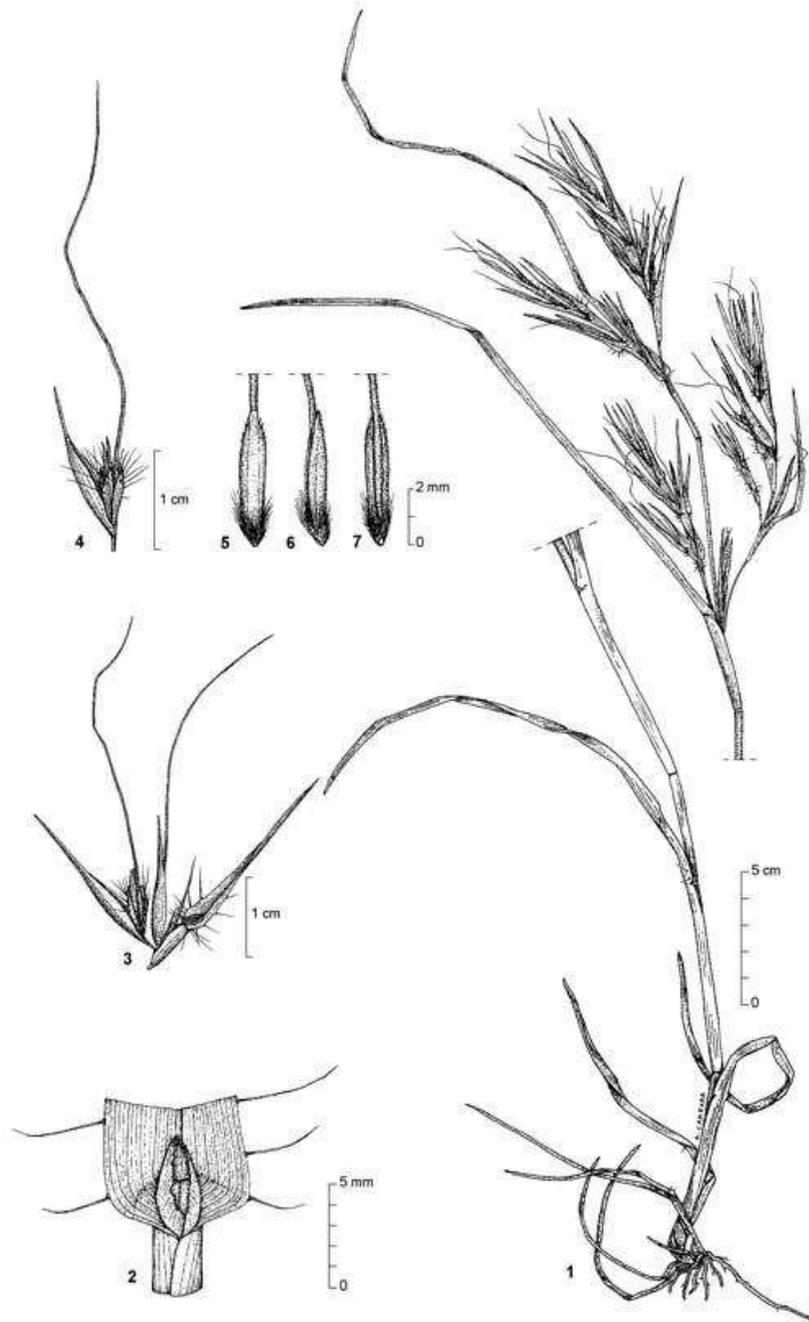
Similarities to Other Species/Conditions:

T. quadrivalvis appears similar to other *Themeda* species such as: *T. triandra*, *T. avenacea* and *T. arguens*. These species can be distinguished by the following morphological and ecological traits:

- *T. quadrivalvis* is a moderately-sized to relatively large short-lived (annual) grass growing up to 2 m tall. Its individual flower spikelets are relatively small (4-7 mm long), stiffly hairy (i.e. setose) in the upper half, and its seeds are topped with a relatively fine awn (10-45 mm long).
- *T. triandra* is a moderately-sized long-lived (perennial) grass usually growing less than 1 m tall. Its individual flower spikelets are moderately-sized (6-14 mm long), hairless (i.e. glabrous) or slightly hairy (i.e. hispid), and its seeds are topped with a relatively large awn (25-70 mm long).
- *T. avenacea* is a large long-lived (perennial) grass often growing up to 2 m tall. Its individual flower spikelets are very large (13-30 mm long), densely hairy (i.e. villous), and its seeds are topped with a large and robust awn (40-100 mm long).
- *T. arguens* is a large short-lived (annual) grass growing up to 3 m tall. Its individual flower spikelets are moderately-sized (6-11 mm long), softly hairy (i.e. pubescent), and topped with a large and robust awn (50-90 mm long).



Themeda quadrivalvis



Themeda quadrivalvis

II.

UN-PALATABLE GRASSES

1. *Aristida setacea*

Common name:

Broom grass , Kata Jhadu , Khadda

Aristida is a very nearly cosmopolitan genus of plants in the grass family. *Aristida* is distinguished by having three awns (bristles) on each lemma of each floret. The genus includes about 300 species found worldwide, often in arid warm regions. This genus is among those colloquially called **three-awns wire grasses**, **spear grasses** and **needle grasses**. The name *Aristida* is derived from the Latin "arista", meaning "awn" They are characteristic of semi-arid grassland.

Morphology:

General Habit

Perennial; caespitose. Butt sheaths coriaceous; yellow; glossy. Culms erect; 50-120 cm long. Leaf-sheaths glabrous on surface. Ligule a fringe of hairs. Leaf-blades filiform; flat, or convolute; 20-40 cm long; 2-2.5 mm wide. Leaf-blade surface scabrous; rough adaxially.

Reproductive / Inflorescences

Inflorescence a panicle. Panicle contracted; linear, or lanceolate; 15-40 cm long. Spikelets solitary. Fertile spikelets pedicelled.

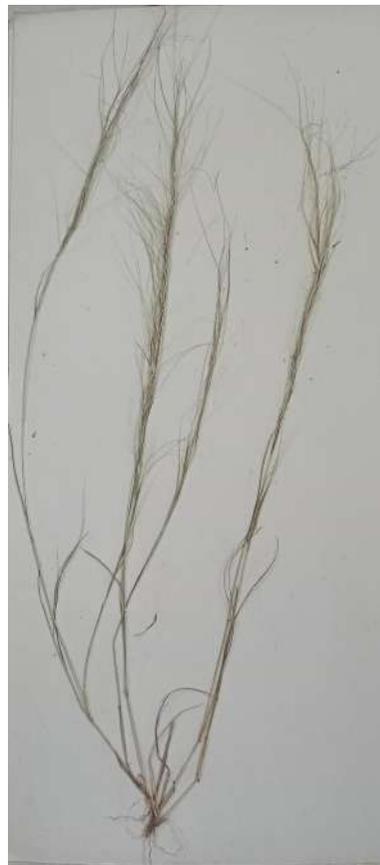
Distribution:

Arid and Semi arid regions of India.

In PTR, it is present throughout the Reserve, in sandy areas. Prefers open places.

Flowering and Fruiting:

Throughout the year.



Aristida setacea

2. *Aristida adscensionis*

Common name:

Common Needle grass (E), Lappa (H)

Description:

A. adscensionis is **annual** or some times considered to be short lived **perennial** grass, forming erect or sprawling clusters 10-100 cm tall. Leaf-blades are linear, up to 20 cm long and 3 mm wide, expanded or folded. Panicle are up to 30 cm long, occasionally lax, usually contracted about the main branches, sometimes narrow and dense. Spikelets are pallid, green or purple; glumes unequal, linear - lance shaped to lance shaped, prominently shorter.

Distribution:

Arid and Semi arid regions of India.

In PTR, it is present throughout the Reserve, in sandy areas. Prefers open places.

Flowering and Fruiting:

March to December.



Aristida adscensionis

3. *Arthaxon hispidus*

Common name:

Basin (H)

Description:

A.hispidus is some times considered to be **perennial**, but it is more commonly described as annual. It is a sprawling plant, rooting at the nodes with flowering stems up to 30 cm high; nodes hairy. Leaves are relatively short and board narrowly obovate up to 5 cm long and 15 mm wide, auricled at the base and acutely tipped, variably glabrous or hairy on the margins.

Distribution:

A.hispidus is native to India, M.P.

In PTR, it is present throughout the Reserve, sparsely distributed, in the shade of trees. Prefers moist and shade areas.

Flowering and Fruiting:

September to March.

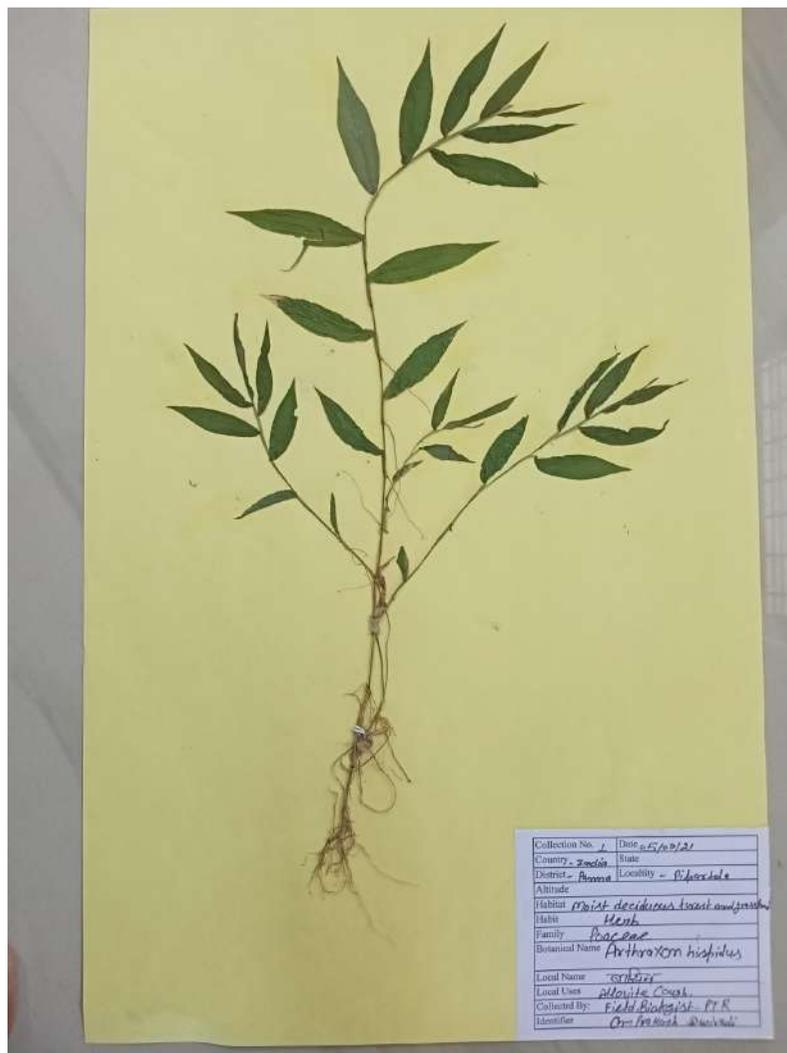
Climate:

A.hispidus is apparently favoured by relatively moist conditions and full or at least partial sunlight.

Soil:

It prefers light to medium textured soil. *A.hispidus* does not tolerate acidic soils.





Arthaxon hispidus

4. *Arundinella setosa*

Common name:

Reed grass

Description:

Annuals; culms tufted, 20-40 cm high; nodes glabrous. Leaves 3-10 x 0.5 cm, lanceolate; rounded at base, densely hairy; sheath rounded, hairy; ligule a fimbriate membrane. Panicle 5-20 cm long; effuse, branches scabrid. Spikelets 6 x 2 mm, glabrous; lower glume 5 x 1.5 mm; upper glume 6 x 1.5 mm, ovate, acuminate; first lemma 3 x 1 mm, ovate, acute; second lemma elliptic, 2 x 1 mm, with arista on either sides of the awn; awn 8 mm long; palea 2 x 1 mm, 2-keeled; anthers 1.5 mm long.

Distribution:

In PTR, it is found in sparsely distributed. It is present in the grassland on the margins.

Flowering and fruiting:

May-December

Habitat:

Dry deciduous forests and grasslands.



Arundinella setosa

4. *Chrysopogon zizanioides* (*Vetiveria zizanioides*)

Common names:

Vetiver grass (E), Ganrar, Urai, Khas (H).

Description:

It is an erect **perennial**, densely tufted, awnless grass. It has no rhizome or stolons. The vetiver grass has deep and intensive spongy aromatic roots, which form a mat in sub surface strata of the habitat. The culms are stout, smooth and attain upto 2.0 m height. Basal diameter is about 6 to 15 cm with tillers ranging from 6 to 30. Leaves are stiff, 30 to 75 cm long, 8 mm wide and green in colour. Inflorescence is conical panicle, 15-40 cm long, glabrous and often reddish brown or purple in colour. Spikelets are narrow, acute, appressed and awnless. One spikelet is sessile, hermaphrodite with short sharp spines and the other spikelet is pedicelled and staminate. Its seed producing ability is poor as well as seed germination percentage is also very low (10 to 15%) but de-husked seeds give about 50 per cent germination. It is a 'shy seeder' and is considered sterile outside its natural habitat.

Distribution:

The grass is native of tropical and sub-tropical areas. It is found near water bodies whether seasonal or perennial.

In PTR, it is present along the Ken river and all the major Nalas.

Flowering and fruiting:

July - December

Climate:

It is a plant of semi-arid climate and is found growing in the areas having annual rainfall from 500-5000 mm. It can withstand extreme drought and ill drained (waterlogged) situations.

Soils:

It thrives well in sandy loam to clayey soils with a pH range of 4 to 7.5. It may grow even on neutral to slightly alkaline soils too.

Utilization:

The grass is not considered as a valuable fodder but it could be utilized/grazed in young stage. In drought conditions this grass is utilized for foraging purposes. However, after flowering it becomes coarse, fibrous and unpalatable. Moreover the presence of Vetiver oil in the plant makes it somewhat distasteful to grazing animals and rodents. It provides a seeping terrace, which slows the rate of run off, ponds water temporarily which in turn settles out most of the sediments. Therefore this grass may be very useful for soil conservation purposes. Besides the usefulness of its roots as Khus-khus tatties, the spikes of the plants are used for making brushes.



Chrysopogon zizanioides

5. *Cenchrus ciliaris*

Common Name:

Buffel grass (E)

Description:

C. ciliaris is a fast-growing, shortly stoloniferous **perennial** that can flower in its first year of growth. Individual plants develop as clumps usually with only limited lateral spread, but a clump may eventually grow to >1 m in diameter. Morphology (especially size) is highly variable depending on the genotype and the environment. Height of flowering culms may range from 15 cm to ~1.5 m. The width of the blades typically varies from 0.5-1.5 cm.

Inflorescences are bristly, typically from 3-15 cm long and 1-2 cm wide, and can range in colour from tan to purple-tinged. spikelets are 3-6 mm long with 2 florets, in clusters of 2-4, each surrounded by an involucre of feather-like bristles joined at the base, up to 15 mm long. Cariopses are ovoid, 1.5-2 mm long.

Seed production is generally high, with most fascicles (detachable dispersal units) containing 1-2 viable, apomictic seeds.

Distribution:

C. ciliaris grows in a variety of arid and semi-arid habitats, in particular those subject to disturbance.

In PTR, it is sparsely distributed in grasslands under the shade of *Zizyphus* trees.

Flowering and fruiting:

July - January

Rainfall:

Mean annual rainfall range between 400 mm to 1200 mm.

Uses:

Not completely un-palatable but is grazed in stress period when availability of other palatable grasses is low.



Cenchrus ciliaris

6. *Desmostachya bipinnata*

Common name: Kush (H)

D. bipinnata grows commonly and abundantly in fallow land, along roadsides and on boundaries and bunds of agricultural fields on dry and sandy soils; it often forms dense tufts producing a dominating patch of plants. It is one of the hardiest and most aggressive weeds in native land growing either with the native grasses or on the margins. It is very difficult to manage or eradicate established populations because of the extensive and deep rhizomatous root system.

Description:

It is a tall tufted, **perennial** rhizomatous grass, branching from the base, with stout, robust rhizomes, covered with shiny sheaths. Culms are rigid and herbaceous having glabrous nodes, covered at the base by leathery yellowish sheaths; varying in height from 30 to 150 cm. The stems are much branched, tufted and profusely rooted, and it branches from the rootstock, sending out rhizomes in all directions. The leaves are linear to linear-lanceolate, non-auriculate, acuminate and scarbid on the margins, without cross venation and persistent. The leaf sheaths are glabrous, leaf blades flat or inrolled, tough, long acuminate. The inflorescence is an erect, spike-like panicle having 101-185 spikes per panicle.

It has coarse leaves and very sharp tillers cause small painful cuts when in contact with the skin.

Distribution:

It is widely distributed in arid and semi-arid regions of India having an annual rainfall of 250-750 mm. It is, however, very drought tolerant and known to survive where annual rainfall may be as low as 54 mm, and will also be found in higher rainfall zones, above 1000 mm. It is very tolerant of saline soils, alkaline and calcareous soils and highly sodic soils. On alluvial saline soils with restricted water penetration, *D. bipinnata* constitutes the dominant weed, which occurs in dense patches. It frequently grows in dry places and open wastelands subject to periodic disturbance such as cutting, grazing and burning. In dry and hot conditions, *D. bipinnata* flourishes well, forming big tussocks in dry-sandy areas.

In PTR, it is present in Sankara grasslands and in few places along the Ken river.

Flowering and fruiting:

Flowering and fruiting occurs from May to July, maturing from August to October.

Physiology and Phenology:

On moderately alkaline calcareous soils, the monsoon rains trigger active growth of *D. bipinnata* in June and plant biomass attains a peak during the rainy season in

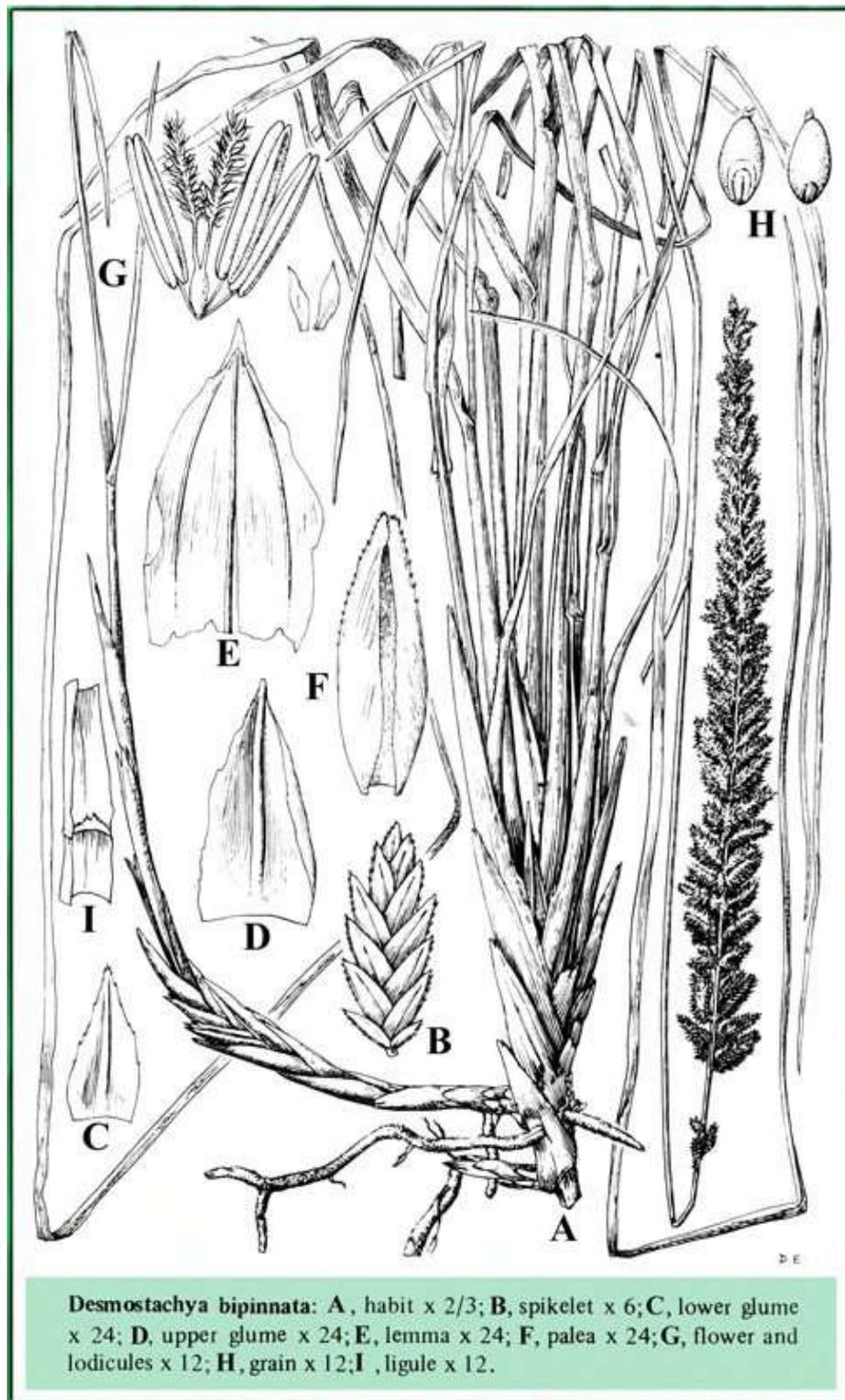
September. The leaves senesce with the onset of dry weather during winter months from November to February followed by a spurt of growth in summer months due to regeneration of shoots from the perennial rhizomes. Being a deep-rooted grass, 52-55% of the root biomass remains concentrated in the top 10 cm of the soil, whereas the rhizomes and roots penetrate deeper than 1.5 m.

Uses:

This grass branches from the rootstock, sending out rhizomes in all directions and making it an excellent sand binder. It is used for fibre, the culms used for thatching and making rough rope and brooms. Young shoots have a crude protein content of 6.75% and are a good fodder in arid zones. Medicinally, it is diuretic, used to treat urogenital disorders and dysentery as well as being a mild stimulant. *D. bipinnata* has been mentioned as an important medicinal plant in the Atri-samhita associated with mythological significance in India, as well as being used in rituals and Hindu ceremonies.



Desmostachya bipinnata



Desmostachya bipinnata

7. *Eleusine Indica*

Common name:

Crow foot grass;

Description:

E. indica is a tufted **annual** grass, prostrate and spreading, or erect to about 40cm, depending on density of vegetation but not usually rooting at the nodes. The root system is very well developed and strong and the name jongs grass, it on germination, the first leaf, about 1cm long tapers very suddenly to a point and may be pressed quite flat on the soil. The inflorescence consists of 3-8 racemes, each 5-10 cm long, about 5 mm wide, arranged more or less digitately, though one raceme may be inserted about 1 cm below the others.

Distribution:

It is considered native to India and spread throughout M.P. It occurs up to 2000 m altitude in the tropics.

In PTR, it is well distributed in open areas of the Reserve.

Flowering and fruiting:

July - January

Climate:

Mean annual temperature lower limit 15 /upper limit 30 °C minimum temperature of coldest month 7 °C. Rainfall 200-2000 mm favours the grass for higher growth .

Utilization:

E. indica is used as an antipyretic agent for all the herbivorous species of animals.



Eleusine Indica

8. *Eragrostiella bifaria*

Common name:

Double-Row lover grass

Description:

Double-row lover grass is a densely clustered **perennial** grass with clumps 30-80 cm high, nodes hairless. Leaves are many $15-30 \times 0.2 - 0.5\text{cm}$, linear mostly basal, sheath rounded, hairless, ligule a narrow membrane. Flowers are borne in solitary raceme, 20-30mm long. Spikelets are $20 \times 2-3$ mm, linear-oblong, arranged in two rows, glumes nearly equal, ovate, pointed, 1-nerved upper large, florets 20-40, all bisexual; lemmas 2×2 mm, broadly ovate, 3-nerved; palea 2×1 mm, obovate 2 keeled, hyaline; stamens 3, anthers 1 mm long; ovary elliptic, styles 2, free; stigmas plumose.

Distribution:

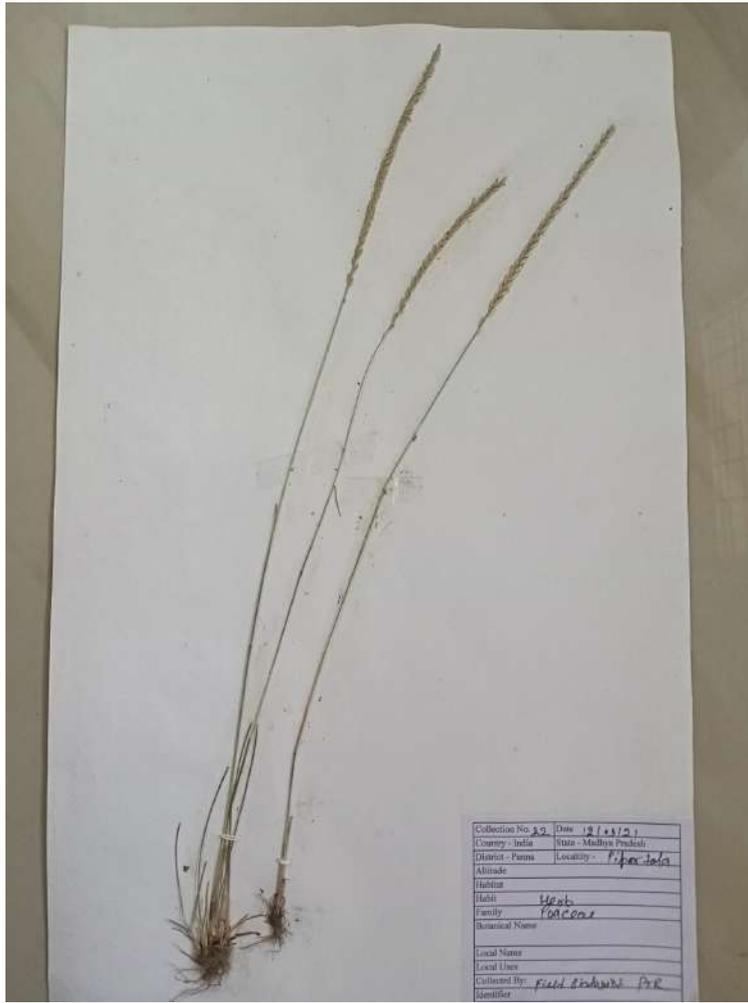
Tropical India. Spread in Madhya Pradesh.

In Panna TR, it is found sparsely distributed in Grasslands, sandy areas near streams and rocky hills.

Flowering and fruiting:

August to January





Eragrostiella bifaria

9. *Eragrostis tenella*

Common name:

Bhurbhusi (H)

Diagnostic characters:

E. tenella is a small densely tufted **annual** grass, with variable size, usually not more than 50 cm high. Clums glabrous, spindly, the nodes at the base, may be ramified or not. Leaves up to 10cm long. Inflorescence usually with many slender spreading branches.

Biology:

E. tenella is a prolific seed producer. One plant produces 140000 seeds. It is a very competitive species, with a rapid growth rate and fast production of erect tillers and leaves.

Ecology and distribution:

It occurs in grasslands, waste land and road-side. It thrives on both permeable and impermeable soils, and is often found in compacted and stony areas. *E. tenella* is native of tropical Areas.

In Panna TR, it is found sparsely distributed along the roads, pathways in Grasslands, sandy areas near streams and rocky hills.

Flowering and fruiting:

March to September



Eragrostis tenella

10. *Eulaliopsis binata*

Common names:

Sabai grass (E), Bhabar, Baib, Babui (H).

Description:

A tufted **perennial** grass, 0.5-1.5 m high with erect slender culms, shiny and woody at the base. Leaves are narrow, linear, 30-40 cm long. Inflorescence of 2-4 racemes, 3-6 cm long on piliform peduncles. Seed black, exceedingly minute and light. The grass flowers during cold weather and seeds are collected during last week of December or 1st week of January.

Distribution:

It is distributed throughout India.

Though found in some areas along Ken river but not very common in PTR.

Flowering and fruiting:

November to January.

Climate:

It is hardy to frost and drought and requires 750-1500 mm annual rainfall. It prefers hot and dry climate.

Soils:

It thrives best on well drained sandy loams and can grow even on poor soils not subjected to water logging.

Nutritive value:

It contains 2-3 per cent C.P., 32.1 per cent crude fibre and 6.4 per cent total ash.

Utilization:

Being less palatable, it is not used as forage. It is useful for controlling soil erosion.



Eulaliopsis binata

11. *Imperata cylindrica*

Common name:

Chhir (H) ,Blady grass

I. cylindrica is a serious weed in natural areas, causing serious economic and environmental damage. The ability of *I. cylindrica* to effectively compete for water and nutrients, spread and persist through the production of seeds and rhizomes that can survive a wide range of environmental conditions, and its allelopathic effects and pyrogenic nature, allow it to exclude native plant species and other desirable plants and dominate large areas of land.

Description:

I. cylindrica is a **perennial** grass which varies in height (30-150 cm). The culms (above-ground stems) are short, erect and arise from rhizomes (underground stems). The rhizomes are tough, white, commonly 1 m long but can be considerably more, are extensively branched and covered with papery scale leaves at the nodes. Roots are fibrous, emerging from the base of the culm and the nodes on the rhizome. Leaves are stiff, linear-lanceolate, up to 120 cm long and 4-18 mm wide, with a prominent, off-centre, whitish midrib, scabrid margin and pointed tip. The ligule is an inconspicuous membrane. The inflorescence is a white, spike-like panicle, terminal, fluffy, 5-20 cm long and up to 2.5 cm in diameter. Spikelets are numerous, 3.5-5.0 mm long, each surrounded by a basal ring of silky hairs 10 mm long. The grain is oblong, pointed, brown and 1-1.5 mm long.

Distribution:

The habitats of *I. cylindrica* vary from dry sand dunes of shores and deserts to swamps and river margins. This weed is found at altitudes from sea level to 2700 m and rainfalls of 500-5000 mm/year. It occupies a wide range of habitats including grassland, cultivated annual crops, plantations, abandoned farm land, road and railway embankments, reclaimed mined areas, pine and hardwood forests, recreational areas and deforested areas.

Due to its requirement for sunlight, *I. cylindrica* survives poorly in closed-canopy forest or plantations where shading occurs.

In Panna TR, it is found sparsely distributed along the Ken river and some Nalas.

Flowering and fruiting:

July to November.

Biology and Ecology:

Reproductive Biology

I. cylindrica is a prolific producer of seeds which are dispersed by wind over long distances to colonize cleared or previously un-infested land. It can produce as many as 3000 seeds per plant, and 95% of *I. cylindrica* seeds can germinate within one week

but can also retain viability for at least one year. *I. cylindrica* is not capable of self-pollination and produces viable seeds only through cross-pollination. Flowering is variable between individual plants and can occur in response to stress from slashing, grazing, burning, mowing, or the addition of nitrogen.

Physiology and Phenology

Suspected allelopathic properties and a vigorous growth habit have made *I. cylindrica* one of the most competitive weeds. The aggressive and invasive nature of *I. cylindrica* is largely attributed to its extensive rhizome system which is concentrated in the upper 20 cm of soil. The lateral buds can remain dormant for long periods and give *I. cylindrica* its perennating habit.

The regenerative capacity of *I. cylindrica* rhizomes is affected by their age; older rhizomes regenerate better than those that are young and contain relatively few nutrients.

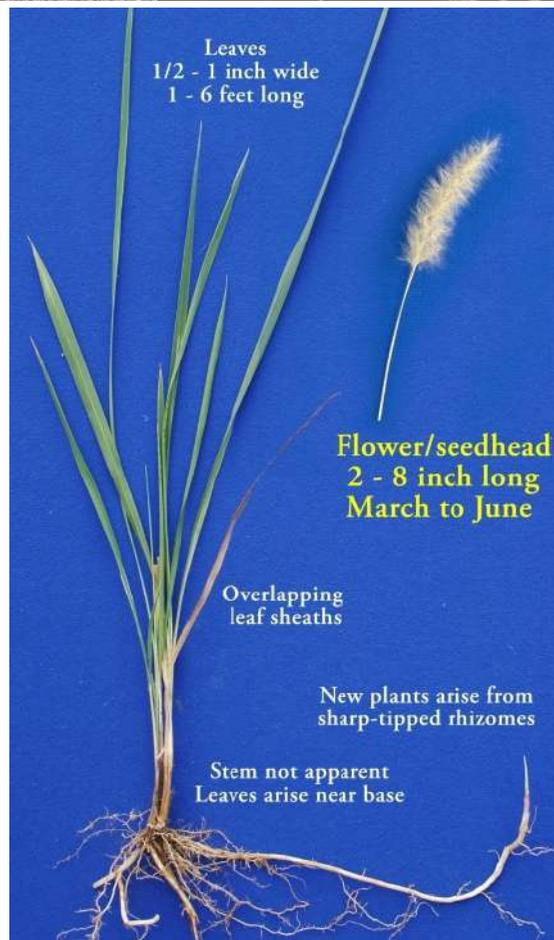
There is marked seasonal variation in the growth of *I. cylindrica*. During the dry season, the number of living shoots and the emergence of new shoots are relatively low compared with in the wet season. Any production of new shoots is balanced by the death of older shoots. Low shoot emergence is associated with low rainfall and soil moisture. During the dry season, the mass of dead shoots can exceed that of live shoots. It appears that *I. cylindrica* sacrifices its shoots in order to maintain healthy, nutrient-rich rhizomes.

Soil:

I. cylindrica grasslands are widely believed to indicate poor soil fertility but *Imperata* occurs on a broad range of soil types and is not confined to the poorest soils.

Uses:

I. cylindrica is an inferior forage crop for domesticated animals. The silica bodies and the sharp edges of the leaves render it undesirable and unpalatable to grazing animals. *I. cylindrica* crude protein, which is estimated to be about 4%, is far below the required 7% crude protein to initiate voluntary intake by cattle.



Imperata cylindrica

12. *Ischaemum rugosum*

Common name:

Saramolla grass

Description:

I. rugosum is a resilient **annual** that inhabits growing in loose clumps to heights, of 10-100 cm. The species is primarily recognized by the wrinkled texture of the sessile spikelets lower glume, with 4-7 distinct horizontal ribs. The plant produces brown, ovoid grains 2 mm long.

The linear leaf blades are 5-30 cm long and 3-15 mm wide, gradually tapering down at the base and sometimes resembling a petiole. Blades have a margin of stiff minute hairs, and may either be smooth or covered with thin hairs on the leaf surface. The spikelets are 4-6mm long and contain two florets, one sterile and one fertile, the pair lack a rachilla extension between them. The pedicelled spikelets may be highly reduced or well developed, and are at least as long as the sessile spikelets, or shorter.

Distribution:

I. rugosum occupies marshes and other wet habitats in tropical and temperate regions.

In Panna TR, it is found distributed in most of the Grasslands along with *Themeda quadrivalvis*.

Flowering and fruiting:

September - January

Climate:

Tropical monsoon climate.



Ischaemum rugosum salisb

13. Paspalidium flavidum

Common name:

Yellow water crown grass (E), Chichvi (H)

Description:

An **annual** grass with stem compressed , leafy, branches from the decumbent base . leaves bifarious, linear- lanceolate , acuminate or ligulate with a rounded tip sheaths compressed, 1-3 fit tall from a prostrate base.lower tumid, smooth hairy. Inflorescence and flowers spikes few or many distant. spikelets 2-20, very pale sessile Glumes membranous white with green nerves , flowering time October months the leaves and roots are said to be slightly cyano genetic.

Distribution:

Widely distributed in tropical areas of the country.

In Panna TR, it is found sparsely distributed in most of the Grasslands and also under the trees in rocky hills.

Flowering and fruiting:

July - December

Climate:

It grows well in arid and semi-arid conditions in the rainfall zones ranging from 60 mm to 120 mm.



Paspalidium flavidum

14. *Perotis indica*

Common name:

Indian Comet grass

Description:

Indian Comet grass an **annual** grass with culms rising to 10-40 cm tall. Leaf-blades are lance shaped, or ovate; 1-3cm long; 2-7mm wide. Inflorescence composed of single racemes, 2-15cm long. Spikelet packing crowded, or contiguous; irregular. Stalks are oblong, 0.2 mm long. Flower and fruits come throughout the year.

Distribution:

Indian comet grass is found growing on river banks and sandy places in PTR.

Flowering and fruiting:

Throughout the year





Perotis indica

15. *Phragmites australis*

Common names:

Common reed, phragmites karka

Phragmites australis, the common reed, is an aggressive, vigorous species which, in suitable habitats, will out-compete virtually all other species and form a totally dominant stand. In Wetland habitats bird, fish and insect populations can also be affected.

Description:

P. australis is a robust erect **perennial** grass, aquatic or subaquatic, growing to 4 m high (occasionally 6 m), strongly tufted, with an extensive rhizome system. Stolons may also be present. Stems rigid, many-noded; internodes hollow. Leaves alternate, up to 70 cm long, with a ligule of hairs (resembling short eyelashes) up to 1.5 mm long; leaf blade flat, up to 60 cm long and 8-60 mm wide, tapering to a spiny point, rigid, glabrous or sometimes covered with a whitish bloom; leaf sheaths loose and overlapping. Inflorescence a feathery, drooping panicle 15-50 cm long, often tan-brown to purplish; many-flowered; branches slender, ascending; spikelets several-flowered, 10-18 mm long, with florets exceeded by rachilla hairs; first glume 2.5-5 mm long; second glume 5.7 mm long; lemmas thin, 3-nerved, densely and softly hairy; nerves ending in slender teeth, the middle tooth extending into a straight awn; seed slender, dark brown.

Distribution:

P. australis is a highly adaptable emergent grass of freshwater to brackish water. It is rare in very nutrient-poor waters. It usually prefers stationary or slow-moving waters, and areas of land with a high water table, or that are seasonally inundated. It occurs as a marginal or bankside species along many watercourses, but can grow to the depths of 1 m in water. It is more common in lowland areas, but can occur in upland.

P. australis is one of the most widely distributed of all flowering plants, with a very extensive native range throughout the world. Although not formally reported in the literature as such, there is a high probability that *P. australis* is present in almost every country worldwide.

In PTR, it is found in few places along the river Ken (in the stretch from Sankra to Sankaro).

Flowering and fruiting:

April to November.

Reproductive Biology:

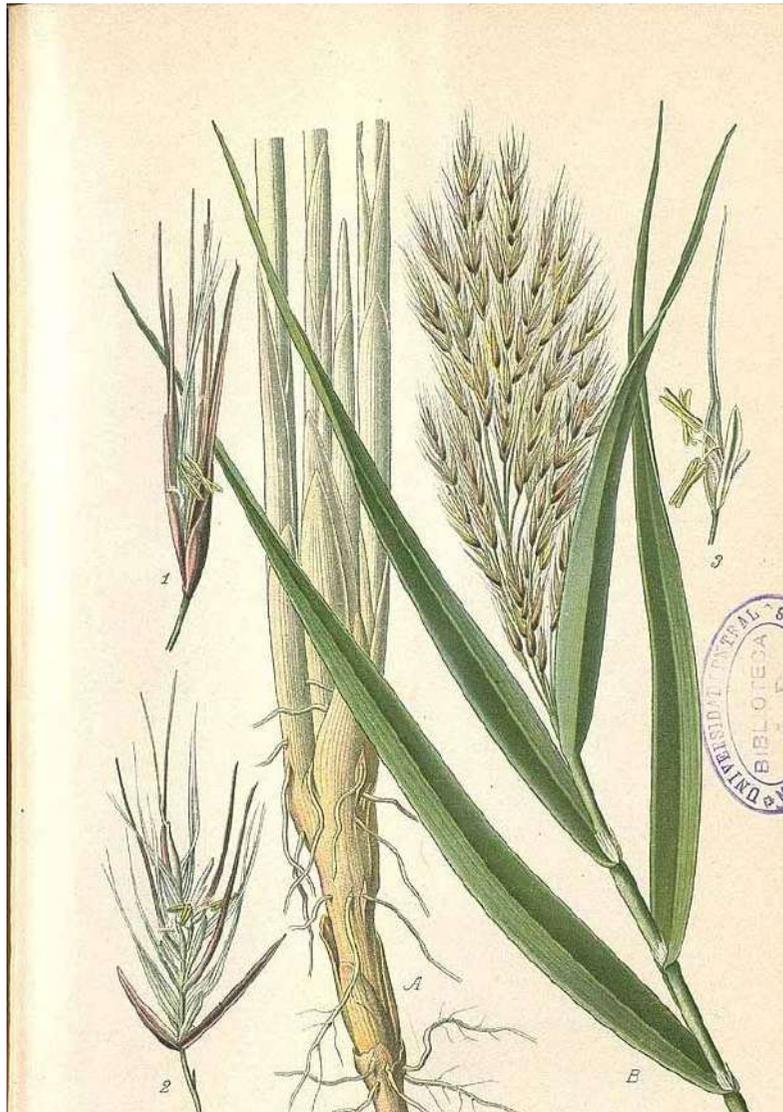
Reproduction is by both seed and vegetative spread. *P. australis* has an ability for aggressive vegetative spread by rhizomes (although stolons may also be produced).

Physiology and Phenology

P. australis is long-lived perennial plants with an aquatic to amphibious strategy, preferring rich muddy substrates, but with a high degree of plasticity, adapting to a wide range of substrates and water conditions. Longevity is reported to be as high as 1000 years. In good conditions, strong, tall stems with large, horizontally-held leaves are produced which permit the plant to compete efficiently for available light. The root system is large and well-adapted to anaerobic conditions common in submerged soils, as they possess aerenchymatous tissues to provide gas ventilation from the leaves. *P. australis* exhibits a combination of long, thick, unbranched roots that penetrate the substrate, plus smaller, much-branched roots infiltrating the water and surface layers of the sediment. Together the two root types maximize the chances of roots successfully tapping available nutrients, even in the crowded conditions typical of the reed swamp habitat. In a dense stand of *P. australis*, underground parts (rhizome, root and bases of stems) may comprise up to 80% of total biomass.

Uses:

In natural wetlands, stands of *Phragmites* reeds, and their associated microflora are excellent clean-up agents for removal of pollutants, sediment and other undesirable materials from water. *Phragmites* reeds are of value in preventing soil erosion on river banks. It can be grazed by animals mainly when young. *Phragmites* stands also play a major co-evolved wildlife support role in wetland areas being a vital part of the wetland ecosystem supporting wildfowl and other animals.



Phragmites australis

16. *Saccharum spontaneum*

Common names:

Wild sugarcane (E), Kans grass (H)

Description:

S. spontaneum is a tropical grass, often considered a weed in its native range and has been introduced outside of this range for use in sugarcane breeding programmes. This species can grow up to 5 m in height and reproduces both vegetatively, from a large network of rhizome and by producing thousands of wind dispersed seeds. *S. spontaneum* is a **perennial** species capable of propagation vegetatively or from seed. Vegetative propagation is from rhizomes and stem fragments, as each node has a root band with one or two rows of root primordia. Seed production is very variable; Mean seed production as 3042 seeds/plant. Dispersal of seeds by wind is aided by the callus hairs which form a parachute mechanism; sometimes a small number of seeds may become entangled to form a woolly mass which may be transported large distances. Germination and emergence occurs in June/July after the first showers of the rainy season; adult plants bear flowers by the end of the rainy season. It does not form a persistent seed bank.

Distribution:

Saccharum spontaneum is a grass native to the Indian Subcontinent. It is a perennial, polymorphic grass species and believed to have originated in India. It grows up to the altitude of 1800 m. In PTR, it is spread in grasslands which are in close proximity Ken river.

S. spontaneum has the potential to become a serious invader of grasslands, often resulting in its abandonment by animals. Kans grass quickly colonises exposed silt plains created each year by the retreating monsoon floods, forming almost pure stands on the lowest portions of the floodplain.

In PTR, it is found in almost all grasslands in different proportion. Grasslands which are closer to the river Ken have high proportion of *S. spontaneum*.

Flowering and fruiting:

October - January

Soil:

It is able to grow on fertile (to approximately 5 m tall) and poorer soils (to about 3 m tall). It is usually most aggressive on heavy, moisture-retentive soils, however, it also grows well on sandy soils.

Uses:

Its extensive rhizome network makes it a very efficient binder of soils, and hence, particularly useful for controlling and preventing soil erosion. I

Prevention and Control:

Deep ploughing is effective for the control of this weed. A specialized plough known as the 'Bakhkhar plough', capable of cultivation to a depth of 26 cm is used to control *S. spontaneum*. Soil inversion during the months of May and June when the temperature is very high, can help to exhaust food reserves in the rhizomes either by drying or by following inversion with irrigation to encourage regeneration. Regardless of timing, an annual deep cultivation will help to reduce the vigour and spread of this species by systematically interrupting the development of the underground reproductive system. A number of mulching techniques have proved successful for the control of *S. spontaneum*. Covering the soil surface with black or white polyethylene sheeting after removing above-ground parts for a period of three to four months prevents regeneration of plant.



Saccharum spontaneum

17. *Setaria pumila*

Common names:

Van bajra, Yellow bristle-grass, Pigeon grass, and Cattail grass.

Setaria pumila is a species of grass. It is native to Europe, but it is known throughout the world as a common weed. It grows in lawns, sidewalks, roadsides, cultivated fields, and many other places.

Description:

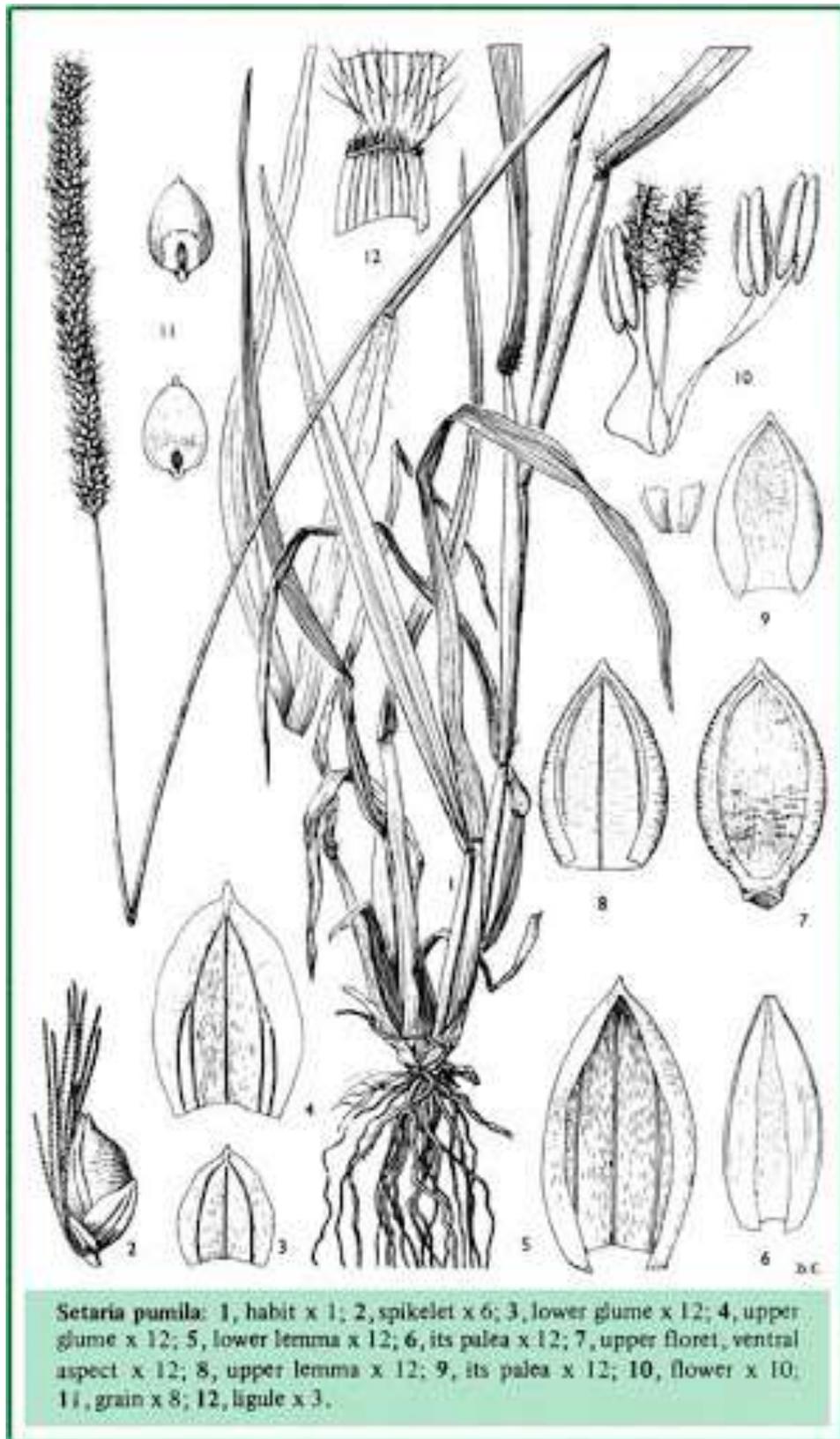
This **annual** grass grows 20 cm to well over 1 metre in height, its mostly hairless stems ranging from green to purple-tinged in color. The leaf blades are hairless on the upper surfaces, twisting, and up to 30 centimetres (12 inches) long. The inflorescence is a stiff, cylindrical bundle of spikelets 2 to 15 centimetres ($\frac{3}{4}$ to 6 inches) long with short, blunt bristles. The panicle may appear yellow or yellow-tinged.

In PTR, it is found in almost all grasslands.

Flowering and fruiting:

July - November





18. *Sorghum halepense*

Common name:

Jhonson grass (E), Bajara (H)

Description:

S. halepense is a coarse **perennial** grass, up to 2 m tall with extensively creeping, fleshy rhizomes which are covered with brown scale-like sheaths, are up to 1 cm in diameter, 2 m in length, and often root from the nodes. Due to its capacity to form extensive networks of rhizomes, *S. halepense* can be useful for control of soil erosion.

Stems and Leaves:

Slender plant with numerous erect stems up to 2m high and 3-9mm thick. The leaf sheaths are essentially glabrous (hairless) and ribbed. The leaves are narrow, alternate, simple, smooth and are 30-60cm long and 2cm wide, with a prominent white mid-vein and hairs at the base of the upper surface, otherwise the leaves remain smooth and hairless. At the base of the leaf blade is also a prominent membranous ligule that is 1-3mm long with hairs to 2mm long.

Flowers and Fruit:

Inflorescence (flower head) consists of pendulous panicles (a compound inflorescence with a main axis and lateral branches which are further branched, and in which each axis ends in a flower or bud), often purple in colour, 25-45cm long, and 3-15cm wide which open when mature. The spikelets are borne in pairs along the branches (with the terminal spikelet being a triplet). The lower sessile (without a stalk) spikelet contains the seed. The upper spikelet is pedicellate (with a stalk) and is narrower than the lower spikelet. The grain is oblong-ovate and 2-3 mm long.

Distribution:

It prefers moist habitats.

In PTR, it is found in grasslands which are closer to the river Ken.

Flowering and fruiting:

October - February .



Sorghum halepense