for favour of inf. pl. 40/7
Chairman Sir
30/08/14

UNIVERSITY GRANTS COMMISSION - CENTRAL REGIONAL OFFICE,

Tawa Complex (Bittan Market), E-5, ARERA COLONY, BHOPAL-462 016
Ph. : 0755 – 2467418, 2467892, Fax. : 0755 – 2467893, web site : www.ugc.ac.in

F No. MS-19/202002/XII/13-14/CRO

Date :

Code : 202002

To
The Principal,
Bhilai Mahila Mahavidyalaya
Bhilai Nagar Bhilai (C.G.)

Return
30/08/14

Sub Financial Assistance for undertaking Minor Research Project by Dr. Mrs. Pratiksha Pandey, Assistant Professor(Botany) Bhilai Mahila Mahavidyalaya, Bhilai Nagar Bhilai (C.G.), in ""A study of Endangered Grasses in Durg - Bhilai Region.".

Sir

The Commission on the recommendations of the Selection Committee has approved the research project entitled in ""A study of Endangered Grasses in Durg - Bhilai Region."." of by Dr. Mrs. Pratiksha Pandey, Assistant Professor(Botany) Bhilai Mahila Mahavidyalaya, Bhilai Nagar Bhilai (C.G.),and has agreed to provide a grant of Rs.310000/-.

Particular		Allocation	Grant being released
NON RECURRING			
1.	Books & Journals	Rs. 50000.00	Rs. 50000.00
2.	Equipments	Rs. 100000.00	Rs. 100000.00
RECURRING			
3.	Travels, Field work	Rs. 50000.00	Rs. 25000.00
4.	Contingency	Rs. 50000.00	Rs. 25000.00
5.	Chemical & Glassware	Rs. 60000.00	Rs. 30000.00
6.	Special Needs	Rs. 0.00	Rs. 0.00
	TOTAL	Rs. 310000.00	Rs. 230000.00

I am directed to convey the sanction of the Commission for Payment of Rs. 230000/- as first installment to The Principal, Bhilai Mahila Mahavidyalaya, Bhilai Nagar Bhilai (C.G.), under following terms and condition.

1. The effective date of implementation of the Project will be the date of receipt of fund by the institution.
2. The tenure for the Minor Research Project will be 2 years
3. On receipt of this letter the Principal Investigator must sign and return the Acceptance Certificate as enclosed duly countersigned by the Principal within 3 month of issue of this letter, failing which the approval should stand withdrawn.
4. In case, the grant is not settled within six months from the date of completion of the project, the same will lapse and no representation will be entertained on this behalf and Principal Investigator has to refund the whole grant.
5. Principal Investigator may undertake only one project at a time under UGC funding either by the UGC, H.O., New Delhi or by the C.R.O., Bhopal. The letter of undertaking enclosed may be sent to this office immediately after receiving this sanction. Failure to the submission of this and also in running two parallel projects funded by the UGC (Regional Office/Main Office at New Delhi), the Principal Investigator will be held solely responsible and have to refund the amount as and when it comes to the notice, of the authorities.
6. The College shall maintain proper accounts of the expenditure out of the Grants which shall be utilised only on approved item of expenditure as per detailed in XII Plan Guidelines.

Bhilai Mahila Mahavidyalaya
559
30/08/14

Scanned by CamScanner

7. All assets generated out of the fund for the project including equipment, books and journals will become the property of the host institution on completion of the project. However, in case of transfer of the project, assets (or a part of it) generated out of the funds of concerned project, may be transferred to the concerned Institution on request, with prior approval of the UGC.
8. The travel/field work is to be undertaken only for data collection and collection of other information such as consultancy, documents and libraries within the general scope and sphere of the project.
9. The sanctioned amount is debatable to the major Head 4(ii)b.
10. The amount of the Grant shall be drawn by the account officer (Drawing and Disbursing Officer), University Grants Commission, CRO, Bhopal on the Grants-in-Aid bill and shall be disburse to and credited to the Principal, Bhilai Mahila Mahavidyalaya, Bhilai Nagar Bhilai (C.G.), through NEFT/RTGS, during, 2013-14.
11. The grants are subject to the adjustment on the basis of Utilisation Certificate, Statement of Expenditure & Progress report of the work done so far in the prescribed performa submitted by the college.
12. A Register of Assets acquired wholly or substantially out of the Grant shall be maintained by the University/College in the prescribed form.
13. The Funds to the extent are available under the scheme.
14. The interest earned by Colleges/Institutions on the grants paid by UGC may be treated as additional grant. It should be included in the accounts & the Utilisation Certificate to be submitted to the University Grants Commission.
15. The expenditure has noted at the BCR No. _____.
16. Rest of the conditions of the project stand as per the XI Plan guidelines of the UGC concerning Research Funding Council for Major & Minor Research Projects, as the case may be.
17. The grantee institution shall ensure the Utilisation of grants-in-aid for which it is being sanction/paid. In case non-utilization/part utilisation, the simple interest @ 10% per annum as amended from time to time on unutilised amount from the date of drawl to the date of refund as per provisions contained in General Financial Rules of Govt. of India will be charged.
18. This issues with the approval of the Chairman, UGC, New Delhi.

Yours faithfully,

09/06/14

(Dr. G.S. Chauhan)
Deputy Secretary

Copy forward for information and necessary action to :

- Accounts Officer
  UGC, CRO, Bhopal (M.P.)
- The Director/Dean,CDC,
  Pt. Ravi Shankar Shukla University
  Raipur (C.G.)
- The Commissioner/Deputy Secretary,
  Dept. of Higher Education
  Govt. of C.G.
  Raipur (C.G.)
- Dr. Mrs. Pratiksha Pandey
  Assistant Professor(Botany)
  Bhilai Mahila Mahavidyalaya
  Bhilai Nagar Bhilai (C.G.)

09/06/2014

(Prashant Dwivedi)
Education Officer

Note:- In Regard to this Sanction letter the Sanctioned amount is already transferred in to your College account. (AS ACCOUNT INFORMATION GIVEN BY THE COLLEGE). Please verify and inform to UGC, CRO, Bhopal as soon as possible.

Scanned by CamScanner

SUMMARY OF EXPENDITURE STATEMENT

File No. MS-19/202002/XII/13-14/CRO
Principal Investigator: Dr. Pratiksha Pandey
Co- Principal Investigator: Dr. Bhawana Pandey
Period of utilization from **1/09/14 to 31/08/16**

SN	Item	Amount Approved (Rs.)	Expenditure Incurred (Rs.)
1	**Books & Journals**	50,000/-	43,400/-
2	**Equipments**	1,00,000/-	1,05,495/-
3	**Field work/ Travel**	25,000/-	51,390/-
4	**Contingency**	25,000/-	25,003/-
5	**Chemicals & Glassware**	30,000/-	29,745/-
6	**Special Needs**	-	-
	Total	2,30,000/-	2,55,003/-

P Pandey

Rpandey

Rekha Hasan

Scanned by CamScanner

PROJECT REPORT OF MINOR RESEARCH PROJECT

ON

"A Study of Endangered Grasses in Durg- Bhilai Region."

Submitted to UGC, CRO, BHOPAL

ज्ञान-विज्ञान विमुक्तये

SUBMITTED BY

Dr. Pratiksha Pandey

Principal Investigator

&

Dr. Bhawana Pandey

Co-Principal Investigator

DEPARTMENT OF BOTANY AND BIOTECHNOLOGY & MICROBIOLOGY

BHILAI MAHILA MAHAVIDYALAYA, HOSPITAL SECTOR, BHILAI

DISTT. DURG (C.G.)

Scanned by CamScanner

DECLARATION

We, hereby, declare that this Minor Research Project Work entitled **"A Study of Endangered Grasses in Durg- Bhilai Region."** is our own work conducted at Biotechnology & Microbiology Research Laboratories, Bhilai Mahila Mahavidyalaya, Bhilai.

We further declare that, to the best of our knowledge, this work does not contain any part of any work which has been submitted for Research Project at any Research Funding Agency

Date 28.9.16

Dr. Pratiksha Pandey
Principal Investigator

Dr. Bhawana Pandey
Co-Principal Investigator

Scanned by CamScanner

ACKNOWLEDGEMENT

We are highly thankful to UGC CRO Bhopal for sanctioning us for the minor Research Project Entitled **"A Study of Endangered Grasses in Durg- Bhilai Region"** for Investigation of endangered grasses of Durg Bhilai region.

We are thankful to Dr. Zehra Hasan, Principal, Bhilai Mahila Mahavidyalaya for her continuous support and encouragement. We are thankful to Miss Sadhana Gupta for her support in this project. We are also deeply indebted staff of Department of Biotechnology & Microbiology, Bhilai Mahila Mahavidyalaya for their support in the progress of this project work. We are also thankful to all the staff members of Botany, Bhilai Mahila Mahavidyalaya for their cooperation and guidance in this research project.

We are thankful to Vaibhav Printers, Durg, for their quality computer printing of this project work. Finally, we would like to thank all those whom we may have inadvertently forgotten to acknowledge.

Dr. (Mrs.) Pratiksha Pandey
Principal Investigator
and
Dr. (Mrs.) Bhawana Pandey
Co-Investigator

Scanned by CamScanner

CONTENTS

Scanned by CamScanner

INTRODUCTION

Scanned by CamScanner

A STUDY OF ENDANGERED GRASSES IN DURG- BHILAI REGION

1. INTRODUCTION

India is basically an agricultural country with more than 70% of its population living in the rural areas. The rural population is dependent mainly on agriculture and animal husbandry for their sustenance. India with about 2% of the total world's geographical area sustain as much as 15% of the total world's livestock population which plays a significant role in country's rural economy's for demand for milk, milk products, meat wool, hides and bone manures etc. in present scenario the population growth of both human beings and livestock population has been increasing day by day and the land under permanent pastures has shrieked. This has further complicated the situation about 49% of total cultivable land (AIRPFC 1995) and culturable wasteland is put for fodder crops which are occupying nearly 10% m.h. This area is being utilized for growing forage grasses and legumes and so called grasslands and pastures.

Angiosperms

Angiosperm plants are the first of the two classes of plants (the other class is gymnosperms) that belong to the division of Phanerogams or Spermatophytes. Phanerogams comprise those plants that produce seeds and are a subset of the land plants (embryophytes). Angiosperms are the flowering plants that produce seeds and pollen for their reproduction.

Angiosperms developed in the early to mid-Cretaceous period about 125 million yearsago. Some analyses of morphological and molecular data support the view that the angiosperms are allied to the gnetopsids and to an extinct group known as the Bennettitales or cycadeoids. These groups have reproductive structures that can be interpreted as owers. These early ower-bearing plants likely were derived from seed fern groups identified as caytonids or glossopterids. As the dominant plants on the earth's surfacetoday, angiosperms number well over 200,000 species. They exhibit a wide array ofhabits, from perennial to annual and woody to herbaceous and occur in essentially allterrestrial habitats as well as in some aquatic ones.

The angiosperms are usually classified in two major groups, the dicotyledons and themonocotyledons. Cotyledon refers to a seed leaf, or the first leaf evident upon seed germination. In dicotyledons, two seed leaves are formed, and in monocotyledons, one seed leaf

Scanned by CamScanner

is formed. The two groups differ in other important vegetative and reproductive characters. Several features of monocotyledons are considered to be derived or apomorphic. These include the solitary cotyledon, absence of a vascular cambium, dissected stele ('scattered' arrangement of vascular bundles in the stem), adventitious root system, sheathing leaf bases, and herbaceous habit. These unifying features of the monocotyledons serve to substantiate that the group is monophyletic

Once upon a lifetime grassland ecosystem consider as a agricultural farming system that emphasizes the importance of grasses legume and forbs to the livestock and land management. But now a day the grasslands are converted into wasteland, barren land due to biological reasons.

Grasslands in India are lands dominated by grasses with certain number of other plants like trees, shrubs and herbs. Whyte (1957) has classified Indian grasslands into eight types but champion & Seth (1968) recognized only three broad categories between 1954 & 1962. The Indian council of agricultural research conducted grassland survey and classified the grass cover of India into 5 major types (Dibadghao & Shankarnarayan 1973) Each of there grassland s have their own characteristics which differentiate them from one another. The most widespread grassland in India are imperator grasslands.

Indian grasslands are the home of the certain endangered plants and animal species. They are also the main centers of genetic diversity of plant species. Indian grasslands are the least understood and most under estimated natural habitats. Less than due percent of Indian grasslands come under the protected area network, making it one of the most neglected and abuse ecosystem in the country. According to forestry commission (1914) reports nearly 40% of protected grassland areas suffer from livestock grazing & fodder extraction.

Grassland are important segment in the worlds productivity long before the advent of man and perhaps the extent of grasslands will control man's diet , population , and habits in the future plant(van dyne *et.al*) , hence they plays significant role in ecosystem . The Indian grassland commune are totally depending upon the climatologically factor's and various biologically interferences especially human activities have affect the grassland structure all over the world.

As a result of exercise human interference it is difficult to locate virgin grassland in our country (Dadsena *et. al*., 2014).

Scanned by CamScanner

Actually grasslands are not form mast of the Indian grassland, originated due to human interferences such as excessive falling of forest trees for timber, fuel and cultivation but the basic reason's know as expanding agriculture land, urbanization and overgrazing by domestic animals. (Tiwari 1997)

Grassland of Chhattisgarh are most neglected in recent year vary little work has been done on Chhattisgarh grasslands. Therefore the present study deals the vegetation and floristic studies of Durg Bhilai region.

The grassland vegetation as regard as a type of vegetation that comes up naturally and provide food and fodder for man and his cattle grassland are made up by grasses , legumes and forbs in which grasses are known as the types of vegetation that comes naturally with rain and complete the life annually.The importance of grasses as objects of botanical research, is mainly due to their bio-geochemical ecological importance since the very beginning of human of human civilization grasses covered one third of the land surface (Schants 1954) common grasses are all around us, two other large groups of plants are easily mistaken for grasses are sedges and rushes. Many of them are in the range of extinction due to over exploitation and destruction of their habitat. There has been no compressive study taken on the enumeration, distribution and the presence of threat to the existing grassland plant species.

There the random sampling method used for grassland vegetation. Grassland play a major role in the economy of the country as grass is also used as fuel .shelter and various traditional activities .Ministry of forest department 1914 say that one third of Indian grasses are considered to have their fodder value approximately 400 plants species were recorded as grass land vegetation (Pandey, 2011) out of there four hundred species, sixty genera are leguminaceae family .twenty one genera are reported to be useful as forage namely Desurodium, Lablab ,Stylosanthea, Vigna, Macroptelium etc. grasses like Bothriochloa, Dichanthium, Cynodon, Penicillium, Penisetum, Cenchrus, Eragrostis etc. and Browse Plants Such As Leucaena, Sesbania, Albizia, Bauhinia , Cassia, Grewia etc. these genera besides many other forms are integral part of feed and fodder sources of the country.

Scanned by CamScanner

Grasses form the major source of fodder. It is observed that *Cynodon dactylon* shows maximum resistance to grazing out of all the fodder species, while other species are suppressed in the constant grazing areas (Ahmad *et al.,* 2009).

Cynodon dactylonis present throughout the area and is considered a first class fodder grass (Cope, 1982) .*Dactyloctenium aegyptiumis* present in cultivated fields, shady places and moist soil and is more abundant and diverse species. It is adapted to soils of wide range of texture, and it is one of the most drought resistant grasses, because of its rapid growth and seedling in each wet season, even a short duration (Skerman and Riveros, 1990). *Chrysopogon serrulatusis* the most dominant species, in the low grazing and protected areas. In the saline soil species like *Cenchrus ciliaris, Sporobolus arabicus, Dicanthiumand Polypogonsp.* are found. *Saccharum spontaneumis* very common along stream banks and margins of ponds. Grasses like *Eulaliopsis bipinnataand Cymbopogan jwarancusaare* abundant on mountains and rocky slopes and near sand stones (Ahmad et al., 2009). It is an excellent soil binder that consolidates the soil particles and sand left bare by retreating floods. It has an extensive root system and acts as an effective soil binder (Skerman and Riveros, 1990).

Saccharum spontaneumand Saccharum bengalensethat are large tussock forming grasses are only recorded along water channels. Tussocks of Saccharumare useful for the nesting of animals and birds (Chaudhary *et al.,* 2001). Other important grass species are *Dactyloctenium scindicum, Dactyloctenium foveolatum, Sporobolus arabicus,*that are palatable and contribute to urial forage (Chaudhary *et al.,* 2001). *Dactyloctinium. Scindicum Boiss* and *Aristida* sp. are frequent in places where wind blown soil has accumulated (Ahmad, 1964). *Vetiveria zizanoidesis* almost near extinction in the area are requires conservation in Salt Range. Some grass species i.e. *Paspalidium flavidum, Enneapogon persicus, Loliumsp* and *Chloris dolicostachyaare* restricted to specific area, due to over grazing and poor management practices, are more vulnerable. *Saccharum spontaneum* and *Saccharum bengalenseare* used for thatching huts for cattle and hollow internodes of *Arundo donaxare* used for making pens and musical pipes. Large and stiff leaves of *Eulaliopsis binataare* used for making brooms, mats and ropes in the area. Some grasses i.e. *Saccharum spontaneum* and *Cymbopogon jwarancusaare* used for medicinal purposes in the area (Ahmad *et al.,* 2009). There are various factors, which are deteriorating the habitat of grasses i.e. growth in live stock population and unrestricted grazing.

Scanned by CamScanner

World wide overview of Grasses

Poaceae is one of the largest families among the angiosperms, and is represented in every phytogeographic region in the world. It comprises about 10,000 species and 651 genera. It is divided into six sub families (Clayton and Renvoize, 1986). It ranks 3rd in number of genera after Compositeae and Orchidaceae and 5thin number of species after Compositeae, Orchidaceae, Leguminoseae and Rubiaceae (Good, 1953). Grasses form one of the most fascinating families of flowering plants and have a wide range of diversity and play significant role in the lives of human beings and animals. The value of grasses to mankind has been recognized since the dawn of human civilization, and culture of cereal grasses dates back to period when man was emerging from wild beast stage. (Mitra and Mukherjee, 2005). Grasses inhabit the earth in greater abundance than any other comparable group of plants, some are present in warm, humid and tropical climates, while others have adopted the polar regions, where the growing season is two months or less anddirect sunlight is absent for many months of the year. Some are important elements of marsh and swamp vegetation, while others inhabit desert regions when the annual precipitation is 5 inches or less (Gould, 1968). Poaceae is the most important family of plants to human from commercial and nutritional point of view (Jones, 1999). Even before the time of recorded history, the grains of grasses undoubtedly provided a staple food supply for human race. Grasses are used as food for human and forage for domesticated animals. A high proportion of the world's most fertile and productive soil is developed under the vegetation cover of grasses. Roots, stolons, rhizomes and littler form the annual replacement of leafy culms, not only are soil builders but also are effective soil stabilizers. Wild life is also dependent upon grass and grassland habitats for food, shelter and normal completion of their life cycle (Gould, 1968).

In the classification system of Bentham (1881), 13 grass tribes were grouped in two subfamilies, the Festucoideae and Panicoideae. Bews (1929) used the Bentham system as a basis for his treatment of the world's grasses. Hitchcock (1920, 1935, 1951) followed it with minor modifications in the classification of united states grasses. Hitchcock recognized 14 tribes, 10 in the Festucoideae (Bambuseae, Festuceae, Hordeae, Aveneae, Agrostideae, Phalarideae Chlorideae, Zoysieae, Oryzeae, and Zizanieae) and four in the Panicoideae (Paniceae, Melinideae, Andropogoneae and Tripsaceae).

Scanned by CamScanner

In the Bentham system, differentiation of subfamilies, tribesand genera was based almost exclusively on morphological characters of the inflorescence. Prat (1960) phylogenetically arranged tribes and subfamilies on the world basis, while Stebbins and Cramption (1961) grouped the grasses in six subfamilies (Festucoideae, Bambusoideae, Oryzoideae, Arundinoideae, Panicoideae and Eragrostoideae. There are striking differences between grasses of Festucoideae and those of Panicoideae, these groups have been used as a general standard of comparisons of all the grasses. By the 1980s, usually five to seven subfamilies were recognized based either on phenetic analysis or presumed evolutionary relationships. Festucoideae contains most of the temperate grasses and the Panicoideae and Chloridoideae, contain most of the tropical and subtropical grasses of economic importance. The Panicoideae includes many high productive grasses and cereals which follow C4type of photosynthesis.

From the early efforts of Theophrastus, 300 years before the Christian era, to the middle of the eighteenth century, plant taxonomy was relatively disorganized. Early taxonomic publications were mainly list of names with short descriptive phrases. In 1708 first paper related to grasses was published by Johann Schenchzr, under the title Agrostographiae Helvetica Prodromus. This paper is considered the start point of Agrostology (Gould, 1968).

Robert Brown (1810) recognized the two main sub divisions of Gramineae, Panicoideae and Festucoideae and described the spikelet characteristics of these groups. In 1812, Palisot de Beauvois named and described a large number of genera and stated that grass family is best known of higher plant groups.

Katewa *et al.*, (2001) pointed out ethnomedicinal and obnoxious grasses of India on the basis of local knowledge and information by local tribes. Sahebi *et al.,* (2001) carried out investigations regarding quantitave, and morphological characters of 350 herbarium specimens from 35 Iranian populations *of Hordium murinum* S.L using morphological characters. Two taxonomic keys were made for the taxa in *Hordium murinum S*.L. Leaf anatomical features of three herbaceous bamboo species (Bambusoideae) were studied by Vieira *et al.*, (2002). Anatomical characters such as midrib with complex vascular bundles and other leaf epidermal characters were observed that correspond to the bambusoid type of leaf anatomy.

Scanned by CamScanner

Saini *et al*., (2007) conducted experiment on four genotypes of Cenchrus ciliaris, two genotypes of *C. setigerus* and one genotype each of *Panicum maximum, P. antidotale and Lasiuras scindicusi*n Heryana (India). Investigations were carried out about morphological characters and nutritive value of the grasses and *C. ciliaris* was recommended as grass with most nutritional value for use in the arid regions of South Wet Heryana (India).

Liu *et al.,(*2005) examined the pollen morphology of *Eustachya tenera* by light scanning and transmission microscope. The studies showed that pollen grains are generally oblate spheroidal and with a single annulate aperture with an operculum. Ying *et al*.,(2006) carried out the leaf epidermal studies of 5 species of *Calamagrostis* and 26 species and one variety of *Deyexia* and no sharp differences were found between these two species.

Cytomorphological and palynological studies of 17 different species of grasses from Lahore were conducted by Meo (1999). It was observed that Pollens of tetraploid and hexaploid species were larger in size as compared to those of diploid species. Chaudhary *et al*., (2001) studied the foliar epidermal anatomy of 4 species of grasses, i.e. *Cymbopogon citrates* DC. Stapf, *Cynodon dactylon* (L) Pers., *Panicum summatrense* Roeth ex Roem and Schult and *Vetiveria zizanoides* (L.) Nash. These taxa showed differences in short and long cells, silica bodies, macro and microhairs and shape of subsidiary cells and it was concluded that most of the characters are diagonostic and can be used for making keys. Gillani *et al.,(*2002) carried out leaf epidermal anatomical studies of selected *Digitaria* species and found it valuable in the identification of these species. *Digitaria* sp. showed differences in size and shape of prickles, short cells, silica bodies, micro hairs with basal and distal cells, hooks, stomata and long cells.

It has been observed that different species of grasses present in the area are known by same vernacular name in the area and even same species has different local names in different localities of the area, so it is confusing for researchers working in this area on different aspects i.e. taxonomic, phytosociological or physiological studies and study the biodiversity, hence often species with incorrect scientific name is mentioned, without studying its characters of identification. Previously no documentation of grasses from taxonomic point of view is reported, so there was need to carry out the systematic studies of grasses along with their distribution, occurrence, habitat, morphological, palynological and anatomical characters as for their correct identification. The species of the same genus and different genera of same tribe are often very

Scanned by CamScanner

similar morphologically and difficult to distinguish them, so this problem can be solved by their anatomical and palynological studies. Anatomical characters are considered an important tool in taxonomy for identification of different species and palynological studies are helpful at the species and generic level within the tribes.

Taking this problem in consideration a comprehensive study of grasses of Durg- Bhilai area was carried out and 147 species belonging to 35 families were studied. Taxonomic investigations were carried out involving their morphology and palynology as an aid to the identification of grasses. This study will be helpful and act as guideline for researchers working in future on different aspects of grasses i.e. molecular phytosociological, ecological and taxonomic studies.

Pollen Grain Structure

The pollen grain is an extremely simple multicellular structure. The outer wall of thepollen grain, the exine, is composed of resistant material provided by both the tapetum (sporophyte generation) and the microspore (gametophyte generation). The exine consists of two layers: ectexina and endexina. The inner wall, the intine, is produced bythe microspore. Intine is a exible layer made of cellulose and pectina and extroversesfrom the apertures of the grain when the pollen germinates. Together, exine and intine are called sporoderm. Intine is the layer that separates the sporoderm. When the pollen grain is delivered to the stigma, a pollen tube grows out; its growth is governed by one of the two nuclei, the tube nucleus. The second nucleus divides once by mitosis to produce two sperm cells (F).the cytoplasm. Cytoplasm is the cell mass inside the sporoderm which winds around the nucleus. A mature pollen grain consists of two cells. The tube cell contains a generative cell within it. The generative cell divides to produce two sperm. The tube cell nucleus guides pollen germination and the growth of the pollen tube after the pollen lands on the stigma of a female gametophyte. One of the two sperm will fuse with the egg cell to produce the next sporophyte generation. The second sperm will participate in the formation of the endosperm, a structure that provides nourishment for the embryo.

Scanned by CamScanner

Objectives:

- To study the field survey for grassland vegetation for estimation of their distribution pattern.
- Collection of grassland vegetations. Make herbaria for identification.
- To identify and classify the grasses on the basis of morphology and palynology.
- To study the distribution, habitat and occurrence of threat grasses sp. in Durg-Bhilai area.
- To study the morphological and palynological differences among species of the same genus to find new characters for the identification and classification of taxa.
- Assesment to threat will be done by the guidelines of IUCN 2000.
- Quantitative phytosociological characters will be studied as per method describe by Mishra, 1968.

Scanned by CamScanner

REVIEW OF LITERATURE

Scanned by CamScanner

2. REVIEW OF LITERATURE

Poaceae is one of the largest families among the angiosperms, and is represented in every phytogeographic region in the world. It comprises about 10,000 species and 651 genera. It is divided into six sub families (Clayton and Renvoize, 1986). It ranks 3rd in number of genera after Compositeae and Orchidaceae and 5th in number of species after Compositeae, Orchidaceae, Leguminoseae and Rubiaceae (Good, 1953). Grasses form one of the most fascinating families of flowering plants and have a wide range of diversity and play significant role in the lives of human beings and animals. The value of grasses to mankind has been recognized since the dawn of human civilization, and culture of cereal grasses dates back to period when man was emerging from wild beast stage. (Mitra and Mukherjee, 2005).

Grasses inhabit the earth in greater abundance than any other comparable group of plants, some are present in warm, humid and tropical climates, while others have adopted the polar regions, where the growing season is two months or less and direct sunlight is absent for many months of the year. Some are important elements of marsh and swamp vegetation, while others inhabit desert regions when the annual precipitation is 5 inches or less (Gould, 1968).

Poaceae is the most important family of plants to human from commercial and nutritional point of view (Jones, 1999). Even before the time of recorded history, the grains of grasses undoubtedly provided a staple food supply for human race. Grasses are used as food for human and Forage for domesticated animals. A high proportion of the world's most fertile and productive soil is developed under the vegetation cover of grasses. Roots, stolons, rhizomes and littler form the annual replacement of leafy culms, not only are soil builders but also are effective soil stabilizers. Wild life is also dependent upon grass and grassland habitats for food, shelter and normal completion of their life cycle (Gould, 1968).

When man came in contact with different kinds of plants for his need and desire, to differentiate; it resulted in plant classification. The plants with food or medicinal values were first plants to be named and grouped in different categories. The naming of agricultural grasses must have antedated the first historical records by many thousands of years. With the increase in scientific knowledge, the classification of plants developed into the science of taxonomy. Grasses are thought to have a tropical origin, evolving in the tropical forest - savannah ecotone (Clayton and

Scanned by CamScanner

Renvoize, 1986). Bambusiodeae was thought to be the most primitive (Stebbens, 1982) but phyllogenetic analysis shows that the sub families Pooideae Bambusoideae, Panicoideae and possibly Chloridoideae are monophyletic and may be derived from polyphyletic Arundinaideae (Kellog and Campbell, 1987).

Most tribes of grasses are widespread (Hartley, 1964) but the major proportion of genera (76%) are restricted toa single land mass (Clayton and Renvoize, 1986). This suggests that the major subfamilies named above have evolved by the early tertiary and become wide spread before the major break up of the super continents, during the tertiary periods as shown by the relatively low endemism of grasses compared to other plant groups (Hartley, 1964).

Endemism is most common at the southern tips of continents. In first edition of Species Plantarium (1753) by Linnaeus, he listed 40 grass genera, including Andropogon, Cenchrus, Panicum, Hordium, Triticum and Phalares and this was the base of binomial nomenclature of flowering plants.

Robert Brown (1810) recognized the two main sub divisions of Gramineae, Panicoideae and Festucoideae and described the spikelet characteristics of these groups.

In 1812, Palisot de Beauvois named and described a large number of genera and stated that grass family is best known of higher plant groups. In 1881 Bentham grouped 13 tribes of grasses in two subfamilies. Tribe Paniceae, Andropogoneae, Maydeae (Tripsaceae), Trisetegineae (Melinideae), Zoysieae and Oryzeae were placed in sub family Panicoideae and Bambuseae, Festuceae, Hordeae, Aveneae, Agrostideae, Chlorideae and Phalarideae were grouped in Sub family Festucoideae.

Kunth (1833) described 13 tribes but recognized no sub Families, his system of classification was adopted by Endlicher, Palatore and Stendel.

The arrangement of Benthem was again presented in Genera Plantarium by Bentham and Hooker (1883) and was used with modifications by Haeckel (1887, 1889), Stapf (1917 – 1934), Hitchcock (1920 – 1935) and Bews (1929). A.S. Hitchcock, in the genera of grasses of the United States with special reference to economic species (1920) and manual of grasses of United States (1935, 1951) shifted the tribes Oryzeae to the Festucoideae and added another small tribe

Scanned by CamScanner

by splitting off the Zizaneae from Oryzeae. North American grasses and grasslands were treated ecologically and taxonomically on the basis of Hitchcock manual for more than 30 years.

Audulov (1931) grouped the grasses in two sub Families, the Poateae (Festucoideae) and Sacchariferae (Panicoideae), he carried out chromosomal studies of about 232 grasses in correlation with leaf anatomy.

Prat (1932) pointed out the significance of grass leaf epidermis and discussed in detail their differences and in 1936, he published a 93 page treatise entitled La Systematique des Graminess. He recognized three sub Families, the Festucoideae, Panicoideae and Bambusoideae and correlated characters of leaf epidermis and anatomy, cytology and morphology of seedlings, Audulov (1931) and Prat (1936) recognized two types of leaf blade anatomy, one associated with the festucoid leaf and other with panicoid leaf.

Prat (1932, 1936) discussed in detail the difference in shape of silica bodies of Festucoid, Panicoid, Chloridoid and Oryzoid grasses, observed the absence of microhairs in festucoid grasses and differences between typical panicoid and chloridoid microhairs.

Hubbard (1948 - 1954) worked on the "new taxonomy" and followed the lines established by Avdulov and Prat. Phyllogenetic arrangements of major grass groups were made from decade 1950 – 1960. New sub family groupings were proposed by Pilger (1954), Jacques – Felix (1955), Beetle (1955), Stebbens (1956) and Tateoka (1957). Differences in typical Festucoid and Panicoid root epidermis, cell division and the position of root hairs in the epidermal cell were pointed out by Reader and Von Maltzalen (1953) and Row and Reeder (1957).

Row and Reeder found that the alternation of long and short cells (Festucoid) versus equal sized cell (Panicoid) is a much more reliable character than either the position or angle of the root hairs.

Brown (1957) and Emery (1958) made a comprehensive survey of apomixis in the tribes Paniceae, Andropogoneae, Chlorideae, Eragrosteae, Papophoreae, Zoysieae and Aristideae. They also reported Paniceae and Andropogoneae are characterized by Apospory and Agamospory is more frequent in these two tribes.

Scanned by CamScanner

Brown (1958) suggested four additional types (Bambusiod, Arundinoid, Aristidoid and Chloridoid) of leaf blade anatomy. Sub family and tribal differences involve mainly the number and type of vascular bundles, sheath cells, the arrangement and type of cells of mesophyll and the type and location of plastids in cells of mesophyll and of the Parenchyma bundle sheath.

Metcalfe (1960) noted diagnostic sub family differences in the shape of subsidiary cells of the stomata and arrangement of long cells and short cells over the veins. Grasses of Festucoideae and those of Panicoideae have numerous differences between them and are used as a general standard of comparison for all grasses (Gould, 1969).

Grasses are considered to be originated from tropical region, evolving in the tropical forest – Savannah ecotone (Clayton and Renvoize, 1986). Bambusoideae was thought to most primitive by Stebbins (1982) and Clayton and Renvoize (1986), but Kellog and Campbell (1987) stated that it is shown by phyllogenetic analysis that sub families Pooideae, Bambusoideae, Panicoideae and possibly Chloridoideae are monophyletic and may be derived from prolyphylletc Arundiniodeae.

Most tribes of grasses are widely distributed and major sub Families i.e Pooideae, Bambusiodeae, Panicoideae. Arundinoideae and Chloridioadeae had evolved by the early tertiary and become wide spread before the major breakup of super continents during the tertiary (Hartley, 1964).

Metcalfe (1960) published a comprehensive work on the anatomy of family Gramineae that is considered a guideline by the researchers working on this line.

Dube *et al.*, (1987) studied 32 populations of *Festuca rubra* L. *Sensu lato* from salt marshes, coastal rocks, coastal sand, and anthropogenic sites in eastern Quebec and observed variations in their morphological and anatomical characters and concluded that character variation patterns are mainly related to ecological rather than geographical factors.

Chromosome number and morphological studies of 260 populations, belonging to 32 taxa of the genus Brachiaria from Indian Subcontinent were carried out by Basappa *et al.*, (1986).

Scanned by CamScanner

Chaudhary (1989) worked on the grasses of Saudi Arabia and gave a synopsis of Sub-families tribes, Sub tribes and genera of the family Gramineae following Clayton and Renvoize, 1986.

Lazarides *et al.*,(1991) described and illustrated a new monotypic genus (Clausospicula) from the Darwinand Gulf district, Northern Territory Australia on the basis of its cleistogamous spikelets, reduced panicles, racemes and spikelets.

Jones (1999) worked on the Biogeography of the grasses and low land grass lands of Southern Eastern Australia and observed that most wide spread of the endemic Australian grasses are the Triodinae subtribe of which Triodia is widespread in arid environments. Many other grasses appear to have migrated from Asia, such grasses present in temperate grass lands of South-eastern Australia include *Themeda, Dicanthium* and *Bothriochloa* of the Andropogoneae tribe, within Sub family Panicoideae.

Katewa *et al.,* (2001) pointed out ethnomedicinal and obnoxious grasses of India on the basis of local knowledge and information by local tribes.

Sahebi *et al.,* (2001) carried out investigations regarding quantitave, and morphological characters of 350 herbarium specimens from 35 Iranian populations of *Hordium murinum* S.L using morphological characters. Two taxonomic keys were made for the taxa in *Hordium murinum* S.L. Leaf anatomical features of three herbaceous bamboo species (Bambusoideae) were studied by Vieira *et al*., (2002).

Anatomical characters such as mid rib with complex vascular bundles and other leaf epidermal characters were observed that correspond to the bambusoid type of leaf anatomy. Saini *et al*., (2007) conducted experiment on four genotypes of *Cenchrus ciliaris*, two genotypes of *C. setigerus* and one genotype each *of Panicum maximum, P. Antidotale* and *Lasiuras scindicusin* Heryana (India). Investigations were carried out about morphological characters and nutritive value of the grasses and *C. ciliaris* was recommended as grass with most nutritional value for use in the arid regions of South Wet Heryana (India).

Lu *et al.,* (2003) observed the phytolith (Microscopic silica bodies) of 32 grass species that were collected from various coastal environments in south eastern U.S.A. (Georgia, Florada, and Louisiana) and a large diversity in the shape and types of phytoliths was observed in these

Scanned by CamScanner

grasses. Grasses from interdune meadow were found to have dumb bell as well as small cross and Cyperaceae type phytoliths, while saddle ellipsoid phytoliths were observed in grasses of coastal salt marshes.

A comprehensive study of leaf anatomy of *Aniselytron* Merr. and *Calamagrestics* (Adans) S.I. was conducted by Ma *et al*., (2005), to review the systematic status of *Aniselytron*. In the result of variations in anatomical characters in combination with the differences in spikelet structures and habitat, it was suggested that *Calamagrostis* S.I should be generally separated and not merged with *Calamagrostis*.

Kharazian (2006) evaluated leaf anatomical characters of 26 accessions of the *Aegilops* L. species. The results showed that anatomical characters had high variations. Length of epidermal hairs, prickles, width of sclerenchyma strands and number of strands were found to be distinguishing characters among these species and were important from taxonomic point of view. Leaf and sheath anatomy of *Austrostipa aristiglumis* was studied by Arriaga and Jacobs *et al.,(*2006). *Austrostipais* a stipoid grass that has normally xeromorphic characters, but studies showed that it has hydrophytous or amphibious characters and it was concluded that hydromorphic characters are adaptations that permit *A. aristiglumisto* maximize its growth, where a surplus amount of water is present.

Liu *et al., (*2005) examined the pollen morphology of *Eustachya tenera* by light scanning and transmission microscope. The studies showed that pollen grains are generally oblate spheroidal and with a single annulate aperture with an operculum. Ying *et al.,* (2006) carried out the leaf epidermal studies of 5 species of *Calamagrostis* and 26 species and one variety of *Deyexia* and no sharp differences were found between these two species.

Leaf epidermal studies of *Cymbopogon citrates* and *Cymbopogon giganteus* were conducted by Folorunso *et al.,* (2007). The aim of study was to determine the variations in epidermal characters of these species and assess their value in species identification and classification. Presence of sparsly distributed micro hairs and prickle hairs in *C. citrates* and papillae along side their long cells in *C. giganteus* were their distinguishing characters.

Delgado (2007) carried out investigations on the transverse sections of the mature flowering culms of Boutelouinae and it was suggested that there is close relationship between B. *eriopoda*

Scanned by CamScanner

and *B. eriostachya* and between *B. ramose* and *B. breviseta* and there is inclusion of satellite genera into Boutelona. Alvarez (2008) observed the ultra structural and anatomic characters of bulliform cells in *Loudetiopsis chrysothrix* (Nees) concert and *Tristachya leiostachya* Nees and it was suggested that bulliform cells are involved in foliar involution of these species.

Chaudhary and Sheikh (1968) worked on halophytic flora of West Pakistan and found that the grasses present in the inland dry saline area of Africa included *Cenchrus biflorus, C. ciliaris, Dicanthium annulatum, Eleusine flagellifera, Panicum antidotale, Sporobolus arabicus and Sporobolus marginatus.* It was observed that *Sporobolus arabicus* was the most salt resistant grass found in this area. Embryological studies of some grasses were carried out by Faruqi *et al.,(*1975), and it was observed that *Chrysopogan serrulatus, Cymbopogon parkeri, Dicanthium annulatum* and *Themeda anathera* exhibit apomixes and cytological and morphological polymorphism is present in these species.

Cope, (1982) described in Flora of Pakistan, five sub families of Poaceae i.e. Bambusoideae, Arundinoideae, Chloridoideae, Panicoideae and Pooideae along with the tribes and their key.

Sarir *et al.,(*1984) carried out investigations on the halophytes of Peshawar district and determined that grasses like *Desmostachya bipinnata, Saccharum spontaneum* and *Cynodon* have wide ecological range and prefer saline and saline sodic soils.Siddiqui and Qaisar (1988) conducted the palynological studies of 64 species of grasses with 40 genera, from Karachi, and it was found that family is stenopalynous, and the pollens are spheroidal, usually monoporate, rarely diporate, smooth, mostly annulate and operculate.

Cytomorphological and palynological studies of 17 different species of grasses from Lahore were conducted by Meo (1999). It was observed that Pollens of tetraploid and hexaploid species were larger in size as compared to those of diploid species.

Chaudhary *et al.,* (2001) studied the foliar epidermal anatomy of 4 species of grasses, i.e. *Cymbopogon citrates* DC. Stapf, *Cynodon dactylon* (L) Pers., *Panicum summatrense* Roeth ex Roem and Schult and *Vetiveria zizanoides* (L.) Nash. These taxa showed differences in short and long cells, silica bodies, macro and microhairs and shape of subsidiary cells and it was concluded that most of the characters are diagonostic and can be used for making keys.

Scanned by CamScanner

Gillani *et al.,* (2002) carried out leaf epidermal anatomical studies of selected *Digitaria* species and found it valuable in the identification of these species. *Digitaria* sp. showed differences in size and shape of prickles, short cells, silica bodies, microhairs with basal and distal cells, hooks, stomata and long cells.

Elahi *et al.,* (2002) evaluated the stem epidermis of six varieties of Saccharum officinarum. Results showed that all the varieties differed in anatomical characters with each other. Width and length of long cells, number and shape of cork cells, number of stomatas and number of rows of long cells were different in different varieties. Morphological characters of different.

Digitaria species from Pakistan were investigated by Gillani *et al.,*(2003). The aim was to know the taxonomic relationship between these *Digitaria* species. He identified a new sub species of *Digitaria sanguinalies* on the basis of presence of spines on the upper half margins of nerves of lower lemma only, while *D. sangunalis* had spines on the whole nerves of lower lemma.

Shaheen *et al.,(*2005) studied the pollen morphology of genus *Setaria,Cenchrus* and *Brachiaria* of tribe Paniceae observed a wide range of variations in pollen size and P/E ratio. Palynological studies of 20 species of grasses belonging to 14 genera were carried out by Parveen (2006). It was observed that pollen grains are mostly spheroidal, monoporate, rarely diporate, operculate or non operculate and it was concluded that pollen studies are helpful at the specific and generic level within the tribes.

Different accessions of *Cenchrus ciliaris* L. were collected from different habitats of Cholistan desert by Arshad *et al.,* (2007) and a wide range of morphological variations among there accessions was observed. It was suggested that germplasm of *Cenchrus ciliaris* L. in hot climate has high potential to survive against drought, salinity and high temperature stress.

Hameed *et al., (*2008) studied some salt tolerant forage grasses i.e. *Cynodon dactylon, Imperata cylandricaand Sporobolus arabicus* collected from saline habitats. *Sporobolas arabicus* was considered most salt tolerant grass followed by *C. dactylon* and *Imperata cylendrica.*

Akram *et al.,* (2008) conducted physiological studies on two populations of grasses i.e. *Cynodon dactylon* (L) Pers and *Cenchrus ciliaris* L. collected from Chattisgarh.

Scanned by CamScanner

MATERIALS AND METHODS

Scanned by CamScanner

3. MATERIALS AND METHODS

Chhattisgarh is the 26th state of our country established on November 1st 2000. It covers only 4.14% of the total area of country; it covers 44% of area with forests. Its unique topographical position makes the enormous diversity among Angiospermic plants. In recent years those neglected grassland have gained due importance in the study.

In Durg –Bhilai region, Bhilai is an industrial township of Chhattisgarh also it is famous for its lush greenery in their open and barren area. It lies between 21.10˚C north latitude and 81˚C - 20˚C east longitude. The area mainly receives the tropical climatic condition with very hot summer and moderate rain fall and short period of winters. The district has very rich plant diversity, including weed and grass species keeping these points in view the extensive field survey were under taken during the year 2014-15.

The study area is divided into three blocks namely Durg block, patan block and Dhamdha block. the durg-bhilai region covering an area of ------ km.

The study area covers urban and rural grassland vegetation. These includes Arjunda, Anda, gunderdehi, Dhamdha, Ahiwara, chhatagarh, Nandini mines area, kokha, dondhilohara, tedesara, Utai, Jamul, pairi, Chandkhuri, dhour, risama , nardha higna , girola , penderi tarai , mohlai, dargaon , hasda , bagdoomar, urla , khapri , karela , murmunda , kherda, surdung, Durg- Bhilai urban area eg- sector 1,2,3,4,5,6,7,8,9,10 Hudco, Talpuri , Adarsh Nagar, Station Para , Vidhuyt Nagar, Risali Area , Shanti Nagar Etc.

Method used for morphological observation and studies

Plant species has been collected from their natural habitats and make herbarium for study of habit, habitat , plant height, branching pattern , inflorescence , fruits leaves were also collected and preserve for future studies by using dissecting microscope,(Bausch and Lomb model w, new York) magnifiers of 10x and 20x were used for observation of various part of the plant. The data so far recorded in the results section as morphological description besides figures and plates. The morphological characters were further confirmed and authenticated with the help of floras and journals.

Scanned by CamScanner

Collection of Grasses

3.1 Collection and Preservation of Grasses

Frequent field trips were carried out to collect grasses in different seasons of the year. In total of -- species of grasses belonging to -- genera and --tribes were collected from different sites and habitats. All plant specimen were collected in triplicate and voucher number was allotted to plants. Date of collection, locality, habitat and colour of inflorescence and leaves were recorded during collection trips. Plants were dried and preserved by using standard herbarium techniques.

3.2 Morphological Studies

Detailed morphological study was carried out under dissecting binocular. Different morphological (vegetative and floral) characters were observed and confirmed by Flora. The following morphological characters of each species were studied .

3.2.1 Vegetative Characters

a) Habit: Annual or perennial, erect, prostrate or decumbent.

b) Culm: Plant height, pubescence of culms, texture of nodes and internodes.

c) Leaf: Shape, length and width, texture of lamina, colour and texture of leaf sheath, (glabrous, scabrid, open or folded). Length and shape of ligule (membranous, lacerate membranous, with ciliated fringe or white hairs).

3.3 Palynological Studies

3.3.1 Method of pollen study by light microscopy

Florets were dissected and anthers were placed on the slide with the help of forceps, added a drop of 45% acetic acid and crushed with iron rod. Pollen was acetolysed according to modified method of Ahmad et al., (2008), who followed Erdtman (1952). Stirred with needle for equal distribution of pollen, placed the cover slip and sealed the slide edges by transparent nail polish. Slides were labeled with their name, locality and voucher number. The slides were kept in wooden slide cases in vertical position.

3.3.2 Formation of Glycerin Jelly

Glycerin jelly was prepared according to modified methods of Ahmad et al., (2008). 50 ml of distilled water was taken in beaker and heated it on the hot plate. Add 35 g of gelatin when temperature of water raised to 70 – 80 C, it will appear as a thick solid matter,but as the

Scanned by CamScanner

temperature rises, it becomes a thick viscous liquid, keep this solution for 1 hour on hot plate and mix 35g of glycerin with few crystal of phenol. Then add 0.1% safranine by 1/8 volume with glycerin jelly, shake it till a uniform pink colour appeared and jelly was stabilized at room temperature. All the chemicals used were standard and purchased from Merck (Germany).

3.3.3 Pollen Parameters

Following pollen parameters were studied under light microscope for pollen morphology.

Qualitative characters

- Shape in polar view
- Shape in equatorial view
- Type of pollen and sculpturing

Quantitative characters

- Polar diameter
- Equatorial diameter
- P/E ratio
- No. of Pores

3.3.4 Pollen Fertility

To determine pollen fertility, acetocarmine and glycerin Jelly was used by the modified techniques used by Khan and Stace (1999). Anthers were squashed in a drop of acetocarmine. Debris was removed gently and cover slip was placed on it. The slides were observed at low magnification i.e. 10 x. The number of stained and unstained pollen were counted. Fully stained pollen were considered fertile while unstained and deformed pollen were considered sterile.

3.4. Preparation of pollen:

3.4.1 From anther

For identification of pollen grains isolated from honey and bee pollen loads, pollen slides from flowering species were prepared as refrences slides. For this anthers separated from filaments were put in distilled water and crushed with a glass rod. It is then sieved through a mesh of 100µ size. The pollen suspension was centrifuge at 3000rpm for 3 min and decanted the supernatant. Pollen pellet was subjected for acetolysis (Erdtman, 1960).

Scanned by CamScanner

OBSERVATIONS AND RESULTS

Scanned by CamScanner

4. RESULT AND DISCUSSION

Description of some grasses present in Durg – Bhilai Region

1. *Echinochloa colona* (L.) Link

Distribution in World: Widely spread in tropical Africa, Asia and Australia.

Occurrence and Habitat: Common weed of fields, and wet land, clay soil, moist clay soil.

Flowering: May – September

Morphological Description

An annual, erect or geniculately ascending, rooting at lower nodes, 65 – 80 cm tall; Leaf blades flat, 5 – 13 cm long, glabrous, scabrid at the margins; Ligule absent; Sheath glabrous, compressed; Inflorescence 4 – 6 cm long, composed of racemes on a central axis, main axis slightly puberulent, racemes 1 – 3 cm long, spikelets arranged in two to four rows on the rachis, 2.3 – 2.6 mm long, ovate, elliptic, hair, pubescent and cuspidate; Upper glume as long as spikelet, 7 nerved, pubescent, hairy on the back, cuspidate; Lower glume a little long or short than half of the length of spikelet, 3 – 5 nerved, oval, cuspidate, pubescent on the surface and at the margens; Upper lemma glabrous and glacuous; Upper palea enclosed by the incurved margins of its lemma, the tip of upper palea inflexed (bent); Upper floret bisexual; Lower lemma as long as the spikelet, 7 nerved, depressed in the middle, pubiscent, inflexed at the margins, its palea hyaline, 2 keeled, as long as spikelet or little shorter than spikelet; Anthers 0.4 – 0.5 mmlong ; Stigma 0.4 mm long, blackish; Caryopsis, 1.6 – 1.7 mm long, 0.9 mm wide, broad elliptic, dorsally flattened.

Palynology

Pollen are circular in polar view and prolate spheroidal in equatorial view. Polar diameter is 33 µm (30 – 35 µm) and equatorial diameter is 30.17 µm (27.5 – 32.5 µm). P/E ratio is 1.1. Pollen are endoporate or ectoporate and monoporate.

2. *Panicum antidotale* Retz

Distribution in World: Tropical Africa, Arabia, Iran, Afghanistan, Pakistan and India

Occurrence and Habitat: Present on banks of fields and on slopes, at the base of mountains, clay and stony clay soil.

Flowering: April – September

Scanned by CamScanner

Morphological Description

A tufted branched perennial, with woody root stock; Plant height more than 100 cm, branched; Leaf blades linear, 5 – 32 cm long, flat, 2 – 11.5 mm wide; Panicle pyramidal to ovate, 12 – 35 cm long; A pair of spikelets, one large and broad and other narrow and lanceolate; Large spikelet 2 mmlong, ovate oblong (staminate); Upper glume 1.8 – 1.9 mm long, 7 nerved, 1.2 mm wide, ovate and somewhat coriaciuos; Lower glume 1.2 – 1.4 mm long, broad ovate, acuminate, 3 nerved, hyaline, 1 mm wide; Lemma 7 nerved, coriacious; Palea thin membranous; Anthers 0.5 – 0.6 mm long.

Palynology

Pollen are circular in polar view and prolate spheroidal in equatorial view. Polar diameter is 24.70 µm (21.5 - 30 µm) and equatorial diameter is 24.5 µm (19.2 – 28.5 µm). P/E ratio is 1.0. Pollen are ectoporate and monoporate.

3. ***Paspalum paspaloides*** **(Michx.) Scribner**

Distribution in World: Widely distributed in tropical region.

Occurrence and Habitat: Common along margins of ponds, ditches, clay soil, sandy clay.

Flowering: April – November

Morphological Description

Creeping stoloniferous perennial, rooting at the nodes, nodes hairy, Culms 36 – 75 cm long; Leaf blades, 7 – 20 cm long, 3 – 45 mm wide, linear lanceolate, glabrous, flat, dentate at margins, rounded at the base; Ligule membranous, 0.6 – 1.4 mm long; Sheath glacuous, glabrous with whitish bands at the margins; Inflorescence having two racemes, 2.5 – 7.2 cm long, rachis flattened on the back, keeled on the axial side, keel narrowly winged and wavy; Spikelet ovate elliptic, 3 mm long, singly arranged in two rows on one side of rachis, two rows of spikelets separated by winged keel; Upper glume as long as the spikelet, 5 nerved, oval elliplic, membranous, puberulent and appressed; Lower glume present as a minute scale or absent; Upper lemma, 3 nerved, smooth, chartacious, inflexed at margins and clasping the palea at the margins; Upper palea having inflexed margins, almost equal in length to lemma, smooth; (Upper floret bisexual); Lower lemma similar in texture and shape to upper glume but is not puberulent, 5 nerved, as long as the spikelet, empty, its palea absent; (lower floret empty). Anthers, 0.9 mm

Scanned by CamScanner

long, yellowish, stigma blackish, 0.8 mm long, style whitish 0.8 mm long; Caryopsis 1.3 – 1.4 mm long, 0.7 mm wide, elliptic oblong.

Palynology

Pollen are circular in polar view and prolate spheroidal in equatorial view. Polar diameter is 36.53 µm (30 – 50 µm) and equatorial diameter is 32.75 µm (22.5-50 µm). P/E ratio is 1.11. Pollen are endoporate or ectoporate and monoporate.

4. *Eragrostis papposa* (Roem. & Schult.) Steud.

Distribution in World: Spain and North Africa, through the Middle East to India.

Occurrence and Habitat: Rare at the base of mountains, occasional at other places.

Flowering: April – October.

Morphological Description

A tufted perennial, up to 35 cm tall, erect or ascending; Internode length 2.2 – 4.4 cm, often short lived; Leaf blades 2.1 – 3 cm long, stiff, leaves usually forming a matted cushion at the base of the plants, flat or rolled; Ligule a ciliated fringe (0.1 – 0.2 mm long); Panicle open, dispersed, having spikelets on slender and long pedicels; Spikelets 5 – 5.5 mm long, 0.8 – 0.9 mm wide, oblong blackish or purplish, breaking up from the base towards the top, florets bisexual, rachilla persistent; Glumes unequal or subequal; Upper glume, 1 – 1.2 mm long, purplish,1 nerved, keeled, scabrid on the keel, hyaline, acute, ovate; Lower glume, 0.9 mm long, 1 nerved, hyaline, nerve reddish, keeled, scabrid on the keel, acute; Lemmas 0.9 – 1 mm long, 3 nerved, coriacious, obtuse, nerves not prominent, appressed to rachilla; Palea 0.9 mm long , 2 keeled, membranous to chartaceous; Stamens 3, anthers 0.1 – 0.2 mm long; Caryopsis 0.4 mm long, subglobose, somewhat rounded, light brown.

Palynology

Pollen are circular in polar view and sub oblate in equatorial view. Polar diameter is 19.2 µm (15 – 22.5 µm) and equatorial diameter is 22.5 µm (20 – 25 µm). P/E ratio is 0.85. Pollen are monoporate and endoporate.

Scanned by CamScanner

5. *Digitaria sanguinalis* (Linn.) Scop

Distribution in World: Warm temperate regions, throughout the world penetrating into tropics.

Occurrence and Habitat: Common near fields, rare on mountains, clay soil, red clay.

Flowering: June – September

Morphological Description

A loose growing green or purplish annual, 20 – 85 cm high; Culms mostly ascending from a bent or prostrate base, rooting from the lower nodes, hairless and glabrous at nodes; Leaf baldes 2.5 – 18 cm long, 3 – 5 mm wide, papillose hispid or with tubercle based hairs at the base, scabrid on the margins, narrow oblong; Ligule membranous, 1.5 – 3.0 mm long, sheath papillose hispid, (densely to sparsly hairy from minute tubercles) or glabrous; Inflorescence digitate having 3 – 6 racemes, culm terminating in inflorescence; Raceme 8 – 14 cm long, raceme axis 3 angled (triqueterous), scabrid on the angles, spikelets, 3 – 3.5 mm long, in pairs along one side of raceme, one spikelet in pair having short pedicel and other having long pedicel, falling entire at maturity, somewhat flattened, ovate ellipticto oblong elliptic; Upper glume shorter than spikelet, 2.5 – 3.0 mm long, 3 nerved, thick hairy at the outer surface, lanceolate to narrowly ovate; Lower glume minute, 0.2 mm long; Upper lemma as long as the spikelet, pointed, firm, except for the broad thin margins, folding over the back of the palea, smooth; Lower lemma as long as the spikelets, membranous at the margens, 7 nerved, hairy on the lateral nerves, nerves dark green, soft hairy between the lateral nerves, its palea minute; Lower floret barren; Anthers 0.7 – 0.8 mm long, filament filiform 1.2 – 1.3 mm long; Stigma 2, 05 – 1.0 mm long; Caryopsis oblong, 0.4 – 0.6 mm wide, 1.0 – 1.8 mm long.

Palynology

Pollen are circular in polar view and prolate spheroidal in equatorial view. Polar diameter is 31.97 µm (25 – 35 µm) and equatorial diameter is 31.16 µm (25 – 37.5µm). P/E ratio, 1.02. Pollen are ectoporate.

6. *Paspalidium flavidum* (Retz.)

Distribution in World: Tropical Asia

Occurrence and Habitat: Common along the road, at base of mountains, clay soil.

Flowering: July – October

Scanned by CamScanner

Morphological Description

Annuals or perennial; Culms 12 – 47 cm long , erect or shortly decumbent; The basal culm flattened and whitish at the base; Leaf blades 7 – 8.5 cm long, 0.5 – 0.7 mm wide, glabrous, scabrulous or dentate at the margins, stiff hairy at the base; Ligule a ciliated rim; Sheaths glacuous, glabrous, the basal sheaths compressed; Inflorescence 8.5 – 24 cm long, with racemes present at distance from eachother, rachis of raceme flexuous (zigzag) and flattened, 4–9 racemes present in alternate manner on inflorescence; The distance between the lower racemes more than the upper racemes, the distance of 4 – 5 cm between the lower racemes; The distance of 1 – 1.2 cm in the upper racemes, raceme length 1.2 – 1.7 cm (ascendingly more or less appressed to the axis); Spikelets in two rows on the rachis, 8 – 20 spikelets in a raceme, 2 – 2.5 mm long, gibbously globose; Upper glume 2 – 2.2 mm long, 1.8 – 1.9 mm wide, 7 nerved, broad ovate, membranous; Lower glume, 0.9 – 1.0 mm long, 0.7 mm wide, less than half of the length of spikelet, 2 – 3 nerved, membranous; Upper lemma granulose or ridged, coriacious, 5 nerved, glacuous, its palea similar and enclosed in its lemma; Lower lemma, chartaceous, 5 nerved,1.8 – 1.9 mm long, 1.7 mm wide, ovate, its palea hyaline, 2 keeled, margins inflexed; Anthers 3, 1 – 1.4 mm long, 0.3 – 0.4 mm wide, filament 0.7 mm long, whitish; Stigma 2, 1.7 –1.8 mm long; Caryopsis broad elliptic.

Palynology

Pollen are circular in polar view and prolate spheroidal in equatorial view. Polar diameter is 32.04 µm (27.5 – 37.5 µm) and equatorial diameter is 31.25 µm (30-35 µm). P/E ratio is 1.02. Pollen are endoporate or ectoporate and monoporate.

7. *Poa annua* Linn.

Distribution in World: Cosmopolitan, not present in hot climates and deserts.

Occurrence and Habitat: Common on moist shady soil, common near fields, sandy clay.

Flowering: March – November

Morphological Description

Tufted annual or short lived perennial, 15 – 22 cm long, having slender culms; Culms erect or decumbent; Leaf blades, 2 – 8 cm long, 2 – 3mm wide, flat and glabrous on the surface, and antrorsely scabrid at the margins, hooked or boat shaped at the tip; Ligule membranous 1.3 – 2.0 mm long; Sheath glacuous and glabrous, thin and membranous on the margins; Inflorescence 3.8

Scanned by CamScanner

– 7.0 mm long, open panicle, spikelets 3.5 – 5.5 mm long, lanceolate, having 3 – 4 florets, bisexual or unisexual florets, shed off above the glumes; Glumes unequal, persistent; Upper glume 1.7 – 2.9 mm long, 0.6 – 1.3 mm wide, 3 nerved, membranous, hyaline at the margins, keeled, scabrid on the keel, purplish at the tip margins; Lower glume 1.4 mm long, 0.2 – 0.5 mm wide,1 nerved, keeled, glabrous and obtuse at the tip, greenish except the margins; Lower floret 2.2 – 2.9 mm long, its lemma 5 nerved, hyaline at the margins, obtuse, keeled, wooly, hairy at the keel, hairy on the margins, wooly at the base of the back, and sparsly wooly at lateral nerves; Palea equal to or little shorter than lemma, 2 keeled, hairy on the keels, bifid at the tip, greenish at the margins, 0.7 – 1.0 mm long; Anthers,0.5-0.8 mm long; Caryopsis, 0.8 – 1.3 mm long,enclosed by the lemma and palea.

Palynology

Pollen are circular in polar view and oblate spheroidal in equatorial view. Polar diameter is 25.76 µm (22.5 – 27.5 µm) and equatorial diameter is 26.13 µm (22.5 - 30 µm). P/E ratio is 0.98. Pollen are ectoporate and monoporate.

8. *Aristida adscensionis* Linn.

Distribution in World: Throughout tropical Africa, India, introduced to the United States.

Occurrence and Habitat: Rare on the foot hills, common in waste places, rocky habitation.

Flowering: March - November.

Morphological Description

Annuals or perennials, culms 36 – 70 cm tall tufted, erect or geniculately ascending.Inter node length, 6.5 – 8.6 cm long, nodes glabrous; Leaf blades scabrid on the abaxial side and glabrous on the adaxial side, 5.5 – 20 cm long. 0.8 – 1.4 mm wide, convolute or expanded, pointed tips, acuminate; Ligule a fringe of small white hairs, 0.2 – 0.4 mm long;

Sheath open or folded, glacuous; Panicle contracted, branches filiform, spikelets 5.3 – 9.0 mm long excluding awns, having one floret, base of floret hairy; Glumes persistent, nerved, linear lanceolate, scarious; Upper Glume larger than lower glume, upper glume two toothed at the tip, greenish at nerves, purplish, folded at margins, scarious, linear lanceolate, 8 – 8.5 mm long; Lower glume 5.6 – 6.5 mm long, 1 nerved, folded at the margins, linear lanceolate, sometimes somewhat, red blackish; Lower glume scabird at the mid nerve, broader than upper glume;

Scanned by CamScanner

Lemma 5 – 8 mm long excluding awns, keeled, scabrid on the keels, having 3 awns, middle awn longer than lateral awns, lateral awn almost equal; Callus hairy, hair length 0.3 – 0.5 mm long; Middle awn,19 – 23 cm long, lateral awns, 15 – 20 mm long; Palea 0.6 mm long, thin; Anthers 3, thin sagitate, upto 1.9 mm long; Stigma 0.9 – 1.1 mm long, plumose; caryopsis hard, 6.5 – 7.0 mm long and narrow.

Palynology

Pollen are circular in polar view and sub prolate in equatorial view, polar diameter is 27 µm (20 – 30 µm) and equatorial diameter is 22 µm (17.5 – 25.4 µm) and P/E ratio is 1.22. Pollen are monoporate or diporate and ectoporate.

9. *Cynodon dactylon* (Linn.) Pers.

Distribution in World: Tropical and warm temperate regions, throughout the world.

Occurrence and Habitat: Common, present throughout the area, clay, sandy clay.

Flowering: Mostly March – November. All year around.

Morphological Description

A rhizomatous stoloniferous often with spiny suckers, perennial grass, rooting at nodes; Culms slender, 20 – 32 cm tall; Leaf blades, flat, linear, lanceolate, distichous, acute, narrow pointed at the tip, 3.2 – 8.5 cm long, 1.5 – 1.7 mm wide, auriculate; Ligule a short ciliolate rim, 0.2 – 0.3 mm long; Sheath slightly membranous at margins, hairy at tip, 0.4 – 1 mm long; Inflorescence digitate, having 4 – 5 spikes, inflorescence at the tip of culm, soft hairy whorl at the base of inflorencence; Spikes somewhat curved, spikes 2 – 4.7 cm long, spikelets on one side of rachis, having one floret, slightly purplish, 1.9 – 2.3 mm long, sessile, oblong; Glumes unequal, upper glume,1.3 – 1.8 mm long, 1 nerved, lanceolate, lower glume 1 – 1.5 mm long, 1 nerved, lanceolate; Lemma 1.8 – 2.0 mm long, 3 nerved, keeled, ovate, oblong ovate in side view, hairy on the keel; Palea equal to lemma in length, 2 keeled, slightly scabrid on the keel, sometimes purplish, boat shaped; Anthers 0.9 – 1 mm long, style 0.2 – 0.4 mm; Caryopsis oblong.

Palynology

Pollen are circular in polar view and spheroidal to sub prolate in equatorial view. Polar diameter is 22.5 µm (15 – 22.5 µm) and equatorial diameter is 19.54 µm (15 – 22.5 µm). P/E ratio is 1.15 and pollen are monoporate or diporate and ectoporate or endoporate.

Scanned by CamScanner

10. *Dactyloctenium scindicum* Boiss.

Distribution in World: Kenya, North to Sudan, and East wards to North West India.

Occurrence and Habitat: Common on mountain slopes. Sandy clay soil.

Flowering: July - September

Morphological Description

A stoloniferous, perennial grass, forming extensive spreading mats, rooting at the nodes, culms 22- 36 cm long, erect, internode length, 5.8 – 10.0 cm long; Leaf blades 3 – 6 cm long,1.3 – 1.5 mm wide, pappilose hispid on the both sides, and on the margins (hair length, 1 – 2.5 mm wide); Ligule membranous, 0.2 – 0.5 mm long, sheath membranous at the margins, sometimes stiff bristles present on the upper side; Inflorescence of 4 – 5, digitate, short, 0.5 – 1.2cm long, falcate (sickle shaped) spikes, disarticulating from the top of the culm at maturity; Spikes secund, pointed at the tip, rachis extended into tip, spikelet 3– 3.2 mm long, 3 – 9 flowered; Glumes subequal or upper glume slightly larger than lower glume; Upper glume ovoid, elliptic, 1 – 2 mm long, keeled, the keel of the upper glume extended into scabrid awn (awn length 0.6 – 0.9 mm long); Lower glume 0.8 – 1.5 mm long, 0.5 mm wide, keeled, scabrid on the keel; Lemmas 3 nerved, with a short mucro, lateral nerves obscure, keeled, scabrid on the keel, 2.5 mm long, 1.5 mm wide, hyaline, broad ovate, translucent; paleas with 2 lateral keels, keels scabrid, membranous, somewhat mucronate, Anthers 3, digitate, 1 – 1.3 mm long, 0.2 – 0.3 mm wide; Caryopsis, upto 1 mm long, transversely rugose.

Palynology

Pollen are circular in polar view and oblate spheroidal in equatorial view. Polar diameter is 29.79 µm (27.5 – 32.5 µm) and equatorial diameter is 30 µm (22.5 – 37.5 µm). P/E ratio is 0.99. Pollen are endoporate and monoporate.

11. *Desmostachya bipinnata* (Linn.) Stapf.

Distribution in World: Throughout the middle East to India, China, North and Tropical Africa.

Occurrence and Habitat: Common in warm places, near fields, along road, mountains slopes.

Flowering: June – October

Scanned by CamScanner

Morphological Description

A robust, coarse perennial grass, upto more than 1 meter tall, culms stout, scaly rhizomes, and forming large swards; Inter node length 5.8 – 10 cm long; Leaf blades 12 – 72 cm long, 4 – 7 mm wide, stiff and hard, linear, convolute or flat, acute; Ligule lacerate membranous, 0.7 – 0.8 mm long; Sheath coriacious, glabrous; Inflorescence, a strict, narrow erect panicle of densely clustered or spaced ascending or spreading spikes; Spikes secund, falling entire, 0.5 – 2 cm long, spikelets 2.5 – 3.5 mm long, laterally compressed, narrowly ovate to linear oblong, having 4 – 3 florets; Upper glume larger than lower glume, upper glume, 0.7 – 1.4 mm long, keeled, 1 nerved, scabird on the keel, somewhat coriacious lanceolate, membranous, 0.7 mm wide, when unfolded; Lower glume 0.4 – 0.6 mm long, 1 nerved, membranous, lanceolate; Lemmas, 1.4 – 1.7 mm long, coriacious, glabrous, 3 nerved, keeled, lateral nerves not extended throughout the lemma, lanceolate when folded; Palea, 1.3 – 1.5 mm long, 2 keeled, scabrid on the keel, hyaline, membranous; Anthers 0.6 – 0.8 mm long, stigma whitish, 0.3 – 0.4 mm long, style 0.3 mm long; Caryopsis obliquely ovoid, compressed.

Palynology

Pollen are circular in polar view and spheroidal to prolate spheroidal in equatorial view. Polar diameter is 19.73 µm (15 – 30 µm) and equatorial diameter is 18.4 µm (15 – 25 µm), P/E ratio is 1.07. Pollen are monoporate and endoporate.

12. *Eleusine indica* (Linn.) Gaertn.

Distribution in World: Tropical and subtropical regions, throughout the world.

Occurrence and Habitat: Common on shady places and near fields, wet clay sandy soil.

Flowering: June - November

Morphological Description

Annuals, culms tufted, 26 – 32 cm tall, flattened; Inter node length, 5.5 – 7.5 cm; Leaf blades 13 – 25 cm long, 2.4 – 3.9 mm wide, usually folded or flate; Ligule lacerate membranous, 0.7 – 0.8 mm long, stiff hairy (hispid) on margins; Sheath keeled, hispid at margins, near ligule, thin membranous at the margins; Inflorescence of usually 3 – 4 digitate spikes, often one spike located below the cluster spikes, secund, 4 – 11 cm long , spikelets laterally compressed, (look like a closed zipper), elliptic, having 5 florets; Glumes unequal,upper glume, 1.4 – 2.5 mm long, 0.7 – 0.9 mm wide, 3 – 6 nerved, oblong ovate, scabrid on the keel, lower glume, 2 – 2.4 mm

Scanned by CamScanner

long, keeled, 1 nerved, thin membranous (hyaline), acute, keels slightly winged, scabrid on the keel; Lemmas 3 nerved, 2.4 – 1.6 mm long, 1 mid nerve and two lateral nerves, lateral nerves not prominent, two nerves closed to the keel on either side; Palea narrowly oblong, 2mm long, 2 keeled, scabrid on the keel; Florets bisexual or unisexual; Anthers purplish 0.3 – 0.4 mm long, stigma 0.3 – 0.5 mm long, style 0.2 mm long, plumose, sometimes reddesh; Caryopsis blackish, enclosed in a hyaline pericarp, 1 – 1.5 mm long, rugose, triqueterous.

Palynology

Pollen are circular in polar view and spheroidal to sub oblate in equatorial view. Polar diameter is 25 µm (20 – 35 µm) and equatorial diameter is 30.7 µm (25 – 35 µm). P/E ratio is 0.81. Pollen are monoporate and ectoporae or endoporate.

13. *Eragrastis cilianensis* (All.) Lut.Ex F.T. Hubbard

Distribution in World: Tropical and Warm temperae regions.

Occurrence and Habitat: Common in irrigated fields, rare on mountains, clay soil.

Flowering: March – October

Morphological Description

Annual herbs, culms tufted, 28 – 46 cm tall, erect or geniculately ascending; Internode length, 3 – 8.5 cm, nodes glabrous; Leaf blades, 3.5 – 17 cm long, 2.5 – 3.5 mm wide, base of the leaves sometimes, hirsute, glandular at margins,(with warty glands along the margins), mostly glabrous; Ligule, a ciliated fringe (hairy on the margins), 0.5 mm long; Sheath open and glabrous; Panicle, 8.5 – 18.5 cm long, effuse or contracted, small spikelets at the base of inflorescence, and larger at the top, spikelets, 4 – 8 mm long, 1.5 mm wide, narrow, oval and oblong, laterally compressed, sometimes purplish green; Upper glume slightly larger than lower glume, upper glume 1.3 – 1.6 mm long, keeled (keel slightly winged, scabrid on the keel, 1 nerved, purplish on one side, hyaline, acute, ovate elliptic; Lower glume, 1.0 – 1.3 mm long, hyaline,1 nerved, keeled, scabrid on the keel, acute; Lemmas, 1.3 – 1.6 mm long, 3 nerved, keeled, blunt at tip, chartaceous, somewhat ovate; Palea persistent, membranous to hyaline, 1 – 1.4 mm long, 2 keeled, scabrid on the keel; Stamens 3, anthers pale whitish, 0.15 – 0.2 mm long; Caryopsis 0.5 – 0.6 mm long, 0.3 mm wide, broad oblong or sub globose, dark reddish brown, present between lemma and palea.

Scanned by CamScanner

long, keeled, 1 nerved, thin membranous (hyaline), acute, keels slightly winged, scabrid on the keel; Lemmas 3 nerved, 2.4 – 1.6 mm long, 1 mid nerve and two lateral nerves, lateral nerves not prominent, two nerves closed to the keel on either side; Palea narrowly oblong, 2mm long, 2 keeled, scabrid on the keel; Florets bisexual or unisexual; Anthers purplish 0.3 – 0.4 mm long, stigma 0.3 – 0.5 mm long, style 0.2 mm long, plumose, sometimes reddesh; Caryopsis blackish, enclosed in a hyaline pericarp, 1 – 1.5 mm long, rugose, triqueterous.

Palynology

Pollen are circular in polar view and spheroidal to sub oblate in equatorial view. Polar diameter is 25 µm (20 – 35 µm) and equatorial diameter is 30.7 µm (25 – 35 µm). P/E ratio is 0.81. Pollen are monoporate and ectoporae or endoporate.

13. *Eragrastis cilianensis* (All.) Lut.Ex F.T. Hubbard

Distribution in World: Tropical and Warm temperae regions.

Occurrence and Habitat: Common in irrigated fields, rare on mountains, clay soil.

Flowering: March – October

Morphological Description

Annual herbs, culms tufted, 28 – 46 cm tall, erect or geniculately ascending; Internode length, 3 – 8.5 cm, nodes glabrous; Leaf blades, 3.5 – 17 cm long, 2.5 – 3.5 mm wide, base of the leaves sometimes, hirsute, glandular at margins,(with warty glands along the margins), mostly glabrous; Ligule, a ciliated fringe (hairy on the margins), 0.5 mm long; Sheath open and glabrous; Panicle, 8.5 – 18.5 cm long, effuse or contracted, small spikelets at the base of inflorescence, and larger at the top, spikelets, 4 – 8 mm long, 1.5 mm wide, narrow, oval and oblong, laterally compressed, sometimes purplish green; Upper glume slightly larger than lower glume, upper glume 1.3 – 1.6 mm long, keeled (keel slightly winged, scabrid on the keel, 1 nerved, purplish on one side, hyaline, acute, ovate elliptic; Lower glume, 1.0 – 1.3 mm long, hyaline,1 nerved, keeled, scabrid on the keel, acute; Lemmas, 1.3 – 1.6 mm long, 3 nerved, keeled, blunt at tip, chartaceous, somewhat ovate; Palea persistent, membranous to hyaline, 1 – 1.4 mm long, 2 keeled, scabrid on the keel; Stamens 3, anthers pale whitish, 0.15 – 0.2 mm long; Caryopsis 0.5 – 0.6 mm long, 0.3 mm wide, broad oblong or sub globose, dark reddish brown, present between lemma and palea.

Scanned by CamScanner

Palynology

Pollen are circular to spherical in polar view and prolate spheroidal in equatorial view. Polar diameter is 21.25 µm (15 – 25 µm) and equatorial diameter is 20 µm (17.5 – 25 µm). P/E ratio is 1.06. Pollen are monoporate and endoporate.

14. *Cymbopogon jwarancusa* (Jones.) Schult

Distribution in World: India, main Nepal, North east tropical Africa, Arabia, China.

Occurance and Habitat: Common on mountains, rare on edges of fields, sandy clay soil.

Flowering: April - November

Morphological Description

Rhizomatous perennial, tufted at the base, erect or geniculately ascending, 43 – 80 cm high; Leaf blades aromatic when chewed, green to reddish & brick reddish, 6.5 – 53 cm long, filiform, dentate at the margins, glacuous and glabrous on the surface, 2 – 3 mm wide, sometimes stiff hairy at the margins and base; Ligule membranous, 1.2 – 2.5 mm long, the basal sheaths whitish and flat, glacuous and glabrous, whitish at the margins; A false panicle, spatheolate, 13 – 23.5 cm long, racemes upto 17 mm long, the rachis and pedicels densely ciliated a the margins; A pair of spikelets, one sessile and other pedicelled, sessile spikelet bisexual or female, 3.5 – 5.6 mm long, lanceolate, densely ciliated at the base; Upper glume 3.5 – 5.4 mm long, 0.8 – 1.5 mm wide, boat shaped with compressed keel, scabird on the keel, purplish on the lower side, bifid at the tip, glabrous, membranous to cartilaginous. Lower glume, as long as the spikelet, chartacious, 2 keeled, concave on the back, margins folded inwards, dentate on the front margins, 0.5 – 0.8 mm wide, bifid at the tip, tapering towards the apex, nerves appear from the middle to the top, two nerves in the middle, and two thick nerves at margins (4 nerved); Upper lemma 2 – 3 mm long, hyaline, narrow, 1 nerved, membranous, about 2mm wide, having glabrous awn, 5 – 9.5 mm long, appearing from the sinus; Lower lemma hyaline, tightly overlapped by lower glume, slightly shorter than lower glume, 0.4– 0.5 mm wide, enclosing the flower. Pedicelled spikelet male or barren, 3 – 6.0 mm long, awnless, not depressed on the back, lanceolate with long dense cilia at the margins of pedical; Upper glume 3.5 – 4.8 mm long, lanceolate, 1 nerved, membranous, folded at the margins, greenish, 3 nerved, chartaceous, several nerved but nerves not prominent, dentate at margins; Lower glume, as long as the spikelet, lanceolate, hairy at the margins, greenish in the middle and whitish at the margins,

Scanned by CamScanner

chartaceous to cartilaginous, folded at the margins, dentate at the front tip; Upper lemma hyaline, just under the upper glume, 2.5 – 3.8 mm long, 0.5 – 0.8 mm wide, when unfolded at margins, oblong, acute; Lower lemma hyaline, 3.0 – 4.7 mm long, 0.5 – 0.6 mm wide; Anthers 1 – 2.3 mm long, stigma, 1.2 – 1.6 mm long, purplish.

Palynology

Pollen are circular in polar view and prolate spheroidal in equatorial view. Polar diameter is 27.69 µm (22.5 – 32.5 µm) and equatorial diameter is 25.86 µm (22.5 – 30 µm). P/E ratio is 1.07. Pollen are monoporate or diporate.

15. *Dicanthium foveolatum* (Del.) Roberty

Distribution in World: North Africa, Eastern Africa, Middle East, Pakistan and India.

Occurance and Habitat: Common on mountains, clay soil, sandy rocky soil, sandy clay.

Flowering: March - September

Morphological Description

A tufted perennial grass, culms slander and ascending, from a few cm to 60 cm, tall, nodes hairy (a whorl of soft hairs); Leaf blades 3.5 – 12.5 cm long, tubercle based stiff hairs at the margin and near the base, 1.8 – 2.5 mm wide, folded and scabrid at the margins, narrow, linear, pointed at the tip; Ligule a lacerate membranous, 1 mm long; Sheath whitish and glabrous above, basal sheaths silky hairy, glacuous and whitish; Inflorescence of solitary narrow spike, some spikes may be subtended by a spatheole, spikes 1.5 – 3.5 cm long; A pair of spikelets, one sessile and other pedicelled, sessile spikelet perfect (bisexual) or male, 2.2 – 3.0 mm long; Upper glume 2.4 – 2.8 mm long, 0.5 mm wide, membranous, folded at the margins, acute or acuminate, having no pit; Lower glume 2.3 – 2.4 mm long with a circular pit above the middle, elliptic, acute, cartilaginous, glacuous and glabrous, folded at the margins, 0.4 mm wide, two nerves originating above the pit; Upper lemma as long as the upper glume, not differentiated easily from the awn, hyaline and narrow, green, upto 2 mm long, awn length 12 – 17.5 mm long; Lower lemma 1.5 mm long, 0.2 mm wide, hyaline; Stamens 3, anthers 0.7 – 1.3 mm long, stigma 2, 1 – 1.2 mm long, plumose, dark brown; Pedicelled spikelet, slightly purplish, male or bisexual, beared at the base, 2.1 – 3.4 mm long; Upper glume, 2.9 – 3.2 mm long, 0.9 mm wide, 3 nerved, 1 nerve apparent in the middle, folded at margins, narrow, elliptic and acute; Lower glume 2.6 mm long, 7 nerved, 3 lateral nerves on each side and mid nerve passing through the pit, acute and hairy at

Scanned by CamScanner

the ends of stolons. A single plant can produce new tubers within a period of one year in the tropical areas. Aerial stems 12 to 42 cm long, glabrous, triquetrous, erect, dilated at the base. Leaves many, 7.6-41 x 0.2-0.5 cm, linear, flat, scabrous towards the aprx, sheaths truncate at the mouth. Inflorescene compound unber, involucral bracts 3 to 4 in number, 3.5- 10 x 0.2-0.3 cm. onger than the inflorescence, leaf-like, linear, margins minutely scabrous. Spikelets (3-5)- 18-36 x 1-1.5 mm, linear-oblong, distichous, flat, 6-34- flowered, rachilla winged, glumes 3-3.5 x 1.5-2.5 mm, ovate,, obtuse or slightly speculate, 5-7 nerved, margins hyaline. Stamen 3, style 3-branched, braches longer than the style, blabrous. Nut 1.2-1.5 x 0.5-0.8 mm, trigonous, ovoid oblong; black.

Palynology

Pollen monad, monoporate, radially symmetrical and isopolar. In equatorial view, shape of the pollen apple shaped to rectangular and in polar view the pollen is circular to intersemiangular. Size of pollen in polar axis is 28.33 µm (25-30 µm) and in equatorial diameter 35 µm (32.50-40 µm). The exine thickness 2.41 µm (2.25-25 µm). The P/E ratio 0.81 µm. Sculpturing foveolate. The depressions are minute and uniforate.

28. *Cyperus alopecuroides* L.

Distribution in World: In the cooler regions of the old world, West Indies, Malayasia.

Occurrence and Habitat: Common in shady places, under the shade of trees, common in fields.

Flowering: April – September

Morphological Description

Perennial, tufted with short rhizome. Aerial stem up to 140 cm long and 3 to 7 mm diameter, trigonous, smooth. Leaves up to as long as stem; sheaths up to 35 cm, leaf blade up to 60 cm long and up to 10 mm broad, keeled, apex trigonous, scabrous. Inflorescence a compound umbel; involucral bracts up to 5-7, leaf like, up to as long and as wide as leaf, primary branches 8-12; secondary branches up to 5-7, leaf like, up to as long and as wide as leaf, primary branches 8-12; secondary branches up to more than 10, with several foliose bracts; some primary and most secondary branches ending with cluster of spikes, sometimes with small teritry anthelodia; cluster of spikes 2-6 x 1-2 cm, each cluster with 70 spirally arranged spikes; spikes 5-15 x 1.5 mm, compressed; glumes 2 mm, keeled, midnerve strong, greenish, side yellowish or grey, with

Scanned by CamScanner

reddish brown stripes, margins narrowly scarious, stamens 2, stigmas 2 or 3. Nut elliptic to obovate-oval, biconvex, slightly flattened (or obcompressed-trigonous in tricapellary pistil), yellowish brown, finely reticulate or almost smooth.

Palynology

Pollen monad, monoporate, radially symmetrical and isopolar. In equatorial view, shape of pollen prolate and in polar view the pollen circular to angular and intersemiangular. Polar diameter 19.16 µm (17.5-22.5 µm) and in equatorial diameter 21.66 µm (20-22.5 µm), the exine thickness 1 µm (0.75-1.25 µm). The P/E ratio 0.90 µm.

29. *Cyperus difformis* L.

Distribution in World: Pakistan, West Indies, Malayasia, Thar Parkar and Kashmir.

Occurrence and Habitat: Common in shady places, under the shade of trees, common in fields.

Flowering: July to December

Morphological Description

Annual herb with fibrous roots. Aerial stems 48-64 cm tall, sharply triquetrous, soft, glabropus. Leaves sessile, sheathed, 3-10 x 0.1 -0.15 cm, leaf blade linear, glabrous, sheaths closed, surrounding the stems bases. Inflorescence umbellate; rays 5-8 in number, 0.5-3 cm long, each bearing a congested head of small sessile spikelets; involucral bracts 3-4 in number, 6.25-10 x 0.15-0.4 cm, longer than the inflorescence, linear oblong, mid vein and margins scabrous. Spikelets 3-4 x 1 mm, suborbicular, margins hyaline. Stamen 1; style 3-branched. Nut 0.5-0.6 x 0.3-0.4 mm, obvoid-ellipsoid, trigonous, yellowish-brown.

Palynology

Pollen monad, monoporate, radially symmetrical and isopolar. In equatorial view, shape of the pollen apple shape to rhomboidal and in polar view the pollen circular to rhomboidal. Polar diameter 30.25 µm (28-32 µm). Equatorial diameter 28.75 µm (27.50-32.5 µm). Exine thickness 2.15 µm (1.75-2.5 µm). P/E ratio 1.05 µm.

30. *Cyperus niveus* Retz.

Distribution in World: India, Kashmir, Burma, Sri Lanka, introduced to tropical Africa.

Occurrence and Habitat: Common in Shady places, wet sandy Soil, wet sandy clay soil.

Scanned by CamScanner

Scanned by CamScanner

Table 2: Occurrence of Grassland Vegetation of Durg Bhilai Region List of Trees/Sr trees/Shrubs

S.N.	Name	Vernacular Name	Family
1.	*Ziziphus mauritiana*	Ber	Rhamanaceae
2.	*Madhuca indica* G. md.	Mahua	Sapotaceae
3.	*Acacia Nilotica* L (Wild)	Babool	Fabaceae
4.	*Mengifera Indica* L	Aam	Anacardiaceae
5.	*Ficus hipsida* F.	Gobla	Moraceae
6.	*Ficus recemosus* L	Goolar	Moraceae
7.	*Acacia lecophloea* Wild	Safed Babool	Fabaceae
8.	*Diospyrous melenoxylon* Roxb.	Tendu	Ebenaceae
9.	*D. cardifolia* Roxb.	Lasoda	Ebenaceae
10.	*Bahunia verigata* L.	Kachnar	Fabaceae
11.	*Pongamia pinnata* Pierre	Karanj	Fabaceae
12.	*Butea monosperma* Lam. (Taub.)	Palash	Fabaceae
13	*Terminalia arjuna* Roxb.	Arjun	Fabaceae
14.	*Vitex nirgundo* L.	Lagundi	Verbinaceae
15.	*Gmelina arborea* L	Teak	Lamiaceae
16.	*Lagerstroemia parvifolia*	Saona	Lytheraceae
17.	*Helicterus isora* Linn	Marod fali	Malvaceae
18.	*Terminalia belirica* , Roxb.	Bahera	Combritaceae
19.	*Semecarpus anacardium*, L.F.	Bhilawa	Combretaceae
20.	*Azadirecta indica*, A. Juss.	Neem	Meliaceae
21.	*Morus alba* L.	Malbary	Moraceae
22.	*Termerindus indica* LRLC	Imli	Fabaceae
23.	*Diospras peniculata* L.	Amarus	Ebenaceae
24.	*Emblica officinalis* Gareth	Amla	Fabaceae
25.	*Ficus religiosa* L.	Peepal	Moraceae
26.	*Albizia lablab* L.	Siris	Fabaceae
27.	*Syzygium cumini* L. (Sheels)	Jamun	Myrataceae

Scanned by CamScanner

Leafflower	Euphorbiaceae
Maxican daisy	Astetraceae
Gorakhmundi	Astetraceae
Kasamarda	Fabaceae
Anshumati	Fabaceae
Giloi	Menispermeae
Nir bhramhi	Scrophulariaceae
Punarnava	Nyctaginaceae
-	Astetraceae
Gokhru	Asteraceae
Bhring raj	Asteraceae

Scanned by CamScanner

47.	*Indigofera tinctoria* L.	Nil	Fabaceae
48.	*Hiptis sauveoleus* L.	Wilayati tulsi	Lamiaceae
49.	*Convolvulus pluricaulis* L.	-	Convonvulaceae
50.	*Convolvulus alsiucrides* L.	-	Convonvulaceae
51.	*Casia alata* L.	-	Fabaceae
52.	*Chenopodium albam* L.	Bathua	Chenopodiaceae
53.	*Merremia emarginata* Hall	Junglee Mung	Fabaceae
54.	*Ruellia tuberose* L.	-	Fabaceae
55.	*Leucas cephalotus* spebh	Guma	Lamiaceae
56.	*Swertia chirayata*	Chirayata	Gentiaceae
57.	*Evalvulus alisnoides*	Shyamakranta	Convonvulaceae
58.	*Mimosa pudica*	Chhuimui	Fabaceae
59.	*Alternanthera sessilis* L.	Garundi	Amaranthaceae
60.	*Ricinus communis* L.	Arandi	Euphorbiaceae

Table 4: List of Endangered Grasses of Durg- Bhilai Region

SN	Name of Species	Rural	Urban
1.	*Anthraxon lancifolius* Hoschst.	NT	NT
2.	*Aristida adscensionis* Linn.	VU	VU
3.	*Aristida adscemion* Linn	NT	NT
4.	*Carex glucina*	VU	EN
5.	*Carex stipata*	EN	EN
6.	*Cenchrus biflorus* Roxb.	VU	VU
7.	*Cenchrus ciliaris*	VU	VU
8.	*Cymbopogon jwarancusa* (Jones.) Schult	LC	LC
9.	*Cyperus cephaloter*	EN	VU
10.	*C. helpan*	VU	VU
11.	*C. pilosus*	VU	VU
12.	*C. malaccinsis*	VU	VU
13.	*C. stoloniferus*	VU	EN
14.	*C. halpan* L.	VU	EN
15.	*C. cephalotes* vahl.	NT	NT
16.	*C. compressus* L.	NT	NT
17.	*C. arenarius Retz.*	VU	EN
18.	*C. castaneus wild*	EN	EN
19.	*C. cnalaccensis* Lam.	EN	EN
20.	*C. invouratus*	NT	EN
21.	*C.pangorei* (Roth.)	VU	EN
22.	*C. pangorei*	VU	EN
23.	*C. juncoides* Lam.	VU	NT
24.	*C. pangorei*	NT	NT
25.	*C. juncoides* (Lam)	LC	LC
26.	*C. iria* (L)	NT	NT
27.	*C. diffuses* vahl	LC	LC

Scanned by CamScanner

Eragrostis papposa	NT	NT
Eleochanis obtesa	NT	NT
Fimbristylis milicea (LAM)	NT	NT
Heteropogon contortus	NT	NT
Panicum antidotale Retz	LC	LC

Scanned by CamScanner

DISCUSSION

Scanned by CamScanner

DISCUSSION

Grasses a natural homogenous group of plants belong to family Poaceae and form one of the most fascinating families of flowering plants, with a wide range of diversity. They play a significant role in the lives of humans and animals. The members of this group are present in all the conceivable habitats suitable for the growth of the plant communities. In India, the Gramineae is one of the dominant families, both on the the basis of its number of genera and species (Mitra and Mukherjee, 2004). The members of this family are present in all climates and regions. Grass lands, which make up 20% of the world's vegetation cover, are composed of the members of Poaceae (Ture and Bocuk, 2007). According to Cope (1982) there are about 620 genera, 10,000 species and about 60 tribes in the world. Olorade (1984) has mentioned 660 genera and 9000 species. There are about 10,000 species and 651 genera of grasses in the world (Clayton and Renvoize, 1986). Clayton and Renvoize (1986) nominated six main sub families in the family Poaceae, although the origins of these groups, their relationship and even constituent memberships still remain to be determined (Soderstrom et al, 1987).

Morphological characters provide useful information for the identification of all levels of taxonomic ranks (families, tribes, genera and species, etc). Many taxa of flowering plants have been distinguished on the basis of morphological characters only. Inflorescence and floral characters are generally considered to be more reliable than vegetative characters in grass systematic. Floral characters such astype of inflorescence, number of spikelets per inflorescence, number of florets per spikelet, spikelet length, pedicel length, glume length, lemma length, number of veins on lemma and glumes, shape and texture of glumes and lemma, awn length, position of awn on lemma, number and length of anthers, size and shape of caryopsis have been used to recognize various grass taxa.

Vegetative characters such as plant habit (annual or perennial) nature of rhizomes, etc, culm height, leaf blade length and width, pubescence of leaf, nature of leaf sheath and ligule have been widely used in species differentiation. The collective use of floral and vegetative morphological characters is an essential basis for a complete and natural classification.

In this study morphological markers were used for the identification of grasses and to correlate them at the species, genus and tribe level. However some additional morphological characters

Scanned by CamScanner

such as length, width and number of anthers and stigma, shape and size of caryopsis were also studied which are not mentioned in the Flora of India.

Pollen morphology has proved to be a valuable tool in plant taxonomy. Pollen morphology was not considered in the earlier taxonomic studies and it was difficult to identify grasses merely on the basis of palynology in the past. Palynology can be helpful in solving problems related to grass systematics and palynological studiescan provide basis for additional features for identification of plant species (Aftab & Parveen, 2006). Pollen morphology of grasses has been studied by Kohler and Lange (1979), Chaturvedi *et al.*, (1994, 1998) and Ma *et al.*, (2001). In the present studies both qualitative and quantitative characters of pollen were studied, as some characters such as grain size and sexine pattern are of significance in taxonomy of grasses (Woodehouse, 1935). Firbas (1937) used the grain size as a basic character to separate wild and cultivated grasses.

4.1 Tribe: Aristideae

This tribe has 3 genera in the world found in tropics and sub tropics, growing in dry climates on poor soil. Two genera *Aristida* with 7 species are present in India. In Durg Bhilai region one species of *Aristida* i.e. *Aristida adscensionisis* present this habitat. According to Chaudhary (2001) there are 2 species of *Arstida* in Chhattisgarh but in my observation there is only one species in this area.

4.1.1 Morphology

The tribe Aristideae can be distinguished by the presence of 3 awns. Ligule is a fringe of small white hairs ranging in length from 0.2 – 0.4 mm. The genus Aristida is studied by Cope (1982) but the nature of ligule is not mentioned by him. Type of ligule is an important taxonomic character in identification of grasses. Its panicle is contracted with filiform branches and glumes are persistent, 1 nerved and are without awn. Absence of awns on the glumes is helpful in the identification of this species. Aristda is also known as 3 awned grass, because of the presence of awns on the lemma. In the specimen observed, middle awn is 19 – 23 mm long and larger than lateral awns which are 15 – 20 mm long. Chaudhary (1989) has mentioned the length of central awn from 10 – 15 mm and the length of lateral awn is from 8 – 22 mm.

Scanned by CamScanner

Morphology of this species is not described in detail in Flora, because several characters which are used to recognize various grass texa such as nature of ligule, length of awns, number and length of anther and stigma, shape and size of caryopsis are not mentioned, that are observed in the present studies and are helpful in identification of species in this tribe.

4.1.2 Palynology

The tribe Aristideae is very heterogenous, but pollen morphology is significantly helpful at specific level (Parveen, 2006). Pollen are circular in polar view and sub prolate in equatorial view, (as in most grasses however the quantitative characters canbe used as identification tool). In *Aristida adscensionis* polar diameter is 27 µm (20 – 30 µm) and equatorial diameter is recorded 22 µm (17.5 – 25.4 µm). Parveen (2006) observed the diameter of this species 26.7 – 35 .5 µm.

4.2 Tribe Eragrostideae

This tribe is represented by about 50 genera in the world, found throughout the tropics. In India 16 genera and 33 species of this tribe are present. In the present studies,

4.2.1 Morphology

This tribe includes the annual or perennial grasses. Among the perennial grasses *Desmostachya bipinnatais* a robust coarse perennial grass, ranging in length from more than one meter, the culms in this grass are with stout scaly rhizomes and form large swards. *Eragrostis papposa* is an erect or ascending perennial grass and *Dactyloctinium scindicum* abaxial epidermis between the vascular bundles. Small vascular bundles were with single sheath and large vascular bundles with double sheath. *Cynodon dactylonis* with slight ribs and furrows adaxially and abaxially. These species show kranz type of anatomy and the chloridoid type of leaf as according to Gould (1968) chlorenchyma cell sare tightly packed, radially arranged surrounding the bundle and vascular bundles are with double sheath.

4.2.2 Palynology

The palynological studies of tribe Eragristideae showed that all the species have circular pollen in polar view except *Eragrostis ciliansis* in which circular to spheroidal pollen are observed in polar view, while pollen are oblate spheroidal, prolate spheroidal , sub oblate and spheroidal in equatorial view in different species. In *Dactyloctinium scindicum* pollen are oblate spheroidal

Scanned by CamScanner

and spheroidal to oblate spheroidal pollen are recorded. In *Desmostachya bipinnata* and *Eragrostis ciliansis* pollen are spheroidal to prolate spheroidal while in *Eragrostis papposa* pollen are spheroidal to sub oblate. Siddiqui & Qaisar (1988) carried out pollen studies in different species of tribe Eragrostideae and found that Eragrostideae is unique by having the smallest as well as the largest grains and found the average size of grains, 14.30 – 37.18 µm. In the present investigations the average size of pollen is 17.5 – 37.5µm and the previous results are similar to the present findings. Maximum pollen size (37.5µm) is observed in *Dactyloctinium* species found to have pollens with minimum diameter (17.5 – 22.5µm), so both type of pollen of small and medium size are found. Meo (1999) observed length and width of pollen in Eragrostis poaeoids 28.93 µm and 26.63 µm. In the present studies two species of Eragrostis i.e. *E. ciliansis* and *E. papposa* are studied having polar diameter, 21.25µm and 19.2 µm and equatorial diameter 20 – 22.5µm. Pollen is endoporate and monoporate.

4.3 Tribe Andropogoneae

.This tribe has 87 genera throughout the tropics, extending in the warm temperate regions. 36 genera and 67 species of this tribe are reported from India.

4.3.1 Morphology

The tribe Andropogoneae is recognized by a pair of spikelets, one sessile and other pedicelled, so this character helps to justify the particular specimen in the tribe. There are some problematic genera which are not easy to distinguish from each plant. Genus *Dicanthium annulatum* is very similar to each other and there is always confusion in identifying these genera. In *Dicanthium annulatum* this pit is not apparent. Faruqi (1969) also observed in his studies on that presence or absence of pit on the lower genera is a variable character. *Dicanthium foveolatum* is easily distinguished from *D. annulatum* by solitary narrow spike. *Cymbopogon jwarancusa* can be easily identified from other species of this genus by chewing its leaves that are aromatic, it has green to reddish and brick reddish leaves. In *Heteropogon contortus*, lemma of the upper female floret is projected into a short well developed blackish awn, and a bunch of twisted awns is present at the top of raceme that is rigid and pungent, so not liked by the cattle at maturity. Genus Saccharum has one specie i.e. *S. munja* is widely distributed in the area, and are common near water channels and mountains bases, as observed by Chaudhary *et al.*, (2001) while *Saccharum ravennae* is rarely present in the area. These two species are very similar in external

Scanned by CamScanner

morphology, and can be differentiated by studying their micro morphological characters as the awn. *Vetiveria zizanoidesis* rarely found in the area, it is differentied by its spiny glumes of the pedicelled spikelets. In most of the genera of this tribe, ligule is lacerate membranous, which is Characteristic of this tribe. In *Cymbopogon jwarancusa*, ligule is membranous and ligule is a ciliated fringe in Eulaliopsis binnata and *Vetiveria zizanoides*. Most distinguishing features on the basis of which most genera of this tribe are recognized is the presence of spikelets in pairs and presence of a geniculate awn on the upper lemma, so these characters are helpful in identification at the species, genus and tribe level.

4.3.2 Palynology

In the present study of 6 species of grasses of tribe Andropogoneae, all the pollen are circular in polar view and spheroidal to prolate spheroidal in equatorial view except one species (*Vetiveria zizanoides*) that has prolate to sub prolate pollen, in equatorial view, hence the qualitative characters are not much helpful, when trying to distinguish the various taxa contained within the family. The same observations were made by Parveen (2006), who concluded that Gramineae is a stenopalynous family, and the pollen morphology of various taxa at the generic or even at the tribe level is remarkably uniform. However the species showed variationsin quantitative characters i.e. polar and equatorial diameter, P/E ratio, pore diameter and exine thickness. Maximum polar diameter was observed in Heteropogon contortus(43.75 µm) followed by *Vetiveria zizanoides* (32µm) Maximum equatorial diameter (40.16 µm) was recorded in *H. contortus*, while minimum equatorial(25.62 µm) diameter was observed in so *H.contortus* showed maximum polar and equatorial diameter and these differences in pollen size are helpful in identification of species and have some value in taxonomic studies of grasses, as Woodehouse (1935) pointed out that grain size has some significance in taxonomy of family gramineae. P/E ratio (1.16) was maximum in *Vetiveria zizanoides* followed by *Dicanthium annulatum* (1.12) and *H. contortus* (1.08) and minimum P/E ratio was observed in genus Saccharum (0.89 – 0.90). Mostly the pollen are monoporate. Chaturvedi (1971) has observed monoporate grains in Saccharum.

Scanned by CamScanner

4.4 Tribe Paniceae

This tribe has about 101 genera in the world, throughout the tropics extending into warm temperate regions. The genus Panicum is one of the largest genera of this tribe with approximately 450 species distributed world wide (Webster, 1988). This tribe is represented by 15 genera and 73 species in India.

4.4.1 Morphology

In tribe Paniceae a wide morphological diversity is observed among the different genera, while different species within the genusseem to be quite similar and difficult to identify. The different genera include Cenchrus, Setaria, Digitaria and Panicum. In *Cenchrus biflorus* involucre is 5-6 mm long and the inner spines are retrorsely barbed and pungent and outer spines are smaller and thin than the inner and generally there are 3 spikelets in a burr. *Cenchrus ciliarisis* distinguished from other *Cenchrus* species by its gray purple or straw coloured panicle and it has inner bristles in involucre, ciliated in the lower half and awn like and scabrid in the upper half. In *Cenchrus,* inner bristles are fused at the base. According to Chaudhary *et al*,(1968) *C. ciliarisis* one of the best range grasses. In Setaria inflorescence is a cylindrical panicle and different Setaria species show a closed morphological resemblance. *Setaria glauca* and *Setaria viridis* can be distinguished by the colour of their bristles as in *S.glauca*, inflorescence looks yellow because of yellow bristles, while *S. viridis* is identified by its green bristles. Upper glume is as longas the spikelet in *S. viridis* but *S. glauca* has upper glume more than half or up to two thirds of the length of spikelet. The length of anthers is also important in the identification and differentiation of species as anthers are 0.3 – 0.5 mm long in *S.viridis* and upto 1.5 mm long in *S. glauca*. In Setaria intermedia, panicle is lobed in the lower part. *Setaria italic* that is a cultivated species and is considered the cultivated form of *S.viridis* has antrorsely barbed spikelets and is distinguished by upper floret disarticulating at maturity. *D. sanguinalis* are According to Cope (1982) is an annual grass. *D. sanguinalis* spikelets fall entire atmaturity. *Echinochloa colona* is best identified by the absence of ligule. Different grasses such as *E. colona*, *Paspalum paspaloides* and *Paspalidium* are good fodder grasses for cattle (Skerman & Riveros, 1990).

The grass species with strong rhizomes hold the sides of cuts and banks of water tributaries and consequently protect then against erosion. Species like *Panicum antidotale*, *Cenchrus ciliaris* is recommended for fixation and reclamation of sand dunes in areas of low rainfall (Yusaf Zai and

Scanned by CamScanner

Gandhi, 1999). *Paspalum paspaloides* that is common along margins of ponds and ditches, has rachis flattened on the back but keeled on the axial side. Its keel is narrowly winged and two rows of spikelets are sparated by winged keel. *Paspalidium flavidum* is rare in the area and only found near Choa Saidan Shah (Chakwal).It is distinguished by its gibbously globose spikelets and, inflorescence has 4-9 racemes present in alternate manner and the upper racemes are more or less appressed to the axis. It is indicated that floral morphology of spikelet proved useful in the identification of the taxa of tribe Paniceae.

4.4.2 Palynology

Shaheen *et al.,* (2005) studied different species of genus, *Cenchrus* and *Setaria* and found that pollen are circular in polar view and mostly the species have endoporous pollen. Among the *Cenchrus* species, maximum polar diameter (40µm) is recorded in *C. ciliaris*. *C. ciliaris* has more polar and equatorial diameter than all *Cenchrus* species. Shaheen *et al* (2005) observed maximum polar and equatorial diameter in *C. setigerus* and found that this species is ectoporate but in my observations *C. ciliaris* showed the maximum polar diameter. The present findings are different to Firbas (1937) and Faegri& Iversen (1964) who suggested that pollen of cultivated grasses are more than 35 µm. In our observations *S. italica* while is considered the cultivated form of *S. viridis*, has pollen size from 22.5 – 32.5 µm that is overlapped with size of pollen in wild grasses. *Panicum maximum* shows more values than *P. antidotale* in all quantitative parameters and *P. maximum* is differentiated from *P. antidotale* by its large pollen size, so the pollen size may help in the identification of species with in the same genus. The *Digitaria* species can be distinguished from each other by correlating their morphological as well as palynological (quantitative) characters. Maximum polar (36.53µm) and equatorial diameter (32.75µm) is found.

4.5 Tribe Poeae

There are about 45 genera of this tribe, found in the temperate regions of both hemispheres. There are 18 genera and 82 species in India. Tribe Poeae is represented by two genera, Poa and Lolium. Poa has two species, *Poa annua* and *Poa infirma* while Loliumis represented by one species *Lolium persicum.* In Durg Bhilai region *Poa annua* is present.

Scanned by CamScanner

4.5.1 Morphology

Poa is the largest genus of grasses with some, 500 – 575 species that occur in a wide range of habitats, throughout the world (Gillespie & Soreng, 2005). This genus is characterized by having small multi flowered spikelets, 5 nerved and unawned lemma that are keeled and leaf blades are hooked or boat shaped at the tip. *Poa annua* is differentarated from *Poa infirma* by its longer anthers from 0.5 – 0.8 mm long.

4.5.2 Palynology

Pollen are circular in polar view in both Poa species while polar view is circular to slightly irregular in *Lolium persicum*. In *Poa annua* quatorial view is oblate spheroidal. Maximum polar diameter is observed in *P. annua* (27.5 µm) while equatorial diameter (30 µm) is more in *P. annua*. Meo (1999) observed the polar diameter in *P. annua* (24.13 µm) and equatorial diameter was 24.88 µm. In the present studies polar diameter and equatorial diameter recorded, in this species is 25.76 µm and 26.16µm respectively. The studies show that pollen size ranges from small to medium. Pollen is ectoporate and monoporate in all the species, as found in most of the grasses.

It is concluded that morphology along with palynology, play a vital role in identification of grasses and their classification at the species, generic and tribe level. It is suggested that molecular systematics can also be used as an alternative approach for identification of endangered grasses.

Grasses and their value have been recognized since time immemorial present day. Use of grasses, as food resources or as fodder has led to extensive breeding programs and improvement in pasture land. In India concept of scientific pasture management has not been properly planned despite the fact that India has one of the largest livestock populations in the world with an estimated 520 million heads. Efforts in India for pasture management have been confined either to improvement of existing grasslands or introduction of suitable exotics. There is no sound management plan for the development of pasture land & protection of existing patches of grassland, grassland of Chhattisgarh are unique and rich in fauna. We have not even fully documented the value of their grasslands in terms of their biological diversity.

Scanned by CamScanner

Grassland of Chhattisgarh are in the mid succession stage are largely maintained by annual or biannual burring in most of the protected areas, whereas in unprotected they are maintained by animal grazing and other biotic factors.

There are several reports of the floristic diversity & grassland vegetation & threat assessment from Chhattisgarh. As per the third conservation assessment & management plan (1997) some endemic, rare critically endangered & valuable plant species of Chhattisgarh were listed. According to them 11 plants (grasses) of Chhattisgarh was endemic in which species of Pycreus, Fibristlis, Bulbostylis and Cyperus were report.

Pandey *et.al* 1997-98 reported 121 plant species recorded in which 03 grasses recorded as rare species.

Varghese *et.al.* (1999) reported the ecological riches and amplitude of rare, threatened and endemic trees of peppara wildlife sanctuary. They have documented 151 species belonging to 51 family with 62 endemic (41% of endemic) 6 rare and 8 threatened species.

Mandal *et.al.* 2000 reported rare and endangered flowering plants of Bay Island with species references to endemic extra Indian taxa.They concluded that 110 plant species are considered as rare threatened.

According to forest ministry and grassland and desert planning of government of India reports (2012-13) those 245 genera and 1,256 species of Poaceae in which about 21 genera and 139 species are endemic.

Central India plateau ranges have 24 species of perennial grasses, 89 species of annual grasses and 129 species of dicot including 56 legume shows rich diversity of vegetation in protected area of grass land (ministry of forest 2015)

Extensive field survey trips were conducted throughout the study area hence; the study is based on critical, minute systematic and palynological analysis of the grasses and their importance.

For this purpose collections of vegetation were made throughout the year from October 2014 – dec 2016.

Scanned by CamScanner

Field observation such as habitat, seasonal distribution pattern color, penology etc was noted in the field book. Detailed observation and palynological study were made under binocular stereomicroscope and light microscope.

The systematic part contains a comprehensive treatment of grasses; classification of grasses was adopted by Clayton and renvoiz (1986) where the family is divided into three main subfamilies, for each grasses the identification, correct nomenclature, detailed morphological description , vernacular names, and their significance and uses were also identified.

The study revealed that the nature occurrence of total plant species found. In which trees, shrubs, grasses, herbs were recorded belonging to the families.

Ecological states of grassland of Durg-Bhilai region is based on random sampling method. Study area is divided into three blocks covering both urban and villages' grassland vegetation. The study based on various Ecological parameters e.g. absolute frequency, relative frequency, absolute density, relative density and important value index of the area. The grasses namely *Cynodon dactylon, Eragrostis ciliasis, Ergrostis gangentica, Echinochloa coloa, Cyperus iria* shows maximum combine frequency than *carex, paspallum, Saccharum munja* which was showing least frequencies. In herbous group *Parthenium hysteriophorus, Cassia tora, Achyranthus aspera, Ageratum, Conizoides, Euphorbia hirta* shows maximum frequency rates. shows maximum frequency.

In small trees/tree, shrubs group shows highest value of frequency e.g. *Acacia nilotica, Ziziphus mauritiana, Mangifera indica* important value index have no significant value was observed. Only *Cynodon dactyolon, Convalvulus pluricaulis, Achyranthus aspera, Eraprostis gangetica, Cyperus irri* had important value.

Statically finding of shows that the most of the plant species distribution depends on climate and topographic conditions. Some of them were migrate from adjacent forest area and scrab jungles over the period of time similar finding obtained by Deo *et al.* in regeneration forest coalmine area Orissa.

One observation and Ecological status of grasslands shows rich biodiversity in all sampling plots because the favorable condition for the growth and development of native plant species make

Scanned by CamScanner

stable grassland community in rural areas but urban blocks grassland are rapidly converted into open barren, sterile land in which many unfertile exotic weed species spreading and reproduced quickly for e.g. *Parthenium hysterophorus, Solenum nigrum, Calotropis giganteatum, Datura metel, Vernonia cinearea, Argimone maxicana, Solanum xanthocarpum* are nauxious, non-palatable and deasease causing.

So many diseases are supporting the growth of other native vegetation (Pati, Agrawal) grasses like *Cyperus rotundus, Cyperus alopecurodes, Tleteropogon contortum, Setaria viridis, Setaria italica, Sacenharum munja, Vetivana zizanioides, Cympopgon contortus* are most evolved spp. They are capable of supporting or converting into incredibly huge amount of biomass. They also support a rich and divers variety of fauna. They are efficient in absorbing rain water and play vital role in water retention and hydrology of an area.

Following findings were found in grass category there are sixty total numbers of cypereace and poaceae were recorded in which NT 22, LC 10, EN 9, CE 03, VU 15, recorded in rural area where as in urban area NT 23, LC7, EN 15, CE 4, VU 10 recorded. This threat assessment shows that there is rich biodiversity found in grass vegetation perhaps the growth and development of urban area might balance form. Results shows that critically endangered species shows 3-4 both rural and urban area similar finding also found in nearly threatnened ratio (22-23) only endangerd species shows variation which is 9 in rural area and 15 in urban area these shows the sustainable use of grassland.

Scanned by CamScanner

CONCLUSION

Scanned by CamScanner

CONCLUSION

Our finding shows that rich biodiversity of the grassland vegetation. But in urban areas the virgin grassland are difficult to locate as a result of human interference.

There is a need for conservation and balanced exploitation of the Indigenous Natural plant wealth. Hence they place significant role in ecosystem having potential sources of Economic important of former.

The grassland of Chhattisgarh shows variation due to various factors like climate, soil, rain and geographical location.

These factors encourage the variation of grassland Ecosystem having its own features but some common features are observed during study are as follows.

Grasses are the most important components tree, shrubs, herbs, climbers and are another important part of any grassland ecosystem.

Birds and insects are the most common components of Indian grassland.

Herbivore & Insectivores form a major and important part of Indian grassland Ecosystem.

Grasslands are affected by their adjoining forest, desert or other land utilization.

The native and naturally grass species maintain a continuum of the mechanism of ecosystem as compared to introduced once.

Importance of grassland in present stage:-

Chhattisgarh is known as rice bowl of the nation mean the state is mainly depended on agriculture and animal husbandry for their sustenance. So the grassland vegetation significant role for the growth and development of socioeconomically status grasses have following specific characteristics.

1. Grasses have winder range of adoptability than the species of any other family being found in humid tropics, temperate, arid areas and also found in alpine peaks.
2. Reproduction of fresh shoots by filtering provides a means of recovery from grazing or cutting.
3. Many grasses maintain continuous vegetation growth interrupted only by drought or cold.
4. Many grasses spread by rhizomes of stolons which readily form adventitious roots and give rapid ground coverage.
5. The root system binds the soil particles together a sod and brings to the surface layer nutrients which have been leached in to the subsoil by heavy rain.

Scanned by CamScanner

6. New tissues produced during growth, arise chiefly at the base of the leaves became they are least damage by cutting or grazing.
7. Grasses yield more starch equivalent and protein per acre than other crops.
8. Grasses contains the high value of crude proteins (CP), active nitrogenase system which fixes approx. 13 Kg N/ ha.

   In addition to above while selecting the species for pasture, the quality desired are productivity, palatability, high nutritive value and adaptability of the grass species with local soil and climatic condition.

Now we can say that grassland s are the common lands of the community and are the responsibility of none. They are the most productive ecosystem in the sub continents but they belong to all and most neglected area of the earth.

As we know most of the cereals originated from wild grasses. For the protection, conservation of the neglected land. A grasslands are policy should be make a give serious attention for their grassland.

The grassland of C.G. is clearly divided into two segment Rurtal grassland and urban grassland. Presently both of grassland showing seral stage due to heavy biotic influences. Most of the grass species would not complete their life cycle. Two main groups of grasses are Cyperaceae and Poaceae plays very important role in both type of grasslands have Cyperaceae showing least of their appearance as compared to family Poaceae the Cyperus grasses are endangered where as *C. diformis, C. rotundus* shows high frequency rate in both rural and urban grassland, in Poaceae *Vetiveria zizanoides* , *Saccharum munja* ., *Heteropogon contortus Iseilema laxum* , *Ischaemum sp, Erioocaulon compressum* are beneficial for soil erosion soil binding and protection for other natural weed of existing grassland. Presences of these species have importance genetic resources of our forest wealth. On the behalf of the study the 147 total grass sp. found in the region. In which 3-4 species as critically endangered, 9-15 as endangered, 10-15 vulnerable, 22- 23 not threated but at lower risk.

Each Indian grassland is unique and specific according to their climate, topography and nature of live stock and human population. Thus grassland ecosystems have their specific plant species and animals. Some of them are endemic and their role in the ecosystem is of vital importance.

Scanned by CamScanner

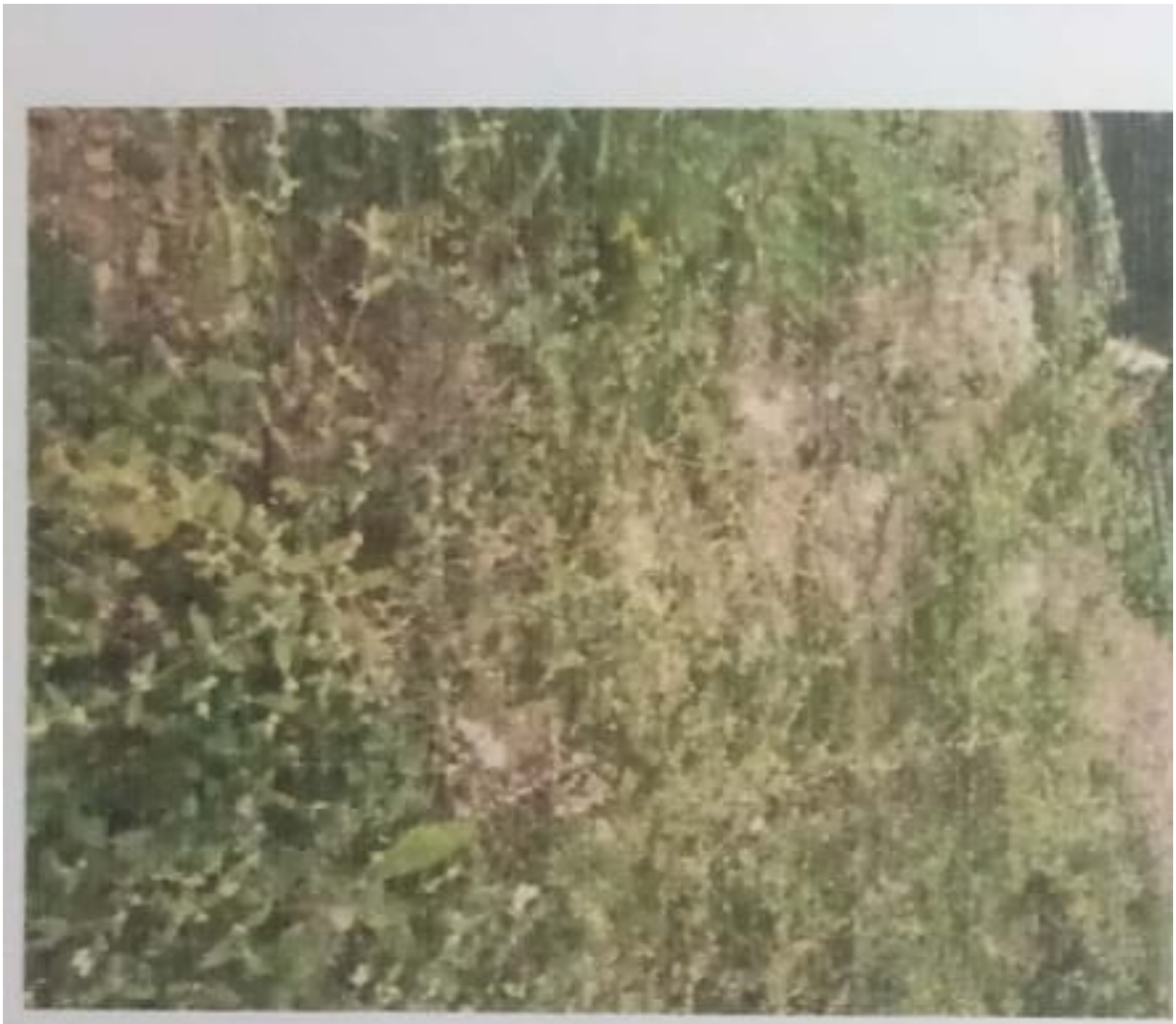
Grasslands of C.G. are as fragile as the grassland themselves. Any change or modification especially by human activities has adverse reversible effect on the grasslands. While the natural inhabitants of the grassland evidently get affected by any damage to there. Human also suffer major losses some of which are immediate and some of which are not imninent. The following suggestion for maintain and constructions of grasslands are as follows:

To form communities for regeneration and restoration of degrading grasslands. Provide a range of incentive to former and part or a listes to continue traditional practices that are beneficial for wildlife and help in sustainable are of grasslands.

Plantation of Prosopis luliflora, Eucalyptus glabra in all grasslands habitat must be completely banned as this exotic spread very rapidly abd covers the grasslands. There should be strict laws to stop encroachment of gorcher land.

Currently "The cattle Trespassess Act" formulated in 1871 is the present act applicabale to regular grazing in public and forest land. The existing act is outdated and inadequate. There is an urgent need for a National grazing policy to eucure the sustainable use of grasslands and biodiversity conservation.

Scanned by CamScanner



Scanned by CamScanner

Cynodon dictylon

Poa annua

Carex stipata

Kinga triceps

Scanned by CamScanner

Eragostris papposa

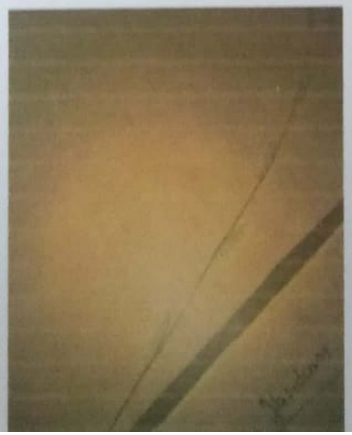
Cyperus niveus

Eragostris cilianansis

Cyperus pilosus

Cyperus rotundus

Cyperus iria



Scanned by CamScanner

Digitaria sanguinalis

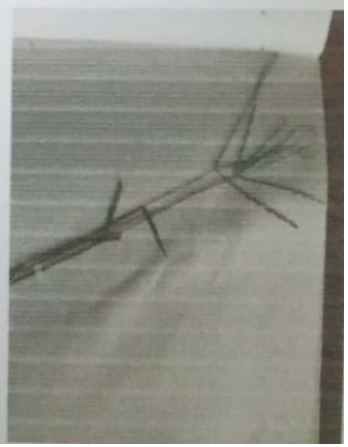
Ischaemum sp.

Sachharam munja

Vetiveria zizanoides

Cyperus esculentus

Eriocaulon compressum



Scanned by CamScanner

REFERENCES

Scanned by CamScanner

9. REFERENCES

- Abid, R., S. Sharmeen and A. Perveen. 2007. Stomatal types of monocots within Flora of Karachi, Pakistan. Pak. J. Bot., 39(1): 15-21.
- Aftab, R and A. Perveen. 2006. A palynological study of some cultivated trees from Karachi. Pak .J. Bot. 38 (1):15-28.
- Afzal, S., M. Yunas and K. Hussain. 1999. Physical and chemical characterization of the agricultural lands of the Soon Sakesar Valley, Salt Range, Pakistan. Aus. J.
- Ahmad, A. 1964. Vegetation of the Salt Range. Pak. J. Forest. 25 (1): 36-64.
- Ahmad, F., M. A. Khan, M. Ahmad, M. Zafar, A. Nazir and S. K. Marwat.2009. Taxonomic studies of grasses and their indigenous uses in the Salt Range of Pakistan. Afric. J. Biotech. 8 (2):231-249.
- Ahmad, H. and M. Waseem. 2004. Conservation status of some medicinal plants of Salt Range. Zonas Ardis: 22-31.
- Ahmad, K., M. Hussain, M. Ashraf, M. Luqman, M.Y. Ashraf, and Z. I. Khan.2007.Indiginous vegetation of Soon valley at the risk of extinction. Pak.J.Bot. 39 (3):679-690.
- Ahmad, K., Z. I. Khan, M. Ashraf, M. Hussain, M. Ibrahim and E. E.Valeem. 2008. Status of plant diversity at Kufri (Soon Valley) Punjab, Pakistan and prevailing threats within. Pak. J. Bot., 40(3) : 993-997 .
- Ahmad, M., M. A. Khan, A. Hussain, M. Zafar and S. Sultana. 2008. Chemotaxonomic standardization of herbal drugs: Milk thistle and Globe thistle. Asian Journal of Chemistry.20 (60): 1443-1453.
- Aiken, S. G, S. J. Darbyshire and L. P. Lefkovitch. 1985. Restricted taxonomic value of leaf sections in Canadian narrow leaved Festuca(Poacee).Canad. J. Bot. 63: 995 –1007.
- Aiken, S. G. and L. P. Lefkovitvch. 1984. The taxonomic value of using epidermal characteristics in the Canadian rough Fescue complex (Festuca altaica, F. campestris , F. hallii , F. scabrella.Canad. J. Bot .62:1864-1870.
- Akram, N. A., M. Shahbaz and M. Ashraf. 2008. Nutrient acquisition in differentially adapted population of Cynodon dactylon(L.) Pers. and Cenchrus ciliarisL. under drought stress. Pak. J. Bot., 40 (4): 1433-1440.
- Aliscioni, S. S. 2000. Anatomia ecologica. de. algunas especies del genero Paspalum(Poaceae – Panicoideae , Paniceae) Darwiniania 38 (3 – 4) : 187 – 207.
- Alvarez, J. M., J. F. Rocha and S. R. Machado. 2008. Bulliform cells in Loudetiopsis chrysothrix (Nees) Conert and Tristachya leiostachyaNees (Poaceae), Structure in relation to function. Brazil. Arch. Biol. & Techn. 51 (1): 113-119.
- Amarasinghe, V. and L. Watson. 1988. Comparative ultra structure of microhairs in grasses. Bot. J. Linn. Soc. 98: 303-319.
- Amidei, T. P. 1932. The anatomy of the leaf of Panicum palmifolium. Bull. Torrey. Bot. Cl, 59: 491– 499.

Scanned by CamScanner

- Ararwal S.C. and Pati R.N., 2010, Folk medicine, Folhk Healer and Medicinal Plant of Chhattisgarh, Swaroop Book Publication PVT. Ltd.
- Arriaga, M.O. and S. W. L. Jacobs. 2006. An anatomo - ecological experiment in Austrostipa aristiglumis, a low land stipoid species. Telopea 11(2): 161–70.
- Arshad, M., M. Y. Ashraf, M. Ahmad and F. Zaman. 2007. Morpho - Genetic variability potential of Cenchrusciliaris L., From Cholistan desert, Pakistan. Pak. J.
- Barthlott, W., C. Neinhuis, D. Cutler, F. Ditsch, I. Meusel & H. Wilhelmi. 1998. Classification and terminology of epicuticular waxes. J. Linn. Soc. Lond .Bot. 126: 237-260.
- Basappa, G. P., M. Muniyamma and C. C. Chinnappa. 1986. An investigation of chromosome numbers in the Genus Brachiaria (Poaceae: Panicoideae) in relation to morphology and taxonomy. Cand. J. Bot. 65: 2297 –2309.
- Beetle, A. A. 1955. The four sub families of the Gramineae. Bull. Torrey Bot.
- Bentham, G. 1881. Noteson Gramineae. J. Linn. Soc. Bot., 19: 14 –134.
- Bews, J. G. 1929. The World grasses: Their differentiation, distribution, economics and ecology. Longmans, Green & Co. Ltd., London.
- Bibi, F., M. A. Khan, M. Ahmad and M. Zafar. 2007. Leaf epidermal anatomy of some grasses. Pak. J. Sci. 59 (1-2): 47-51.
- Bot., 39 (5): 1481-1488.
- Brown, W. V. and W. H. P. Emery. 1957. Apomixes in the Gramineae. Tribe Andropogoneae, Themeda triandraand Bothriochloa ischaemum. Bot. Gaz, 118:
- Cai, L. B., and S. J. Wang. 1994. Studies on the evolutionary trends and mechanism of the constituent cells of the leaf epidermis in Poaceae. Acta Biologia Plateau Sinica 12.13-27.
- Champion, H.G. 1936. A preliminary survey of the forest types of India and Burma. Ind.For. Rec. New ser (silv), 1.
- Chaturvedi, M. 1971. Pollen grains of Saccharum robustum. Grana, 11: 87– 90.
- Chaudhary, I. I., M. Y. Sheikh. 1968. Halophytic flora of saline and water logged areas of West Pakistan plains. Pak. J. Forest.20 (4): 405- 414.
- Chaudhry, A. A., I. B. Agha, A. Hussain, R. Ahmad and M. Hameed. 1995. Biodiversity in a typical sub-mountainous protected area – Chumbi-Surala wild life sanctuary, Punjab, Pakistan.Int. J. Agric. Biol. pp.63-79.
- Clark, J. 1960. Preparation of leaf epidermis for topographic study. Stain Technol: 35–39.
- Clayton, W. D. 1981. Evolution and distribution of grasses. Ann. Missouri Bot. Gard. 68: 14.
- Clifford, H. T. and L. Watson. 1977. Identifying grasses data methods and illustrations. St. Luica, Queensland Australia. Univ Queensland Press.
- Club, 82: 196-197.

Scanned by CamScanner

- Cope, T. A. 1982. Poaceae, No. 143. In: E. Nasir and S. I. Ali (Eds.), Flora of National herbarium, Pakistan Agricultural Research Council, Pakistan.
- Dadsena et.al 2014 –A Study of Productivity on grazed grassland of Bilaspur District (C.G) India. Biolife (2) 605-609.
- Dahlgren, R. M. T. and Clifford, H. T. 1982. The monocotyledons: A Comparative study. Academic press. London.
- Davila, P., and L. G. Clark. 1990. Scanning electron microscopy survey of leaf epidermis of Sorghastrum(Poaceae) Andropogoneae. Americ. J. Bot.77: 499-511.
- Delgado, M. E. S. 2007. Culm anatomy of Boutelouaand relatives (Gramineae: Chloridoideae: Boutelouinae. Acta Botanica Mexicana 78: 39–59 .
- Dileep.P and Geetha Nair (2015) Taxonomic & ethenobotanical studies of grasses used by tribal of wayanad District, Kerala, Journal of Global Bioscience: 4, pp 2212-2335.
- Ditsch, F., H. Patha and W. Barthlott. 1995. Micromorphology of epicuticular waxes in Fabales S .L. and its systematic significance. Beitr. Biol. Pflanz. 68: 297 –310.
- Dube, M. and P. Morisset. 1987. Morphological and leaf anatomical variations in Festuca rubra (Poaceae) sensulato from Eastern Quebec.Can. J.Bot. 65: 1065 –1077.
- Ellis, R. P. 1986. A review of comparative leaf blade anatomy in the Systematics of Poaceae. The past twenty five years. In Soderstorm TR, et al.,(eds). Grass systematics and evolution. Smithsonian Institute,Washington, D C, pp: 3-10.
- Emery, 1958. A cytotaxonomic study of Setaria macrostachya(Gramineae) and its relatives in the South western United States and Maxico. Bull.Torrey Bot. Club, 84: 95-105.
- Esau, K. 1977. Anatomy of seed plants. 2nded. Wiley, New York.
- Fabbri, L. T., G. H. Rua and N. Bortoloni. 2006. Different patterns of aerenchyma formation in two hygrophytic species of Paspalum(Poaceae) as response to flooding. Flora 200(4).
- Faegri, K. and J. Iversen. 1964. Text book of pollen analysis. Blackwell scientific publications, Copenhagen.11: 295.
- Fahn, A. 1965. Plant anatomy, 3rded. Oxford: Pergamon Press.115-119.
- Faruqi, S. A. 1969. Culm and leaf anatomy of the Bothriochloa intermediacomplex. Pak. J. Bot.3 (1 & 2): 11-24.
- Fisher, B. S. 1939. A contribution to the leaf anatomy of Natal grasses. Series1. Chloris Sw. and EustachysDesv. Annals of the natal museum .9: 245 –267.
- Folorunso, A. E. and O. A. Oyetunji. 2007. Comparative foliar epidermal studies in Cymbopogon citratus(Stapf) and Cymbopogon giganteus(Hochst) Chiov. In Nigeria. Not. Bot. Hort. Agrobot. 35 (2). 7-13.
- Gillani, S. S., M. A. Khan, Z. A. Shinwari, F. Hussain and Z. Yusouf. 2003. Taxonomic relationship of Genus Digitariain Pakistan. Pak. J. Bot. 35 (3): 261–278.

Scanned by CamScanner

- Gillani, S. S., M. A. Khan, Z. K. Shinwari and A. Nasim. 2003. A new sub species of Digitaria sanguinalisfrom Pakistan. Pak. J. Bot., 35 (3): 279 – 282.
- Gillani, S. S., M. A. Khan, Z. K. Shinwari and Z. Yousaf. 2002. Leaf epidermal anatomy of selected Digitariaspecies, Tribe Paniceae, Family Poaceae of Pakistan. Pak. J. Bot. 34: 257 – 273.
- Gillespi, L. J. and R. J. Soreng. 2005. A phylogenetic analysis of the Blue grass genus Poa, based on cp DNA restriction site data. Syst. Bot. 30: 84 –105.
- Good, R. 1953. The geography of the flowering plants. 2nded Longmans, Green & Co., Ltd., London
- Gould, F. W. 1969. Grass Systematics. Mc. Graw. Hill book company, New York. pp. 40 – 41.
- Government of India- A task force on grassland and desert, 2012-2015 of forest department.
- Grob, A. 1896. Beitrage Zur Anatomie der Epidermis der Gramineen blatter. Bibl. bot., 7, Heft 36, 1–107.
- Gunzel, F. 1912. Blattanatomie Sudwest afrikanischen Graser. Bot. Jb., 49, Bieblatt
- Gunzel, F. 1921. Weitere Beitrage Zur kenntnis der Blatt anatomie afrikanischer Graser. Bot. Jb, 57, Beiblatt No.126,: 1-26.
- Hackel, E. 1887. Gramineae. In A. Engler and K. Prantl, Die Naturlichen Pflanzen familien, Vol. 2, pp.1 – 97.
- Hartley, W. 1964. The distribution of the Grasses. C. Barnard ed. Grasses and grasslands. Mac Millan, London. pp: 29 – 46.
- Herrera, C. M. 1985. Grass / grazer radiations, an interpretation of silica body diversity. Oikos 45: 3: 446– 447.
- Hussain, M. 2002. Exploration of legume diversity endemic to Salt Range in Punjab. Annual technical report submitted to HEC, Islamabad Pakistan.
- Hussain, M., and A. Ali. 2006. Spatial and seasonal variations in the species composition of herbaceous vegetation indigenous to Soon Valley in the Salt Range of Pakistan. Pak. J. Agric. Sci., 43 (3 - 4): 140 – 145.
- Jacques – Felix, H. 1955. Notes Sur Les Graminees d, Afrique Tropicale. 8. Les tribus de la Serie Oryzoide. J. Agr. Trop. Bot. Appl., 2: 600 – 619.
- Jane, W. N. and S. H. T. Chiang. 1991. Morphology and development of Bulliform cells in Arundo formosana Hack. Taiwania. 36: 85 – 97.
- Khan, M. A. 1991. Cytotaxonomic studies in some species ofBrachypodiumP.Beauv. Pak. Phyton, 3: 141-151.
- Khan, M. A. and Stace, C. A. 1999. Breeding relationships in the genus Brachypodium (Poaceae, Pooideae). Nord. J. Bot.19. 257 – 269. Copenhagen. ISSN 0107 – 055 X.
- Kharazian, N. 2006. The Taxonomy and variation of leaf anatomical characters in the Genus AegilopsL.(Poaceae) in Iran. Turk. J. Bot. 31: 1-9.

Scanned by CamScanner