



**2.**  
**Materials**  
**and Methods**

**Collection:**

Grasses were collected from Panchmahal district by undertaking several fieldtrips at regular intervals during year (2009 - 2012). Field tours were arranged post summer and premonsoon season. Thereafter frequent visits were made till the maturity of grass species. Starting from seedling stage to the mature grasses i.e. all the phenological stages of grass species were collected and photographed in the field by using digital camera (DSC-T20). The collected species were divided into two groups: (1) for identification and morphological studies (2) for anatomical studies. Collected grass species were dried properly and processed with blotting papers and newspapers (Jain, 1977). After proper processing and poisoning, the specimens were mounted on herbarium sheets and deposited in the BARO Herbarium (Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara).

The two main grasslands studied are Rampur which comes under the Baria forest division of Dahod district and Bandheli which comes under the Godhra forest division of Panchmahal district. Other than these grasslands, studies were also conducted in forest areas of Kharoda, Bhe, Zari, Tadagola and Kantu which fall under Dahod, Garbada, Jhalod and Vansiya Dungri range respectively. Bandheli forest is situated 16 km away from Godhra town. The forest comprises of 754.04 ha grassland of Bandheli village. It is surrounded by Sampa, Segwa, Vansia, Kanaji, Bakkhar, Doli, Chalali villages. Samali grassland comes under Godhra forest division. In past years, Samali was considered to be a good grassland but gradually this grassland is being converted in to forest because trees are growing now more. Both these grasslands managed under grass bir working circle for the purpose of production of grasses.

Rampur grassland is a protected area, which is situated on the left side of Dahod-Godhra highway, and it includes mainly three grasslands. Kalitalai (658.68 ha), Muvalia (750.43 ha) and Rozam (378.40 ha). The total area is 1987.81 ha (Forest Dept., Gujarat Government). These are commonly known as Rampura grassland, situated near Dahod (N: 22° 53' E: 74 ° 19'), Dahod District, Gujarat. These areas are well protected by the Forest Department from late June to December for the production of hay.

**Identification:**

The collected grass species were critically observed for features, described and photographed. Spikelets were dissected and identified satisfactorily by means of available literature. The important floras used for identification were 'The Bombay Grasses' (Blatt. and McCann, 1935), Grasses of Burma, Ceylon, India and Pakistan' (Bor, 1960), The Flora of the Presidency of Bombay, Vol. II (Cooke, 1901-1908), Flora of Gujarat state (Shah, 1978). The specimens were authentically confined from Blatter Herbaria (St. Xavier's Collage, Mumbai).

**Preparation of Herbarium:**

Collected samples were pressed for the herbarium. The specimens were spread gently between newspapers. Long samples were folded in “V” or “N” shape and then pressed. Unnecessary overlapping leaves and other parts were removed. A few leaves were turned over to show the lower and upper view. These specimens were kept in a wooden press and tightly screwed (Jones and Luchsinger, 1986).

Drying techniques are mainly two types: (1) those accomplished without heat (2) those with the aid of artificial heat. The most common method of drying is without applying heat. In this plants are placed in pressing papers between blotters of the plant press. After a period, the blotters are removed and specimens are examined, and parts rearranged. 3-4 times blotters must be change and every blotter removed must be dried. About a week is required for the completion of drying. In the present study the sun drying method has been followed.

After drying, mounting process was done. Mounting is the process by which a specimen is fixed to a herbarium sheet and a label affixed at the lower right corner. Specimens were mounted on a standard size (29 X 43 cm.) herbarium sheet. Mount the specimens to the sheet with the help of glue (favicole) (Maden, 2004). Herbarium sheets for the seedlings were prepared similar to the mature plant. As the seedlings were of shorter length folding the culm was not required.

**Socio economic survey study:**

A socioeconomic survey of the Baria and Godhra forest divisions was also conducted to study the economic value of the grasses and associated legumes by the tribals of the area.

Field visits were arranged at an interval of one month beginning from June 2009 to January 2010 in all the representative localities (Raval, Baria, Muslim, Nayak, Vadand, Brahmin, Rathva, Patel, Navi, Vanzara, Malivad, Adivasi, Savarn) of the area. The growth period of grasses was at its peak during September to December, during which the field visits were conducted at an interval of 15 days. Grasses and legumes associated with these grasses were collected during the field trips.

A questionnaire (Proforma 1) was prepared for collection of useful information regarding the local uses of the grasses and associated legumes growing in the nearby grasslands. From the data available with the forest department and local people information about the different tribal blocks existing was collected and the socioeconomic survey conducted including population from each tribe. A face to face interview was conducted among randomly selected 10% households from each community tribals from these villages. The questionnaire attempted to elicit information about the plant species in the grassland being used medicinally, ecologically and economical. Social customs, traditional knowledge and nature and extent of dependency on the forest by the tribals were tried to be evaluated.

## PROFORMA 1

Source / Village : \_\_\_\_\_ Range : \_\_\_\_\_

Total House holds: \_\_\_\_\_ Total Population: \_\_\_\_\_ Area: \_\_\_\_\_

Different Tribes with their House Holds:

- |    |     |
|----|-----|
| 1. | 6.  |
| 2. | 7.  |
| 3. | 8.  |
| 4. | 9.  |
| 5. | 10. |

1. Species Name:

2. Local Name:

3. Medicinal Use:

4. Part used and it's Method:

5. Other Use:

Ecological Use:

Economical Use:

6. Season of collection:

7. Stage of collection:

8. Palatable or not:

9. Fodder for which animals:

10. Fodder value:

### MORPHOLOGICAL STUDIES

#### Mature Grass Morphology:

Morphological study was carried out under dissecting binocular microscope. Different vegetative and floral morphological characters were observed. Spikelets have been studied, preferably in fresh condition or if dried, after soaking in warm water. The specimens could be identified with the help of the available literature (Blatter and Mc Cann, 1934, 1935 ; Cooke, 1902-08 (Rept. Ed. 1958) ; Shah, 1978 and Cook, 1996). All the descriptions of mature grasses have been prepared with my observations and from different floras (Cooke, 1902-08 ; Blatter and Mc Cann, 1934, 1935 ; Shah, 1978 ; Clayton and Renvoize, 1986 and Cook, 1996).

#### Caryopses Morphology:

During the field trips mature grasses were collected and mature caryopses were obtained by cleaning the spikelets. Mature caryopsis were manually separated from the spikelets and used for the light and scanning electron microscopic studies. 15-20 dried caryopses were examined for each species. For light microscopic observations and measurements mature, dry seeds were examined under Stereo Microscope (Olympus microscope-SZ2-ILST) and the diagnostic features were photographed.

All the morphometric measurements are averages (n=15–20) and were carried out as per Nesbitt (2006). The dimensions were taken parallel to the embryo axis. Length of caryopses (L) was measured (in mm) parallel to the middle vertical axis

included embryo tip, either in dorsal or ventral view. Breadth of caryopses (B) was the maximum width (in mm) on the horizontal axis measured either in dorsal or ventral view. Thickness of caryopses (T) was the maximum width (in mm) measured at right angles to the breadth and in the same horizontal plane, such that  $T \leq B$ . The length to breadth ratio (L: B) was calculated as the length of caryopses divided by the breadth and multiplied by 10. The thickness to breadth ratio (T: B) was calculated as the thickness of caryopses divided by the breadth and multiplied by 100. The length of the embryo (from embryo tip to scutellum/endosperm boundary) was calculated as a % of caryopses length (Embryo %). Hilum % was calculated as the length of the hilum for linear hila (measured from base to tip) and for basal and subbasal hila (from base of caryopses to end of hilum) and calculated as a % of caryopses length. The terminology of Nesbitt (2006) was followed for the description of the light microscopic features.

Scanning electron microscopic studies were conducted with mounting seed samples on carbon conducting tape mounted on brass stubs. Seeds were washed with absolute alcohol or acetone for 1-2 mins to remove any debris present, dried and placed on the stub with their dorsal, ventral and lateral side upwards so that the characteristic features of all the different sides could be examined and photographed on JEOL JEM - 5610 SEM with a voltage of 15KV. The terms used to describe the morphological and micromorphological features have been adapted from Barthlott (1981), Murley (1951) and Koul *et al.* (2000).

The terms used are as follows:

1. Foveate: Pitted or having depressions marked with little pits
2. Foveolate: Marked with little shallow pits
3. Ocellate: Having eye-like depressions, each with a raised circular border
4. Reticulate: Having a raised network of narrow and sharply angled lines frequently presenting a geometric appearance, each area outlined by a reticulum being an interspace
5. Reticulate-foveate: A type intermediate between reticulate and foveate types
6. Rugose: Wrinkled, the irregular elevations making up the wrinkles and running mostly in one direction
7. Ruminant: Penetrated by irregular channels giving an eroded appearance and running in different directions
8. Sulcate: Grooved or furrowed with long V-formed depressions
9. Undulate: Having a wave like pattern
10. Verrucate: Irregular projections or knobs

The information included in the morphological data was used to prepare a morphological key. The morphological features were grouped and a dichotomous key was prepared. The data was used to perform a preliminary analysis using Minitab software (Version 16) to prepare a dendrogram in order to explore the correspondence between morphological and taxonomic features.

#### **Seedling Morphology:**

The seedling study was carried out both in field and in laboratory.

(1) In field: Seedlings of grasses were collected as the new emergents. The collected seedlings and their different parts were photographed by Digital camera in the field itself. Total 10-15 samples for each species were collected from the field and observed for distinctive features.

(2) In laboratory: Total 45-50 seeds were grown in earthen pots and seedlings were raised till the emergence of four to five leaves. Randomly selected seedlings were evaluated for their characteristic features and photographed by Digital camera (DSC-T20). All observations were made on seedlings < 20-25 days old. Characteristic features of seedlings raised in the pots were critically observed and compared with those collected from the field.

In grasses, as most of the identifying characteristics are seen on the collar region, this region was examined carefully by pulling the leaf blade back from the stem. Features like the presence of ligule, auricle, characteristics of node, internode, etc. were recorded. Terms used to describe these have been used from Nowosad *et al.* (1942) and Philips (1962).

The information included in the morphological data was used to prepare a morphological key. The morphological features were grouped and a dichotomous key was constructed on the basis of the most conspicuous morphological features observed in the field collected samples. The features were critically observed and compared with the laboratory raised seedling features. In addition, the data was used to perform a preliminary analysis using Minitab software (Version 16) to prepare a dendrogram in order to explore the correspondence between morphological and taxonomic features.

#### **Dichotomous Key:**

Generally a dichotomous key is prepared to identify the different genera or species within a particular genera. The key to and description of each of the 100 grass species of Panchmahal and Dahod districts of Gujarat treated in the present study, are artificial and do not reflect phylogenetic relations. The key do not necessarily emphasize features of evolutionary importance, nor do they have closely related plants appearing next to one another. All the keys to genera and species are dichotomous and numbered. It consists of a series of couplets, paired and contrasting statements (leads) that describe one or more featured of the plant. The couplet lead begin with a characteristic feature and then alternative states to guide users efficiently to an identification. The paired statements are numbered. At each step in the key a choice is to be made as to which one of the statements best fits the unknown sample that is being attempted to identify. Each statement in the dichotomous key ends in the name of a genera and its species or in a number directing to a subsequent dichotomy. The present study represents the state of knowledge of Poaceae in Panchmahal and Dahod districts and is an important addition to grass literature. Linked type of key was prepared. In dichotomous keys the statement of characters and the taxa to be identified are inescapably intermingled.

At the end of the species description of a single genera key to identify them are also provided. A dichotomous key differentiating the 100 species on the basis of leaf anatomical characters has been represented at the end of the discussion.