ON THE GRASSES AND GRASSLANDS OF KUTCH

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INTRODUCTION

Cultivators of Kutch district in Gujarat State depend more on their animals than on agriculture due to the highly erratic rainfall in the area. The animal population of the region is solely maintained on the natural grasslands. Grasslands are, therefore, the mainstay of the peasantry. But these grasslands have been over-exploited and are in the last stage of degradation especially with respect to their fodder potentials. In order to sustain and strengthen the economy of peasantry concenrated efforts are essential to scientifically improve and upgrade these areas by encouraging suitable and desirable fodder grasses. In this paper, which is the outcome of the extensive explorations and survey in Kutch district of Gujarat State in the years 1960–62, an attempt has been made to throw light on the fodder grasses of the region with their phenology, fodder potential, economic importance, growth characteristics, habitat preference and distribution of individual species.

ENVIRONMENT

(a) *Location* Major portion of the district, under study, falls in the arid region of the Indian sub-continent. It lies between 22°47′ to 24° N. and 68°21′ to 71°10′ E. It measures accross 256 km. from east to west and 112 km from north to south, covering a total area of 28672 sq. km. The mainland exclusive of the Rann of Kutch embraces only 19497 sq. km. The area is surrounded by the Arabian sea in the west, by Great Runn of Kutch in the south and by the Little Rann in the east. Thus the area is more or less encircled by either sea or swampy marshes and saline belts.

(b) *Landforms* The tract is characterised by three major landforms of which only two figure on the mainland, where vegetation grows. The ranns, which form the third landform occupy a salt encrusted waste-land and do not support any vegetation. The two landforms of which the grasses and grasslands have been accordingly dealt with are :

(i) Plains formed by old and young alluviums including coastal sands and sandy habitats with deep soils.

(ii) Rugged hilly projections and gravel formations representing various geolithological series with shallow soils.

The latter landform occupies the major portion of the mainland.

(c) *Soils* Each landform is characterised by specific soil environment. The soil in the former landform is deep, sandy to sandy loam in texture with variable soil characteristics depending on the site location. It is generally saline also. It is low in nitrogen, medium to high in available potash, low to medium in available phosphate, low in organic carbon, pH ranging from 7.0–8.5 and with water holding capacity of 23.8–43.0 per cent. It contains high percentage of soluble salts and calcium carbonate.

On the other hand the soil from the latter landform is shallow with plenty of disintegrated rock and exposed rocky boulders. It is generally immature, structureless and very coarse in texture; yellow brown to dark yellow brown in colour; low to medium in available phosphates, pH ranging from 7.6–8.5 and with water holding capacity varying between 22.4 to 32.1. The total soluble salts are low, ranging between 0.04–0.08 and very low in organic matter.

(d) *Climate* The climate of Kutch has been classified as Ed (arid with little or no water surplus, Subrahmanyam, 1956). A brief erratic monsoon, very hot summers and extremely cold and dry winter characterise the climate of the region. Generally the monsoon commences from 1st June. The total number of rainy days vary from 20–30 per annum. The winter depressions, which pass over north India, affect only the temperature, winds and clouds but provide hardly any precipitation. Any rainfall during October to May is entirely abnormal and has, therefore, insignificant influence on the vegetation.

The hottest and driest months are April and May. The area is subjected to frequent violent dust storms during May-June. The average annual rainfall (34.04 cm), which is very erratic throughout the area varies from 27.25 cm. in Khadir taluka to 40.50 cms in Mandvi. It has been recorded from 0.80 cms. in Khadir taluka in the year 1911 to as high as 123.50 cms in Khavda Taluka in 1913. Generally July is the rainiest month when nearly 50% of the annual rainfall occurs. June to September are the cloudy months and the area receives about 80–90 per cent of the total annual rainfall. From September onwards the number of sunny days gradually increase until the next monsoon.

The region experiences severe winter which extends from November to February and the temperature goes as low as 1°C during January. The relative humidity during this period is generally very low. The area is subjected to south-westernly winds during the period from May to August and northernly winds during September to January. The velocity of wind varies from 5.5 km to 18.7 km per hour in June and July.

GRASSES AND GRASSLANDS

Each landform is characterised by a specific set of grasses, some of which occupy sizeable area in association with other species to form dominant communities. Depending on the extent of exploitation through cutting only, cutting and aftermath grazing, grazing all the year round progressive stages in each community could be observed. However, each community can be improved by proper management and encouragement to the best fodder grasses for optimum forage production.

There are eight grass species which are common to both the landforms. Of these eight species only two species viz. *Eleusine compressa* and *Aristida adscensionis* formed sizeable communities and are important for grazing. *Eleusine compressa* forms a dominant ccommunity at Sim of Sadi in Banni area; mixed with *Aristida* species at Habey forest area in Bhuj taluka; San Rakhal in Bachau taluka; and Mav Rakhal in Lakhpat taluka. The characteristic features of these common eight grasses are listed below. The salient features of the characteristic species of the two landforms have been discussed under each landform separately.

1. *Aristida adscensionis* L. Medium-sized, annual to biennial, xerophytic, drought evading grass; common on gravels and sandy places; good fodder grass and platable to animals in green stage but disagreeable at maturity due to its sharp callus.

Loc : Sadi in Banni area; Kargaria Reserve forests, Bhuj; Habey forests, Bhuj. Sherdi Rakhal, Nakhtrana taluka; Kothara varadia area in Abadasa taluka; on Voyar-Brinda Road; Mave Rakhal, Lakhpat taluka; Bachau taluka; Nakhtrana taluka.

2. *A. hystrix* L. Short, annual, xerophytic, drought evading grass; common on gravels and sandy plains; palatable to animals when young, unpalatable at maturity.

Loc : Sherdi Rakhal, Nakhtrana taluka; Kanthkot area, Rapar taluka.

3. *Chloris montana* Roxb. Short, annual, psamophytic grass, forming small patches in saline depressions; palatable to animals in all stages; insignificant as a fodder grass.

Loc : Grazinglands Bhuj; Kothara varadia area; Abadasa taluka and Mave Rakhal in Lakhpat taluka.

4. *Dactyloctenium aegyptium* (L.) P. Beauv. Small, annual, drought evading grass; common on heavily grazed areas and footpaths; palatable to animals; insignificant as a fodder species.

Loc : Kargaria and Habey Reserve Forests, Bhuj; Kothara Varadia area, Abadasa taluka; Mave Rakhal, Lakhpat taluka; San Rakhal, Bachau taluka and Kanthkot area in Rapar taluka.

5. *Eragrostis ciliaris* (L.) R. Br. Small, annual, drought evading, ephermeral grass; common in compounds and along footpaths; palatable to animals; insignificant as a fooder grass.

Loc : Nakhtrana; 16th mile on Bhuj-Khsrda Road; Kothara Varadia area, Abadasa taluka and Kanthkot area in Rapar taluka.

6. *Eragrostis tremula* Hochst. Tall, annual, drought evading ephemeral grass; common in gravel and sandy plains, palatable to animals but insignificant as a fodder species.

Loc : Nakhtrana; Habey and Kargaria Reserve Forests, Bhuj.

7. *Eragrostis viscosa* (Retz.) Trin. Short, annual, drought evading, tufted grass, frequent in sandy places and along footpaths; palatable to animals, insignificant as a fodder grass.

Loc : 16th mile on Bhuj-Khavda Road and Kargaria Reserve Forest, Bhuj.

8. *Eleusine compressa* (Forsk.) Asch. et Schw. Short, perennial, stoloniferous, drought evading grass, forming sizeable colonies in open gravels and sandy habitats; palatable and also a good sand binder. Being a hardy plant, provides good grazing grounds where it forms sizeable stands. Seeds are eaten by Francolins and Sand grouse (Faruqui *etal*, 1960).

Loc : On way to Old Port, Jakhau, Bhuj taluka; Bhindara Jhil, Banni area; Sim of Sadi, Banni areas; Habey Forest area, Bhuj; Saiyad Par Rakhal, Anjar taluka; Mave Rakhal, Lakhpat taluka and San Rakhal, Bachu taluka.

Grasses of plains including coastal sands and sandy habitats.

Grasses from all the flat areas in between the hillocks, coastal sand and Banni grasslands have been included under this landform, which is characterised by the deep sand to sandy loam soils with high soluble salt contents. In the lower horizons of the soil profiles, the soil is generally normal due to the presence of gypsum.

There are in all 30 grasses that occupy this land system. Out of which 23 species are exclusively found in this land system. Some of these typical species only occur in sizeable colonies to form characteristics grass communities. These are *Dichanthium annulatum, Desmostachya bipinnata, Cynodon dactylon, Sporobolus helvolus, S. marginatus; Aeluropus lagopoides.* Other species occur as their associates. Of these communities *Dichanthium annualatum* community is economically most important providing good forage and soil cover. All the lesser communities can be transformed into this community by proper management and cultural practices. The highest expression of this community was observed in a Gochar area, while going from Kothara to Bhindara village, which had been closed to grazing about 10 years back. Grass was being cut from this area only after seeding. *Desmostachya-Dichanthium* association was observed at Bhindara Jhil, Banni area. *Cynodon dactylon* community covering an area of about 3 sq. km. was observed at Luna area in Banni region. *Aeluropus lagopoides* formed colonies in association with sedges on the borders of saline marshes. On higher ground in Banni area, on the border of Rann of Kutch *Sporobolus helvolus and S. marginatus* formed sizeable colonies along with *Dichanthium annulatum, Suaeda biryosma* showing thereby that the area, if properly reclaimed from salinity could be converted into a productive grassland.

The typical grasses of this land system are alphabetically listed below with their characteristics :

1. *Aeluropus lagopoides* (L.) Trin. Short, perennial, trailing, pioneer, halophytic grass; very common in marshy, saline habitats; palatable to animals; insignificant as a fodder species.

Loc : Banni Grasslands, Old port, Jakhau, Bhuj taluka; Gandhidham.

2. *Bothriochloa pertusa* (L.) A. Camus. Tall, perennial, bunch grass; common in grazed areas and flat plains; palatable in all stages and a good fodder grass.

Loc : 16th mile on Bhuj-Khavda Road.

3. *Brachiaria ramosa* (L.) Stapf. Medium-sized, trailing, annual, hygrophilous, weak stemmed grass; frequent in low lying areas and moist places; palatable in all stages, insignificant from fodder point of view.

Loc : Kanthkot area, Rapar taluka.

4 *Cenchrus biflorus* Roxb. Short, annual, xerophytic, poineer grass; very rare in open plains; palatable only in preseeding stage; insignificant for fodder value.

Loc : Kanthkot area, Rapar taluka; Nakhtrana.

5. *C. ciliaris* L. Medium - sized, annual to biennial, xerophytic invader; frequent in open, sandy plains; palatable in all stages; important fodder grass of other arid regions, but does not contribute to the fodder wealth of Kutch; the region being unsuitable for its prolific growth.

Loc : Nadi Bag, Bhuj; Nakhtrana; Kanthkot area, Rapar taluka.

6. *C. setigerus* Vahl. Medium-sized, perennial, xerophytic, bunch grass; frequent in sandy plains only; relished by animals; important fodder grass of other arid regions, but insignificant for Kutch area, which is unsuitable for its prolific growth.

Loc : Nakhtrana; Nadi bag, Bhuj; Kanthkot area, Rapar taluka.

7. *Crypsis schoenoides* (L.) Lamk. Small, annual, drought evading grass; rare on sandy soils; palatable to animals but insignificant as a fodder species.

Loc : Goshala area, Phatal talao and On way to Nadi Bag, Bhuj.

8. *Cynodon dactylon* (L.) Pers. Short, trailing colonizer, perennial, halophytic grass; forming vast mats in moist places; palatable at all stages of growth; adds to a fair extent to the fodder wealth of the area.

Loc : Vast grassy mats at Luna and in Banni grasslands.

9. *Desmostachya bipinnata* (L.) Stapf. Tall, perennial, halophytic, savannah grass; common in moist plains and dominant along coasts; palatable to animals and the mainstay of animal wealth during summers.

Loc : Nakhtrana; Jordi Badi, Jakhau; Banni grassland and coastal regions.

10. *Dichanthium annulatum* (Forsk.) Stapf. Tall, dominant, perennial, psamophytic, bunch grass; very common in moist habitats; palatable in all

stages; very important fodder grass for Banni area, where it forms pure colonies.

Loc : Old port Jakhau; Nadi Bag, Bhuj; Khavada-Kala Dungar; Bhindara Jhil, Banni; Sim of Sadi in Banni area; Near Kothara village, Abadasa taluka.

11. *Echinochloa colonum* (L.) P. Beauv. Small, annual, hygrophilous grass; frequent in moist depressions and ditches; palatable grass but insignificant as a fodder species. Seeds are eaten by Black Francolins (Faruqi *et al* 1960).

Loc : Jorodi Badi, Jakhau; Nakhtrana; Bhuj; Depressions on 16th mile from Bhuj on Khavda Road.

12. *E. crusgalli* (L.) P. Beauv. Medium-sized, annual, hygrophilous grass; frequent in moist places; palatable to animals but adds little to its fodder wealth; seeds are eaten by Francolins (Faruqi *et al*, 1960).

Loc : Depressions on 16th mile on Bhuj-Khavda Road.

13. *Eragrostis pilosa* P. Beauv. Medium-sized, annual grass; frequent in sandy areas; palatable but insignificant as a fodder species.

Loc : Anjar; Bhindara; Chitrod; Habey reserve Forests, Bhuj.

14. *Imperata cylindrica* (L.) P. Beauv. Both tall and dwarf froms, perennial, hygrophilous, bunch grass; not very common in the area; palatable only at young stage; afterward it becomes very fibrous.

Loc : Vajor Dam area and other moist localities.

15. *Panicum antidotale* Retz. Tall, perennial, savannah, bunch grass; common in depressions and among bushes; palatable fodder species and also as good soil binder.

Loc : Along Bhuj-Khavda Roadside, Bhuj taluka.

16. *Paspalidium flavidum* (Retz.) A. Camus. Medium-sized, annual, hygrophilous grass; common in ditches and depression; palatable to animals but insignificant as a fodder grass; seeds taken by Gray Francolins (Faruqi *et al*, 1960).

Loc : Nakhtrana; Bhindara Jhil, Banni grassland area.

17. *Saccharum spontaneum* L. Tall, perennial, hygrophilous, savannah grass; frequent near river banks and coastal regions and serves as a good sand stabilizer; non-palatable and hence of no fodder value.

Loc : Lakhpat and Mandvi areas.

18. *Sorghum halepense* (L.) Pers. Tall, perennial, savannah grass forming big clumps; very rare; palatable in all stages but adds very little to the fodder wealth of the region. Seeds eaten by the poor, wherever in plenty during famines.

Loc : Dhinodhar; On way to Bhindara village from Kothara, Abadasa taluka.

19. *Sporobolus coromendalianus* (Retz.) Kunth. Short-sized, halophytic, annual, poineer grass; frequent in saline areas; palatable but insignificant as a fodder species.

Loc : Sim of Sadi in Banni grassland area.

20. *S. helvolus* (Trin.) Dur. et Schinz. Medium-sized, halophytic, perennial, bunch grass; very common and codominant in saline flat plains; palatable only when young and latter becoming fibrous.

Loc : On way to Nadibag, Bhuj; Sim of Sadi in Banni area; Near Rann of Kutch in Banni; Kothara varadia area, Abadasa taluka; San Rakhal in Bachau taluka.

21. *S. marginatus* (Hochst.) Richb. Medium-sized, halophytic, perennial, bunch grass; very common and codominant in flat plains; palatable when young and contributes much as fodder grass in Banni area.

Loc : Old Port Jakhau; Near Kukma Rly. station; Bhuj Nadi Bag, Sim of Sadi in Banni area; Kothara varadia area in Abadasa taluka.

*22. *Urochondra setulosa* (Trin.) Hubb. Tall, perennial, halophytic, savannah grass; common in swampy saline habitats; not palatable and can be used for mulching.

Loc : Old Port, Jakhau; Mandvi, Banni grasslands; Gandhidham.

*Note : This species has earlier been recorded from Kathiawar, Sind, Arabia, Socotra and African stases, hence forms a new record for Kutch and extends its distribution from Sindh, Kathiawar southwards to Kutch in Gujarat.

23. *Vetiveria zizanoides* (L.) Nash. Tall, perennial, hygrophilous, savannah, bunch grass; not very common; found only in depressions where water accumulates; unpalatable but highly valuable for its "Khas khas oil" and a prospective species for cottage industry.

Loc : Depressions along Adesar to Chitrod Railway line tract.

Grasses of Rugged hilly projections and gravel formations.

This landform is characterised by detached spurs and rugged hills subjected to severe sheet and wind erosion. The areas under this landform have been serverely over-grazed and exploited for fuel. The soil is generally sandy to sandy loam, very shallow with protruding pebbles and rocky boulders.

In all thirty-three grass species occur in this landform. Of these twenty-five species (enumerated below) exclusively belong to this landform. Some of these species, which occur in sizeable colonies are *Schima nervosum*, *Chrysopogon fulvus*, *Heteropogon contortus* and *Cymbopogon jwarancusa*. *Schima nervosum* community is economically the most important one. It provides good fodder and protection to area. A sizeable area occupied by this community was observed in protected area at Sherdi village Rakhal. The area is cut only after seeding. The other prominent associates were *Chrysopogon fulvus* and *Schima ischaemoides*. *Chrysopogon fulvus* community is a retrogression stage from *Schima nervosum* community. It takes over the areas where there is more slop and light grazing. The other associates of this community are *Schima nervosum*, *Eremopogon foveolatus*, *Cymbopogon jwarancusa* and *Eleusine compressa*. A sizeable area under this community was observed at Saiyed par Rakhal, Anjar taluka.

Heteropogon contortus community is further retrogressive stage of the above two communities. Probably the area occupied by this community is specially suited for *Heteropogon contortus* to grow and multiply. Once this grass takes over it is difficult for other species to compete as it seeds profusely. This community was observed occupying a sizeable area at Kanthkot, Rapar taluka.

The *Cymbopogon* community is the poorest from fodder point of view. Animals generally do not graze on it, the grass being unpalatable. It seeds and multiplies unhampered and occupies the entire area. A large area under this community was observed at 5th mile on Vajor-Brinda road.

1. *Apluda mutica* L. Tall, annual, savannah grass; not very common in shade and gravels; provides good hay and preferred by buffaloes; does not add much to the fodder wealth of the area.

Loc : Kargaria Reserve Forest area, Bhuj and Sherdi Rakhal in Nakhatrana taluka.

2. *Aristida funiculata* Trin. et Rupr. Medium-sized, annual, xerophytic, pioneer grass; common on open gravels; palatable only at young stage; insignficant as a fodder species.

Loc : 16 km. south of Bhuj; Kanthkot area, Rapar taluka; Mave Rakhal, Lakhpat taluka; Saiyed par Rakhal, Anjar taluka; Habey R. F.,- Kergaria R.F. and Goshala areas, Bhuj.

3. *A. hystricula* Edgew. Short-sized, annual, xerophtic, pioneer grass; common on open lands; provides browsing to sheep when young but insignificant as a fodder species.

Loc : Habey Forest area, Bhuj; Sherdi village Rakhal, Nakhtrana taluka.

4. *Chrysopogon aucheri* (Boiss.) Stapf. Short-sized, perennial petrophytic, bunch grass; rare in the region; palatable at all stages of growth, but insignificant as a fodder species.

Loc : Kargaria Reserve Forest, Bhuj and Habey forest area, Bhuj taluka; Dhinodhar.

5. *C. fulvus* (Spreng.) Chiov. Tall, perennial, petrophytic, bunch grass; forming large colonies and a codominant of gravels; palatable in all stages and very good fodder species of the area. Also a good soil binder.

Loc : 8 miles east of Narayansarowar; Shordi village Rakhal, Nakhtrana taluka; Saiyed Par Rakhal, Anjar taluka; Habey forest area, Bhuj taluka and Karagaria R. F., Bhuj.

6. *Cymbopogon jwarancusa* (Jones) Schult. Tall, perennial, xerophytic, bunch grass; forming large colonies on heavily grazed gravels; less relished by animals due to the presence of oil, hence less significant as a fodder grass but a prospective species of Cottage Industry for its aromatic, medicinal oil.

Loc : Khavda; On way to Kaladungar; Kanthkot area, Rapar taluka; Mave Rakhal, Lakhpat taluka; Saiyed par Rakhal, Anjar taluka; Vajor-Brinda Road, 5 miles from Bhuj; Kargaria R. F. area, Bhuj.

7. *C. martinii* (Roxb.) Wats. Tall, perennial, xerophytic, bunch grass; grows in colonies on hillocks; unpalatable to animals due to its aromatic "Motia & Sofia" oils, which can feed a cottage industry.

Loc : Mata Dhola near Bhuj; Saiyed par Rakhal, Anjar taluka; Habey Forest area, Bhuj and Kargaria R. F., Bhuj.

8. *Dactyloctenium sindicum* Boiss. Short, perennial grass with runners and rooting at nodes; very common in gravel formations; palatable and good soil binder, but insignificant as a fodder species; seeds are eaten by Gray and Black *Francolines* (*Faruqi et al* 1960).

Loc : Mave Rakhal, Lakhpat taluka; Kargaria R. F., Bhuj; Habey forest areas in Bhuj taluka.

9. *Digitaria pennata* (Hochst.) T. Cooke : Medium-sized, annual, low grass; frequent in gravel formations and rock crevices; palatable at all stages of growth; insignificant as a fodder species.

Loc : Dhinodhar Hills.

10. *D. adscendens* (H.B.K.) Henr. Small, annual, shade loving grass; common among bushes and shady rock boulders; palatable to animals and contributes very little to the fodder wealth.

Loc : Kanthkot area, Rapar taluka; Mave Rakhal, Lakhpat taluka.

11. *Dignathia hirtella* Stapf. Medium-sized, annual grass; frequent only among boulders in valleys; palatable but insignificant as a fodder grass.

Loc , Dhinodhar Hills.

12. *Eragrostis interrupta* (Lamk.) P. Beauv. Tall, annual, petrophytic grass; rare in gravelly areas; insignificant as a fodder grass.

Loc : Kanthkot area, Rapar taluka.

13. *Eremopogon foveolatus* stapf. Tall, perennial, petrophytic, bunch grass; common and sub-dominant species in rock crevices; forming large colonies in overgrazed grasslands; palatable and a good fodder; also provides good hay to animals when dry.

Loc : Kargaria R. F., Ghoshala area, Bhuj; Habey forest area, Bhuj taluka; Kothara-Bhindara route, Abadasa taluka; Saiyed par Rakhal, Anjar taluka.

14. *Heteropogon contortus* (L.) P. Beauv. Very tall, perennial petrophytic, bunch grass; common in the area; palatable only in perseeding stage, later on avoided by animals due to its sharp, hygroscopic awns; provides good hay for animals when dried seeds are shed.

Loc : 5 km. south of Bhuj; Kanthkot area, Rapar taluka; Kargaria R. F. area, Bhuj.

15. *Latipes senegalensis* Kunth. Small, creeping, annual, xerophytic bunch grass; rare in rock crevices and gravels; palatable but insignificant as a fodder species.

Loc : Between Kothara-Bhindara Village; Abdasa taluka; Dhinodhar.

16. *Melanocenchris abyssinica* (R. Br.) Hochst. Short-sized, petrophytic, annual grass; forming large colonies on overgrazed gravel formations; palatable but contributes very little to the fodder wealth of the area.

Loc : Kargaria R. F., Goshala area; Bhuj; Kanthkot area, Rapar taluka; Khavda-Kaladungar.

17. *Panicum trypheron* Schult. Short-sized, annual, petrophytic grass; rare in gravels and grazed areas; palatable at all stages; insignificant as a fodder species.

Loc : Habey forest area, Bhuj taluka.

18. *Perotis indica* (L.) O. Ktze. Small, annual, petrophytic, pioneer grass; frequent in moist places and gravels; palatable to animals but insignificant as a fodder grass.

Loc : Kanthkot area, Rapar taluka.

19. *Rhynchelytrum villosum* Chiov. Short, stout, annual grass; frequent on hills and gravels; palatable but insignificant as a fodder species.

Loc : Dhinodhar hills.

20. *Sehima ischaemoides* Forsk. Short-sized, annual, petrophytic grass, forming quite large colonies in protected grasslands; palatable to animals and a good fodder species in the area.

Loc : Sherdi village Rakhal, Nakhtrana taluka.

21. *Sehima nervosum* (Rottl.) Stapf. Tall, perennial, petrophytic, bunch grass; forming large colonies and co-domiant species of grasslands; palatable at all stages of growth; very important fodder grass of this landform.

Loc : Sherdi village Rakhal, Nakhtrana taluka; Saiyed par Rakhal, Anjar taluka; Dhinodhar hills.

22. *Setaria glauca* (L.) P. Beauv. Short-sized annual grass; rare in shady places only; palatable at all stages of growth; insignificant as a fodder species.

Loc : Kargaria Reserve Forest, Bhuj.

23. *S. verticillata* (L.) P. Beauv. Medium-sized, annual, shade loving grass; rare in moist and shady places; palatable only in preseeding stage, later on unliked due to its verticillate hairs; insignificant as a fodder species.

Loc : Nakhtrana; Bhuj; Habey forest area; Bhuj taluka.

25. *Themeda triandra* Forsk. Tall, perennial, savannah grass, forming large colonies; palatable when young; insignificant as a fodder species in Kutch but provides good hay to animals when dry.

Loc : Saiyed Par Rakhal, Anjar Taluka; Sherdi Rakhal, Nakhtrana.

STATISTICAL SYNOPSIS AND CONCLUSIONS

Blatter (1908), Blatter & McCann (1935) and Thakar (1926) have together recorded 63 species of grasses. Puri et al (1959) have just reported 72 species of grasses, followed by Jain and Deshpande (1960), who added 9 grass species as new records for the area. Most of these species were collected and analysed or observed during various field excursions in the area in the period 1960-1962 and the specimens deposited in the Herbarium, Botanical Survey of India, W. Circle, Poona. Of these only 56 species belonging to 42 genera which are of much economic value, have been narrated in the foregoing pages. As is evident from the appended table that out of the total 56 species only 8 species representing 5 genera of the sub-family Pooideae are the species common to both the landforms and the rest are divided conservatively to the two landforms of the region.

In the landform I with sandy habitats, out of the total 23 species belonging to 18 genera, only 14 species of 11 genera, consisting of the two tribes (Andropogoneae and Paniceae) are the members of the sub-family Panicoideae and the remaining 9 species represent 7 genera and 4 tribes (Viz. Aeluropoidae, Chlorideae, Eragrostae and Sporoboleae) of the sub-family Pooideae. The ratio of genera to species of the family in this landform comes to 1 : 1.28. This ratio of genera to species is also maintained in case of both the sub-families. The ratio of species in Panicoideae to Pooideae is 1.55 : 1.0 and so also is true for their genera. *Sporobolus* (=3 sps.) is the largest genus of Pooideae and *Cenchrus* (=3 sps.) is that of the Panicoideae, concluding that these two are the prominent genera of this landform.

Of the 25 species representing 19 genera belonging to 7 tribes of both the subfamilies from the landform II with gravels and hills, 16 species represent 11 genera and 2 tribes of the subfamily Panicoideae and the remaining 9 species belonging to 8 genera and 5 tribes (Aristideae, Chlorideae, Eragrosteae and Zoysieae) are the representative of the subfamily Pooideae. The ratio of genera to species in this landform results to 1 : 1.32 in the family; 1 : 1.45 in the subfamily Panicoideae and 1 : 1.13 in the case of Pooideae. The ratio

of species of Panicoideae to Pooideae is 1.78 : 1.0 and of genera is 1.38 : 1.0. *Aristida, Sehima, Setaria* etc. are the larger genera with two species each in this landform.

From the above it is concluded that the sub family Panicoideae is dominant over Pooideae in both the landforms, thereby indicating its cosmopolitan nature and the adaptability of its species to varied type of environments. It becomes unvoidable to mention here that the genera of Panicoideae are not only statistically dominant in the area, but also contribute economically the most palatable and important fodder grasses in the Kutch region, particularly *Dichanthium annulatum, Bothriochloa pertusa, Panicum antidotale Sorghum halepense, Sehima nervosum, Chrysopogon fulvus* etc., which, if properly exploited under scientific management in respective landforms, can yield very good grasslands and mighty remunerative fodder and cattle wealth.

SUMMARY

Fifty six species of palatable grasses, which add considerably to the fodder wealth of Kutch region, Gujarat State, under different landforms alongwith their important phenological, ecological and growth characteristics, habitat preference and their distribution in the area have been enumerated. As far as possible, the places where the species were either observed or collected have also been cited. An attempt has also been made to throw some light on the economic aspect of these species and thereby indicating the possibility of raising good pasture lands in the region.

ACKNOWLEDGEMENT

The authors are highly grateful to Dr. P. C. Raheja, Director, Central Arid Zone Research Institute, Jodhpur for all the guidance and to Dr. R. K. Gupta, Ecologist for all the necessary improvements in the paper. Grateful thanks are also due to Shri Rolla Seshagiri Rao, Regional Botanist, Botanical Survey of India, Poona and to Dr. S. K. Jain, Economic Botanist, Calcutta for all the facilities and guidance during the Kutch Survey, while the senior author was working at Poona.

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