RESEARCH ARTICLE

PHYTOSOCIOLOGY AND NUTRIENTS ANALYSIS OF DOMINATEDGRASSES OF PASTURELANDS IN KASHMIR VALLEY

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Abstract: The study was carried out at three altitudes viz., Arishan, Harkani and Deesu, which were selected on the basis of altitude and migratory grazing status in Daksum range of Anantnag Forest Division, Kashmir in the year 2014-15. Samples of dominant grass species were collected for their nutrient analysis at all three sites. Results revealed IVI of herbaceous species indicated that *Poa annua* (63.72) was dominant at lower altitude while *Fragaria nubicula* (75.66) and *Poa pratense* (77.10) dominates the upper altitude site respectively (Fig 02).Thenutrient content of dominant grass species were recorded higher in all the three sites because the summer season is considered peak nutrient season for plant species. The highest nitrogen per cent was found in *Poa balbusa* (1.42%) at lower elevation, phosphorous per cent in *Cynodon dactylon* (0.41%) at middle elevation, Potassium per cent in *Poa annua* (0.74%) at lower elevation, calcium per cent and magnesium per cent in *Dactylis glomerata* (0.91%) and (0.99%) at lower elevation respectively (Table 01, 02 and 03). The IVI of herbaceous species indicated that *Poa annua* (63.72) was dominant at lower altitude while *Fragaria nubicula* (75.66) and *Poa pratense* (77.10) dominates the upper altitude site respectively (Fig 2).

Keywords: Phytosociology, Nutrients, Grasses, Nitrogen, Phosphorus, Calcium

INTRODUCTION

The total area of the state of Jammu and Kashmir is about 2,22, 236 sq. km (Anonymous, 2011). The pasture areas of Jammu and Kashmir State which lie in sub-tropical zone of Jammu, temperate, sub alpine and alpine areas of Kashmir and Ladakh are extensively used for grazing. Temperate areas are situated between 1000-4500 m altitude and this exhibits a remarkable diversity. Because of the geographical features of the state, 82 per cent land area falls under non crop land category, be it forests or rangelands and 18 per cent is cropland (Anoymous, 2011). The Himalayan region is known for its rich biological diversity and has always been a botanist's paradise. Its diversified land forms, relief and environmental conditions support an array of vegetation types. It has a wide range of altitudes, temperature, precipitation and topography which results in a diversified and rich forest flora varying from northern tropical dry deciduous forests to alpine pastures (Champion and Seth, 1968). Grasslands including savanna, shrub steppe are among the largest ecosystem in the world and are the potential natural vegetation on 33 million sq. km on earths land surface, their area is estimated at 52.5 million sq. km which is about 40.5 per cent of the total terrestrial area excluding Greenland and Antarctica (White *et al.*, 2000). Globally grasslands are major resource to sustain the life of about one billion people. They also provide a broad range of services that are beneficial for human life. In addition to production of herbage for livestock, grasslands play a major role in the maintenance of biodiversity, carbon sequestration, clean surface and ground waters and provision of an attractive environment for recreation and leisure activities.

MATERIALS AND METHODS

Present study was carried out along three locations of the Daksum range spread over an area of 34418.73 ha. This forest range is situated between 33°36′ 43" N North Latitude and 75° 26′ 6" E East longitude in Kashmir valley. The Anantnag division forests are classified in the revised classification of forest types by champion and Seth under the broad type groups 12,13,14 & 15 but do not strictly conform to on account of the diversity in structure and composition. An attempt has been made hereunder to identify the forest types of Kashmir valley with special reference to Kashmir Forest Division, within the overall frame work of the Champion and Seth (1968) classification.

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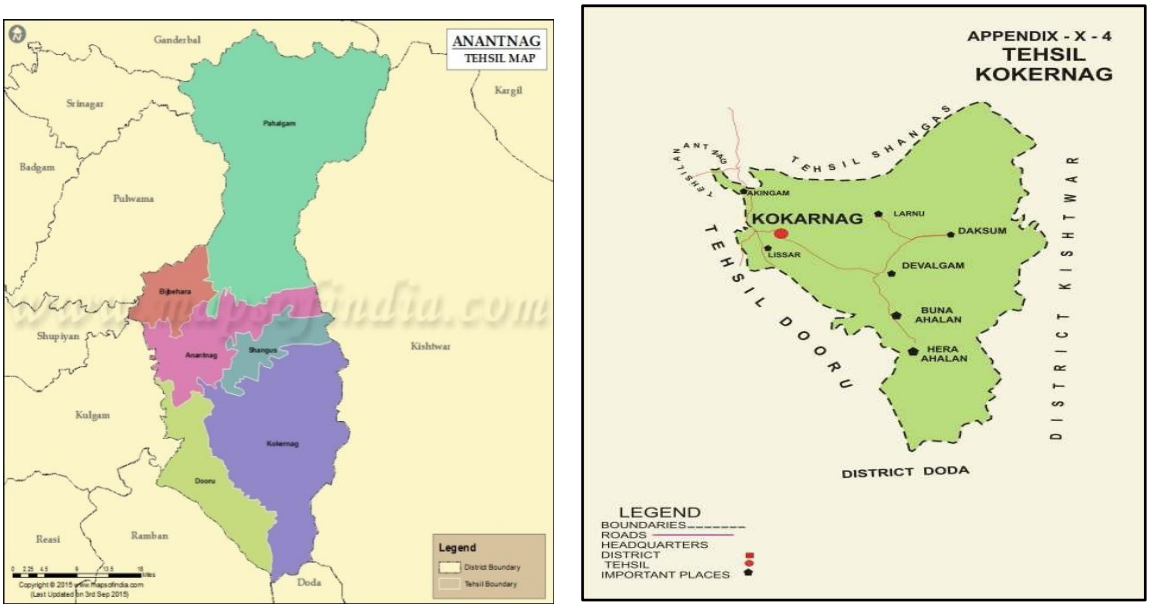

Fig.1 Map showing the Particular study area of Daksum Range.

Relative density, relative frequency and relative basal area

The vegetation of the selected grassland was recorded in all the quadrates laid at three altitude sites. The vegetation data were quantitatively analyzed for Relative density, Relative frequency and Relative basal area according to the procedure followed by Curtis and McIntosh (1950) and Misra (1969).

$$\text{Relative density} = \frac{\text{No. of individual of the species}}{\text{No. of individual of all the species}} \times 100$$

$$\text{Relative frequency} = \frac{\text{No. of occurrence of the species}}{\text{No. of occurrence of all the species}} \times 100$$

$$\text{Relative dominance} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all the species}} \times 100$$

Importance Value Index

The IVI, which is an integrated measure of the relative frequency, relative density and relative dominance, was calculated for all species of trees, shrubs and herbaceous species separately for different elevation classes in the study area of the forest division according to procedure followed by Curtis and McIntosh (1950) and Misra (1969).

IVI = Relative Density + Relative Frequency + Relative Basal area

To record the sampling intensity structure, quadrates of 1m × 1m for grasses and herbs were laid down on each sampling plot at all three sites. Sampling was carried out by stratified random sampling in the month of June and there after vegetative analysis was carried out.For grasses and herbage species samples from different points (Lower, middle and upper sites) were taken and made composite samples for each of the species. The Representative samples were then packed and were oven dried to a constant weight at 60°C. To determine their chemical composition only three potential fodder species were selected for nutrient analysis. These species were selected after consultation with local people and migratory grazers. Samples were collected in the month of August.The observations recorded on various parameters were analysed using standard statistical procedures followed by Cochran and Cox (1963). Following parameters were recorded for nutrient analysis:

Nitrogen per cent

For the of estimation nitrogen, 0.5 g of plant sample was digested in concentrated H_2SO_4 using standard digestion mixture K_2SO_4 : $CuSO_4$ (3.5 : 0.4). After digestion, Nitrogen was estimated in Kjeltec Auto 1030 Analyzer.

Phosphorous and potassium per cent

For the estimation of P and K content in plant, 0.5 g of the ground material was digested in 4:1 Nitro-perchloric acid (HNO_3 : $HCLO_4$) mixture. In order to have a complete transfer of digested material, three washings of digestion flask were given with distilled water and final volume of the digest was made to 100 ml. Phosphorous was determined by Vando-molybdate yellow colour method using spectronic-20D. Potassium was estimated with Flame photometer.

Calcium and magnesium per cent

Calcium (Ca) and Magnesium (Mg) were determined by inductively coupled plasma (ICP) Emission Spectroscopy.

RESULTS

The nutrient status of three dominant grasses at three altitudes have been presented in Tables 01 to 03 and discussed as under:

Phytosociology of grasses and herbs

Regarding the grass species in upper altitude (Arishan) the dominant grass species were *Poa pretense, Hypercium perforatum* and *Cynodon dactylon* with their Importance value Index 77.10, 54.37 and 38.74 respectively. The highest density (39 tillers/m^2), frequency (62%) and basal area (3.89 cm^2/m^2) were recorded for *Poa pretense* followed by *Hypercium perforatum* with density (25 tiller/m^2), frequency (51%) and basal area (2.52 cm^2/m^2). The rarely distributed species were *Gysophilla cerastoides, Agrostis canina* and *Rumex neplensis* with their importance value index 16.40, 21.06 and 22.87 respectively. The lowest density (3.29 tillers/m^2). Frequency (60%) and basal area (0.11 cm^2/m^2) was recorded for *Gysophilla cerastoides.* Further the data shows that at Middle altitude (Harkani) the dominant plant species were *Fragaria nubicula, Poa annua, Cynodon dactylon* and *Heracleum candicans* with their importance value index 75.66, 63.75, 46.22 and 33.15 respectively. The density, frequency and basal area recorded for the *Fragaria nubicula* were 89 tillers/m^2, 100% and 7.31 cm^2/m^2, respectively followed by *Poa annua* with density (75 tillers/m^2), frequency (61%) and basal area (6.92 cm^2/m^2). The rarely distributed species were *Asplenium ramosum, Airsiama jacquemontii, Trifolium repens* and *Persicaria amplexicaulis* with their important value index 3.92, 7.63, 10.03 and 17.90 respectively. The lowest density (1.05 tillers/m^2), frequency (52%) and basal area 0.02 (cm^2/m^2) was recorded for *Arisiama jacquemontii.* The data for lower altitude (Deesu) shows that the site was dominated by *Poa annua, Poa balbusa, Dactylis glomerata* and *Poa pretense* with the importance value index 63.72, 56.39, 54.92 and 37.42 respectively. The highest density (98 tillers/m^2), frequency (100%) and basal area (10.98 cm^2/m^2) was recorded for *Poa annua* followed by *Poa balbusa* with density (82 tillers/m^2), frequency (100%) and Basal area (9.56 cm^2/m^2). The rarely distributed plant species were *Artimisia bienis, Rumex patentia, Acomastylis elata, Mentha longifolia* and *Arctium lappa* with their importance value index 0.58, 0.80, 1.12, 1.23 and 1.60 respectively (Fig. 2).

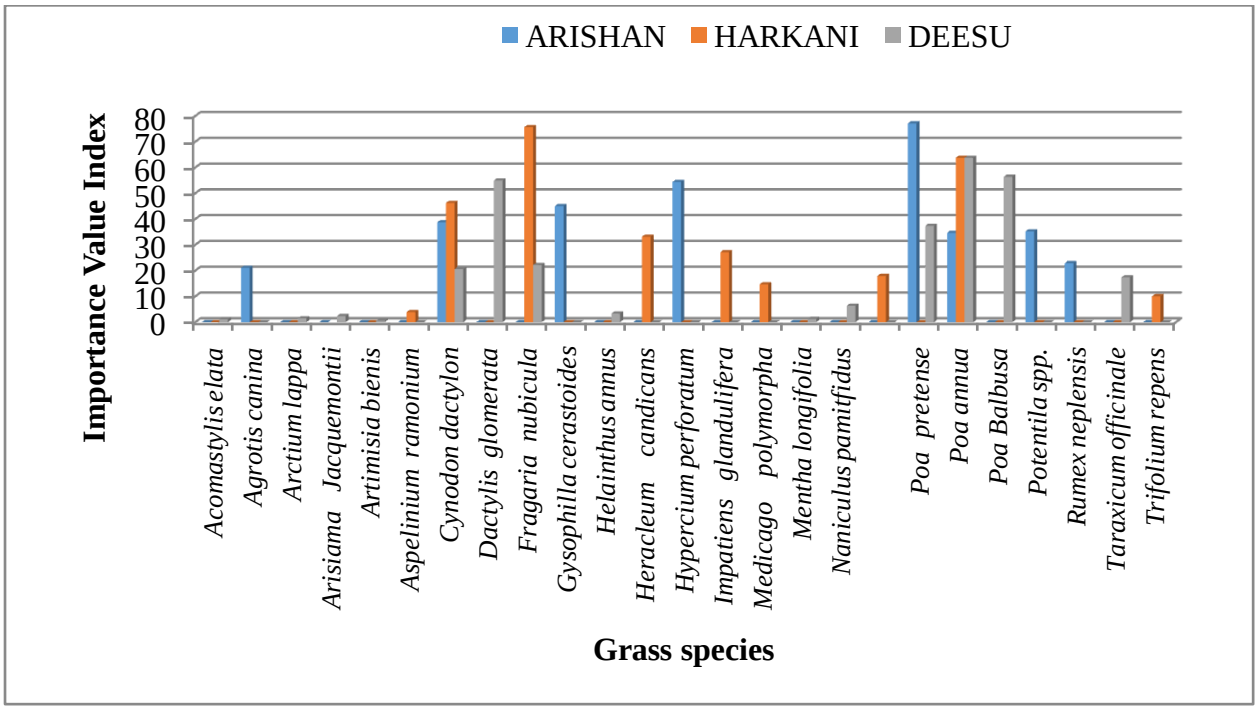

Fig. 2 Important value index of grass species at three sites.

Nitrogen content of dominant grass species

The data presented in Table 01 pertaining to Upper altitude (Arishan) revealed that the nitrogen per cent of three dominant grass species at higher altitude ranged from 1.19 to 1.26%, with *Cynodon dactylon* attaining maximum (1.26%) followed by *Hypercium perforatum* (*1.*20%) while the least was found in case of *Poa pretense* (1.19%). Further the data tabulated in Table 02 pertaining to Middle altitude (Harkani) shows that the nitrogen per cent of three dominant grass species at Middle altitude ranged from 0.87 to 1.21%, with *Cynodon dactylon* attaining maximum (1.21%), followed by *Poa anuua* (1.07%) while the least was found in *Fragaria nubicula* (0.87%). The data depicted in Table 03 pertaining to Lower altitude (Deesu) revealed that the nitrogen per cent of

three dominant grass species at lower altitude ranged from 1.22 to 1.42%, with *Poa balbusa* attainingmaximum (1.42%), followed by *Dactylis glomerata* (1.24%) while the least was found in *Poa annua* (1.22%).

Phosphorous content of dominant grass species.

A scrutiny of data presented in Table 01 for Upper altitude (Arishan) revealed that the Phosphorous per cent of three dominant grass species at Upper altitude range from 0.21 to 0.16%, with *Cynodon dactylon* attaining maximum (1.26%), followed by *Hypercium perforatum* (1.20%) while the least was found in *Poa pretense* (1.19%). Further The data tabulated in Table 02 pertaining to Middle altitude (Harkani) revealed that the phosphorous per cent of three dominant grass species at Middle Altitude range from 0.12 to 0.41%, with *Cynodon dactylon* attaining maximum (0.41%), followed by *Poa annua* (.31%) while the least was found in *Fragaria nubicula* (0.12%).At lower altitude. Table 03 pertaining to Lower altitude (Deesu) for Phosphorous content of three grass species revealed that the phosphorous per cent of three dominant grass species at Lower Altitude ranged from 0.18 to 0.16%, with *Poa balbusa* attaining maximum (0.18%), followed by *Dactylis glomerata* (0.17%) while the least was found in *Poa annua* (0.16%).

Potassium content of dominant grass species

The data presented in Table 01 pertaining to Upper altitude (Arishan) for Potassium content revealed that the potassium per cent of three dominant grass species at Upper altitude ranged from 0.49 to 0.36%, with *Cynodon dactylon* attaining maximum (0.49%), followed by *Poa pretense* (0.45%) while the least was found in *Hypercium perforatum* (0.36%).While the data presented in Table 02 pertaining to middle altitude (Harkani) revealed that the Potassium per cent of three dominant grass species at Middle Altitude ranged from 0.36 to 0.19%, with *Fragaria nubicula* attaining maximum (0.36%), followed by *Cynodon dactylon* (0.19%) while the least was found in *Poa annua* (0.15%). The perusal of data in Table 03 pertaining to Lower altitude (Deesu) revealed that the potassium per cent of three dominant grass species at Lower Altitude ranged from 0.44 to 0.74%,with *Poa annua* attaining maximum (0.74%), followed by *Dactylis glomerata* (0.67%) while the least per cent was found in *Poa balbusa* (0.44%).

Calcium content of dominant grass species

The scrutiny of data tabulated in Table 01 pertaining to Upper altitude (Arishan) revealed that the Calcium per cent of three dominant grass species at Upper Altitude ranged from 0.51 to 0.59%, with *Hypercium perforatum* attaining maximum (0.59%), followed by *Poa pretense* (0.51%) and *Cynodon dactylon* (0.51%). Further, the data presented in Table 02 pertaining to Middle altitude (Harkani) revealed that the Calcium per cent of three dominant grass species at Middle Altitude ranged from 0.24 to 0.71%, with *Fragaria nubicula* attaining maximum (0.71%), followed by *Poa annua* (0.66%) while the least was found in *Cynodon dactylon* (0.24%). At lower elevation, Table 03 pertaining to Lower altitude (Deesu) revealed that the calcium per cent of three dominant grass species ranged from 0.64 to 0.91%, with *Dactylis glomerata* attaining maximum (0.91%), followed by *Poa balbusa* (0.86%) while the least calcium per cent was found in *Poa annua* (0.64%).

Magnesium content of dominant grass species

The data presented in Table 01 pertaining to Upper altitude (Arishan) revealed that the Magnesium per cent of three dominant grass species at Upper Altitude ranged 0.58 to 0.62%, with *Hypercium perforatum* attaining maximum (0.62%), followed by *Poa pretense* (0.61%) and *Cynodon dactylon* (0.58%). At intermediate altitude, Table 02 pertaining to Middle altitude (Harkani) revealed that the Magnesium per cent of three dominant grass species at Middle Altitude ranged from 0.10 to 0.29%, with *Cynodon dactylon* attaining maximum (0.29%), followed by *Fragaria nubicula* (0.21%) while the least was found in *Poa annua* (0.10%). Further data presented in Table 03 pertaining to Lower altitude (Deesu) revealed that the magnesium per cent of three dominant grass species ranged from 0.95 to 0.99%, with *Dactylis glomerata* attaining maximum (0.99%), followed by *Poa balbusa* (0.98%) while the least was found in *Poa annua* (0.95%).

Table 1. Nutrient content (%) of three dominant grasses of at higher altitude.

Species name	Nutrient content (%)				
	N	P	K	Ca	Mg
Poa pratensis	1.19	0.16	0.75	0.51	0.81
Hypercium perforatum	1.42	0.21	0.46	0.59	0.82
Cynodon dactylon	1.26	0.17	0.49	0.51	0.98

Table 2. Nutrient content (%) of three dominant grasses at Middle altitude elevation.

Species name	Nutrient content (%)				
	N	P	K	Ca	Mg
Fragaria nubicula	1.43	0.12	0.36	0.71	0.41
Poa annua	1.47	0.13	0.45	0.66	0.99
Cynodon dactylon	1.21	0.14	0.49	0.44	0.52

Table 3. Nutrient content (%) of three dominant grasses at lower altitude elevation.

Species name	Nutrient content (%)				
	N	P	K	Ca	Mg
Poa annua	1.22	0.16	0.34	0.44	0.55
Poa balbusa	1.20	0.18	0.44	0.46	0.18
Dactylis glomerata	1.14	0.17	0.27	0.51	0.59

DISCUSSION

In case of herb population the highest density was recorded in 98 tillers/m^2 for *Poa annua* at lower elevation, 89 tillers/m^2 for *Fragaria nubicula* at middle elevation and 39 tillers/m^2 for *Poa pretense* at upper elevation. The herb species also show the same pattern as the shrub population and their density ranged from 1 to 98 tillers/m^2 which is lower compared to the reported values by Ismail *et al.* (2015) i.e., 36 to 110 tillers/m^2 in Rasshad and Alabassia localities of Sudan .Indices like dominance index, species diversity, IVI are in higher values in non-grazed sites as compared to the Grazed site (Arishan). So this study depicts that at herbaceous level the anthropogenic interference decreases species richness or species diversity or dominance index, similar observation was made by (Kukshal *et al.*, 2006).

The concentration of different elements varied among the individual of same component or different components at the same or different study sites (Table 01 to 03). It may be due to cumulative effect of their different growth stages, their efficiency to draw elements from soil, biotic interferences, seasonal variation, effect of micro-climate and the most important, the soil nutrient status of that particular grazing site.At the time of sampling (July), summer season the plant species were at their initial bloom stages of growth, so this may the cause of high nutrient content in all the species. Sharma *et al.* (1967) also reported high nutrient content in grasses during the intial bloom stages.Analysis of Nutrient content in biomass of three dominant grass species shows that the maximum Nitrogen (%) was exhibited by *Poa annua* 1.47 per cent at Middle altitude (Harkani) followed by 1.43 per cent by *Fragaria nubicula* at middle altitude (Harkani). The minimum nitrogen content of 1.14 per cent by *Dactylis glomerata* was recorded at lower altitude (Deesu).Analysis of nutrient content in biomass of dominant grasses (Table 01 to 03) shows that the maximum Phosphorous per cent was exhibited by *Hypercium perforatum* (0.21%)at upper altitude site (Arishan) while minimum was recorded f*or Fragaria nubicula at* lower altitude site (Deesu). The potassium content in biomass of dominant grass species ranged between 0.27 to 0.74%. The maximum values were recorded for *Poa pretense* at upper altitude site and minimum values were recorded for *Dactylis glomerata* at lower altitude site. The values of Ca and Mg ranged between 0.44 to 0.71% and 0.18 to 0.99% respectively at an altitudinal gradient across the range.These results are supported by studies conducted by Bawa (1986) who noticed seasonal variations in N, P and K per cent of grasses in different seasons and reported maximum nitrogen (%) in September near Shimla, Himachal Pradesh. Gupta (1988) reported that N, P, and K was maximum in above ground biomass of grasses at peak biomass stage (July-September) and they varied from 0.63 to 1.68, 0.05 to 0.16 and 0.26 to 0.58 per cent respectively in grasslands around Shimla.

CONCLUSION

Amongst the shrub species *Juniperus squammata* exhibited highest frequency value of 85% at higher altitude, *Rhododendron anthopogon* (70%)and *Vibernum* spps (78%)displayed maximum frequency value respectively at middle and lower sites. In case of basal area of shrub species *Juniperus squamatta* recorded the maximum basal area (37.04 m^2/ha) at higher altitude site, *Skimmia laureola* (10.20 m^2/ha) and *Vibernum* spps (19.87 m^2/ha) recorded maximum basal area at middle and lower altitude site respectively.The herbaceous species recorded ranged from 07 to 16 at three sites. The basal cover of herbaceous species depicted maximum basal cover of 3.98, 7.63 and 10.71 cm^2/m^2 for *Poa pretense, Fragaria nubicula* and *Poa balbusa at* Upper, Intermediate and Lower altitude sites respectively.The nitrogen content% in biomass of dominant grass species at lower altitude ranged from 1.14 to 1.22%, at middle elevation from 1.21 to 1.43% and 1.19 to 1.42% at upper elevation site. The Phosphorous content (%) in biomass of dominant grass species ranged between, 0.16 to 0.18%, 0.12 to 0.14% and 0.16 to 0.21% at lower, middle and upper elevation respectively. The potassium content (%) in biomass of dominant grass species at lower elevation ranged from 0.27 to 0.44%, 0.36 to 0.49% and 0.49 to 0.75% at lower, middle and upper elevation respectively. The values of Ca, and Mg ranged between 0.71 to 0.44% and 0.18 to 0.99% respectively at an altitudinal gradient across the range.

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