INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

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GRASSES OF BABABUDANGIRI–KEMMANNUGUNDI MONTANE HIGH LANDS OF KARNATAKA, INDIA

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ABSTRACT
The present study was undertaken from December 2012 to September 2014 to explore the grass species of Bababudangiri and Kemmannugundi high land montane hills of Karnataka. Result showed 73 grass species belonging to 43 genera were distributed in the area. Due to habitat loss, fragmentation, frequent fires, and invasive species and also by tourism, these grasslands are experiencing threatened conditions.

KEYWORD: Montane, Grasses, Poaceae, Shola.

INTRODUCTION

Bababudan hill range begins at the end of Eastern part of the Western Ghats in Chikkamagaluru of Karnataka state. The same range consist of Bababudangiri and Mullayyanagiri, Kemmangundi chain of hills are one of the most important physiographic features of Karnataka state and also it is said to be the most sensitive hotspot regions. These hill ranges are isolated complex chains that have iron rich plateau consists of rich bio diversity and harbours endemic floristic plant species. These hills naturally form the shape of a crescent moon; they are named as 'Chandradronaparvatha' where shola forests are distributed. They have an average elevation of 1400m high also contains the Karnataka's highest peak Mullayanagiri which is 1895 meters in height. The montane forests of higher altitudes of the Western Ghats are called as sholas as they are closely juxtaposed with grasslands (Mohandas and Davidar, 2010). The tropical montane forests are characterized by the presence of persistent cloud cover (Bunyan *et al*., 2012).The mosaic of shola –grassland with shola fragment are limited to folds and valleys. The mountain separated from the grassland with a sharp edge where this region is called as ecotone region (Mohandass and Davidar, 2010). They represent most of the endemic and threatened taxa. Grasses are ubiquities in distribution as they are evenly distributed in hill parts of the world. They occur in all kinds of situations and under all climatic conditions. In certain places grasses form a leading flora (Rai Bahadur, 1992). Grasses are the fourth largest group of flowering plants, globally represented by 10,550 species under 715 genera (Pathak, 2013). India is having 240 genera and 1,200 species growing which shows highly valuable grass diversity in India (Parmer *et al*., 2012). Grassland such ecosystem perform ecological functions including the maintenance of biodiversity (Tyagi *et al*., 2010). The montane grasslands (sky Islands or montane cloud forest) and adjacent evergreen forests of the Western Ghats form a distinctive vegetation mosaic (Thomas and Palmer, 2007). The montane forest harbours many endemic and rare plant species that cannot regenerate in grasslands and exposed sites due to lack of tolerance to fire and frost (Meher-Homji, 1967). Current threats to montane grasslands are mainly from livestock grazing, fuel-wood harvest frequent fires and agricultural expansion (Somasundaram and Vijayan, 2010).The rapid growth of tourism has created pollution, and put unsustainable impacts on diversity of species found in grassland ecosystems.

MATERIALS & METHODS

Study area

The study was conducted in the areas of montane grasslands which are spreaded in Chikkamagaluru district, namely Kemmanagundi, Mullayanagiri, and Bababudangiri. Hills show extreme climatic conditions. Soil and environmental factors like depth of soil, presence or absence of rocks and boulders, grazing and burnt condition, forest edges, rocky and non-rocky slopes, edaphic factors, microclimatic conditions, rainfall mainly influenced on the species composition. Bababudan hills consist of the Dharwarschists, these schists have iron ores, consists of hornblendic schists, which are associated with ferrugineous quartzites and hematite bands. Iron is in the form of banded iron formations, which is limonite (Saldanha, 1984). Along the Bababudan hills is a rich of black cotton soil, water holding capacity is more due to supply of water from the hill streams, soil is acidic in nature. Study area was visited regularly from September 2011 to March 2014. For the qualitative collection of grass and herbaceous plants, a random sampling method was used. Grass specimen collected was identified by regional floras (Gamble, 1935; Yoganarasimhan and Razi, 1981; Ramaswamy *et al*., 2001; Bhat, 2003; Singh, 2007) and voucher specimens are deposited at Department of Applied Botany, Kuvempu University Shankaraghatta, Shivamogga, Karnataka.

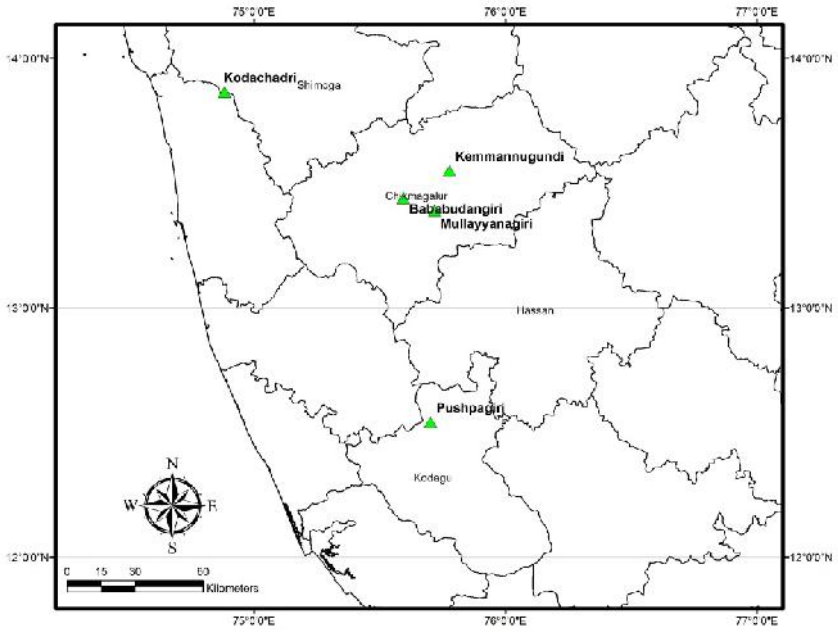

FIGURE 1. Map showing locations of study sites in three districts of Karnataka

RESULTS & DISCUSSION

The result indicated that a total of 73 species of grasses under 43 genera occurred in the study sites. Among 73 species, 60 species belong to Poaceae and 13 species belongs to Cyperaceae. Montane grasslands are well known for endemic and rare taxa. Among this *Arundinella perpurea*, *A. mesophylla*, *Jansenella grifithiana* and *Paspalum canare* were endemic to Kemmannugundi and Bababudangiri (Hooker, 1896). In this montane grasslands of Kemmannugundi, comprised tall grasses whereas Mullayanagiri and Bababudangiri harbours the small or stunted grass communities. The common species in Kemmannugundi, Bababudangiri and Mullayanagiri are *Arundenella perpuria*, *Chrysopogan Hackelli*, *C. velutinus*, *Heterogan contratus*, *Eulalia trispicata*, *Jansenella grifithiana*, *Themeda triandra* are abundent in Kemmannugundi. Some of the herbaceous species associated with grasses are *Habenaria hyneana*, *Murdania simplex*, *Peristylis densus*, *Satyrium nepalensis etc*. which are listed in Table 2 which are indicators of seasonal overwhelm. Ordination analysis of grass showed 65 species are abundant spread in Kemmannugundi and Bababudangiri region. Whereas lower number of species spread in Mullayanagiri. *Isachne* and *Ergrostis* have the highest representation with six and four species each. The genera *Arundinella*, *Bulbostylis*, *Digitaria*, *Ischaemum* and *Themeda* have three species each. *Arthroxan*, *Brachiaria*, *Chrysopogon*, *Cymbopogon*, *Cyperus*, *Dactyloctenium*, *Fimbristylis*, *Kyllinga*, *Panicum*, *Paspalum*, and *Pennisetum* represented by two species. Twenty-five genera represented only one species. Augustine *et al*., (1998) recorded the occurrence of 163 species from Periyar Tiger Reserve. Among those 33 belongs to endemic species to peninsular India. Similarly VasanthaKumari *et al.* (2010) reported 67 species of grass with 48 genera belonging to 9 tribes and 6 subfamilies from Bhadra Wild Life Sanctuary of Karnataka. Some of these species available at specific habitats. Occurrence of 73 species in the present study area showed the moderate richness and diversity of flora. In earlier documentation, Fyson (1920) recorded 87 species of grass from South Indian hill station. Nine species of grasses were reported from Chikkamagaluru (Yoganarasimhan *et al.,* 1982) and 19 species from Shivamoggha district (Ramaswamy *et al*., 2001). Distribution of grasses were sorted based on ordinal scaling (Jongman *et al*., 1987).

TABLE 1: List of Grass species collected from the Bababudan. Kemmannugundi hill grassland slopes of Karnataka

Plant name	Family	Kemmannugundi	Bababudangiri	Mulainagiri
Alloteropsis cimicina	Poaceae	3	0	0
Amphilophis insculpta	Poaceae	3	3	0
Aristida redacta	Poaceae	2	3	0
Aristida setacea	Poaceae	3	0	0
Arthraxon villosus	Poaceae	1	3	3
Arthroxan quartinianus	Poaceae	3	1	2
Arundinella pumila	Poaceae	3	2	2
Arundinella purpurea	Poaceae	3	1	0
Arundinella villosa	Poaceae	1	3	1
Brachiaria ramose	Poaceae	3	2	1
Brachiaria reptans	Poaceae	1	3	2
Bulbostylis capillaris	Cyperaceae	2	3	1

Bulbostylis densa	Cyperaceae	3	3	3
Bulbostylis puberula	Cyperaceae	0	0	1
Capillipedium huegelii	Poaceae	2	3	1
carex filicina	Cyperaceae	3	0	0
Chloris barbata	Poaceae	3	0	0
Chrysopogon hackelii	Poaceae	3	0	0
Chrysopogon velutinus	Poaceae	3	0	0
Cleistachne stocksii	Poaceae	1	3	0
Cymbopogon caesius	Poaceae	3	0	0
Cymbopogon flexuosus	Poaceae	3	0	0
Cynodon dactylon	Poaceae	2	0	0
Cyperus digitatus	Cyperaceae	0	0	0
Cyperus distans	Cyperaceae	3	0	0
Dactyloctenium aegyptium	Poaceae	3	0	0
Digitaria stricta	Poaceae	0	3	2
Digitaria ternate	Poaceae	2	3	0
Digitaria wallichiana	Poaceae	0	0	0
Echinochloa colona	Poaceae	2	0	1
Eleusine indica	Poaceae	3	2	2
Eragrostis pilosa	Poaceae	3	2	1
Eragrostis tenella	Poaceae	1	2	3
Eragrostis tenuifolia	Poaceae	3	0	0
Eragrostis unioloides	Poaceae	3	0	0
Eremopogon foveolatus	Poaceae	2	3	0
Eulalia trispicata	Poaceae	3	0	0
Fimbristylis miliacea	Cyperaceae	0	0	0
Fimbristylis sp	Cyperaceae	3	2	2
Glyphochloa forticulata	Poaceae	3	0	0
Heteropogon contortus	Poaceae	3	0	0
Imperata sp	Poaceae	3	0	0
Isachne bourneorum	Poaceae	3	2	0
Isachne elegans	Poaceae	0	0	0
Isachne gracillis	Poaceae	3	0	0
Isachne Kunthiana	Poaceae	2	3	1
Isachne lisboae	Poaceae	0	0	0
Isachne setosa	Poaceae	3	3	3
Ischaemum impressum	Poaceae	0	0	0
Ischaemum indicum	Poaceae	3	1	1
Ischaemum semisagittatum	Poaceae	3	0	0
Jansenella griffithiana	Poaceae	3	0	0
Kyllinga melanosperma	Cyperaceae	3	0	0
Kyllinga pumila	Cyperaceae	2	0	0
Manisuris forficulata	Poaceae	3	2	0
Mariscus cyperinus	Cyperaceae	2	0	0
Microchloa sp	poaceae	3	0	0
Panicum antidotale	Poaceae	1	0	3
Panicum psilopodium	Poaceae	3	0	1
Paspalum canare	Poaceae	3	2	1
Paspalum compactum	Poaceae	3	1	0
Pennisetum hohenackeri	Poaceae	3	0	0
Pennisetum polystachyon	Poaceae	3	0	0
Polypogon monspeliensis	Poaceae	2	1	3
Pseudopogonatherum contortum	Poaceae	3	0	1
Pycreus pumilus	Cyperaceae	3	3	3
Scleria sumatrensis	Cyperaceae	3	2	0
Setaria pumila	Poaceae	3	1	0
Themeda quadrivalvis	Poaceae	3	2	2
Themeda tremula	Poaceae	3	3	0
Themeda triandra	Poaceae	3	3	2
Tripogon bromoides	Poaceae	3	3	2
Tripogon pauperculus	Poaceae	3	3	0

Note: 1, 2, 3 represents the distribution of grass in the study area ranked based on ordinal scaling

TABLE 2: Dominant associated herbaceous plant species in the study area of Karnataka

Plant name	Family
Ageratum conizoides	Asteraceae
Anaphalis lawii	Asteraceae
Campanula fulgens	Campanulaceae
Cassia mimosoides	Fabaceae
Chlorophytum tuberosum	Lilliaceae
Curculigo orchioides	Hypoxidaceae
Cyonotis tuberosa	Commilinaceae
Drosera peltata	Droseraceae
Euphorbia psylostegia	Euphorbiaceae
Gentiana quadrifaria	Gentianaceae
Hebenaria grandifloriformies	Orchidaceae
Hebenaria hyneana	Orchidaceae
Hebenaria longicorniculata	Orchidaceae
Heraculum	Apiaceae
Hypoxis arurea	Hypoxidaceae
Impatiens raziana	Balsaminaceae
Justicia procumbens	Acanthaceae
Justicia Simplex	Acanthaceae
Lecus aspera	Lamiaceae
Lecus morrubidioides	Lamiaceae
Linnum mysorensiss	Linnaceae
Murdania simplex	Commilinaceae
Ophioriza mungosa	Rubiaceae
Peristylus densus	Orchidaceae
Pimpinella wallichiana	Apiaceae
Strobilanthes sessilis	Acanthaceae
Senecio ludenus	Asteraceae
Setarium nepalensis	Orchidaceae
Simithia blanda	Fabaceae
Smithia sensitive	Fabaceae
Tephrosia tinctoria	Fabaceae
Tricholepis glaberrima	Asteraceae
Viola patrinii	Violaceae
Wahlenbergia erecta	Campanulaceae

Grassland community composition was found to be strongly related to environmental and soil factors, like depth of soil, presence or absence of rocks and boulders, grazed and or burnt conditions, forest-grassland edges and rocky or non-rocky slopes. Soil type, altitude and precipitation also determined the vegetation composition of montane grasslands (Thomas and Plamer, 2007). Grasses play a very important role in ecosystem, used as forage for domesticated animal and soil conservation (Ahmad *et al*., 2009). Due to overgrazing and poor management practices, the grass species are restricted to specific areas (Ahmad *et al*., 2009). Many of the literature suggest that grasses are useful to human beings as a food and forage. Hence there is an urgent need for conservation of grasses in the fragile ecosystem of Bababudan-Kemmannugundi hill complexes.

ACKNOWLEDGEMENTS

Authors are gratefully acknowledging the financial support by the University Grants Commission, New Delhi for studies. Both authors are grateful to Dr. Gopalakrishna Bhat, Poorna Prajna College, Udupi, Karnataka who have helped identification of plant species. Thanks are also due to Karnataka Forest Department, Bengaluru for giving permission for field studies.

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