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PLANT BIODIVERSITY AND PHYTOSOCIOLOGICAL ATTRIBUTES OF DUREJI (KHIRTHAR RANGE)

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Abstract

An Inventory of plant species of Dureji game reserve was prepared on the basis of field trips conducted in different parts of the year particularly in winter, summer and monsoon. A total of 79 plants species were collected belonging to 66 genera under 32 families. Three rare species were found from the study area. Phenological status of each species i.e. flowering and fruiting condition was also observed. Quantitative analysis on species diversity in addition to phytosociological attributes analysis was conducted. Some ecological parameters such as lifeforms, density, relative density, cover, relative cover frequency and relative frequency were investigated. Vegetation cover varies from place to place depending upon the texture and structure of the soil. Vegetation structure and density is greatly influenced by the rainfall. One of the main threats to the vegetation of the study area is grazing. The current work provides floristic and ecological data for these threatened habitats of Dureji Game Reserve and documents the structure and composition of vegetation.

Introduction

The Khirthar range comprises eastern part of Khirthar mountains. It is approximately 400 Km long and 30 Km wide. North-South oriented hill range and its altitude varies from about 1000 m in the south to 2400 m in the north. The area of Khirthar range is covered with calcareous rocks (Anon., 2005). The Khirthar range includes three types of protected area, the Khirthar National Park, Mahal Kohistan Wild life Sanctuary and the Sumbak Game reserve (Akhter, 2003). The entire Khirthar National Park falls under Saharo-Sindian region (Ali & Qaiser, 1986) or Sudanian region (Zohary, 1973). The vegetation of the whole area is xerophytic, sparse and dominated by spiny thorny shrubs, bushes and few tree species along with large number of ephemerals.

The area, which is taken under consideration, has been visited in different parts of the year for plant collection, phytosociological attributes and ecological conditions of the study area. Species composition and their population level fluctuate from year to year depending on the rains.

The present paper summarizes three years of field and laboratory investigation on plants of Dureji. Every species name cited in this paper is documented and deposited in KUH. The material examined includes herbarium specimens present in KUH and field collections. This is the first attempt to compile and organize all the available data on Dureji flora. There is no published report on flora of the region. However, Baseline study of Khirthar National Park was carried by University of Melbourne (Enright & Miller, 2000) and environmental impact assessment for the exploratory wells on Dumbar-Khirthar, Qaiser *et al.*, (2002). Akhtar (2003) reported 502 plant species in Plant guide of Khirthar National Park.

Study site: The Dureji game reserve lies 150 Km north of Karachi near the town of Dureji in southern Balochistan Province. The area is 130,122 ha., series of mountain ridges running in a roughly north-south direction and adjacent plains with occasional rocky outcrops. The climate of the region is hot and arid with very little rainfall. The average rainfall is about 75 mm of which maximum is received during the monsoon period i.e. from June to September. The winters are dry with a very little rainfall. The summer temperature averages between 44 to 48^{o}C and the winter temperature varies between 30 to 35^{o}C during day and 10–15^{o}C during night (Enright & Miller, 2000).

The Hub River is the only perennial water source. A network of ephemeral streams and water courses flows from north to south into the Arabian Sea (Hagler Bailly, 1998, 2000). A number of springs that flows throughout the year exist in the study area. These springs alongwith a few water holes are the primary source of water for people, livestocks and wildlife inhabiting the area. Dureji is important for Urial, Ibex and Chinkara (International Union for Conservation of Nature Resources (Anon., 1998).

Materials and Methods

The study area was thoroughly surveyed throughout the year from time to time to study the botanical and ecological conditions. It provides an opportunity to make plant collections and field observations during the flowering and fruiting of maximum number of species. The area was sampled by quadrat method. Random stratified sampling was done using 10' x 10' quadrat and in each community 5 to 10 quadrats were taken. Frequency and cover of each species were noted. The quadrats were laid down at regular intervals of 10 steps. Plants from each quadrat were collected and associate species even not present in the quadrats were also noted down and collected.

Specimens were identified using available literatures and by camparision of the collections with specimens at KUH. Nomenclature followed here is that from Flora of Pakistan (Nasir & Ali, 1972–1994) and (Ali & Qaiser, 1995-2008). The Importance Value Index (IVI) of all the plant species noted in the quadrats was calculated (Table 1).

Results and Discussion

The Dureji game reserve is located in southern Pakistan about 150 Km north of Karachi near the town of Dureji in southern Balochistan Province. Environmental conditions on the study area are very severe. Its harsh climate, little rainfall and poor soil conditions neither support rich species nor the luxurious growth. Moreover, due to prolonged drought season in the study area, the present condition of the vegetation is not good.

During the vegetation survey, 79 plant species were recorded belonging to 32 families and 66 genera (Table 1). The largest family was Poaceae consisting 12 species, while the other major families were Papilionaceae comprising of 7 species and Asteraceae six species. No endemic species has been found from the study area. Three species are found rare in the study area i.e. *Cometes surattensis* Burm. *Desmostachya bipinnata* (L.) Stapf., and *Solanum surattense* Burm. f. The life form of each species depending on the position of perenating buds has also been determined according to Raunkiaer system of classification (Raunkiaer, 1934). Chaemophytes are the most dominant class of life form in the study area followed by Phanerophytes, Therophytes, Hemicryptophytes and climbers.

Table 1. List of the Plant species found in the Hub Dureji Road (Lasbela) along with their life form, Abundance and phenological status.

Species	Life Form	Abundance	Phenological status	
			Flowering	Fruiting
Acanthaceae				
Barleria acanthoides Vahl.	Chaemophyte	V. common	-	-
Blepharis sindica Stocks ex T. Anders.	Chaemophyte	V. common	-	-
Aizoaceae				
Corbichonia decumbens (Forssk.) Exell.	Therophyte	Common	+	+
Limeum indicum Stocks ex T.Anders	Therophyte	Common	-	+
Amaranthaceae				
Aerva javanica (Burm. f.) Juss.	Chaemophyte	Infrequent	+	+
Apocynaceae				
Rhazya stricta Decne.	Phanerophyte	Common	-	+
Asteraceae				
Blainvillea latifolia (L.f.) DC	Therophyte	Infrequent	-	-
Dicoma tomentosa Cass.	Chaemophyte	Infrequent	+	+
Echinops echinatus Roxb.	Chaemophyte	V. common	-	-
Iphiona grantioides (Boiss.) Anderb.	Chaemophyte	Common	+	+
*Launaea procumbens (*Roxb.) Ramayya & Rajagopal	Chaemophyte	Infrequent	-	-
Vernonia cinerascens Sch.-Bip.	Chaemophyte	Common	+	-
Asclepiadaceae				
Calotropis procera (Willd.) R.Br.	Phanerophyte	Common	+	+
Leptadenia pyrotechnica (Forssk.) Decne.	Phanerophyte	Common	-	+
Periploca aphylla Decne.	Phanerophyte	Common	-	-
Boraginaceae				
Heliotropium ophioglossum Boiss.	Chaemophyte	Common	+	+
Heliotropium crispum Stocks	Therophyte	infrequent	+	+
Trichodesma indicum (L.) R. Br.	Chaemophyte	Common	+	+
Brassicaceae				
Physorrhynchus brahuicus Hk.	Chaemophyte	infrequent	+	-
Burseraceae				
Commiphora wightii (Arn.) Bhandari	Phanerophyte	common	-	+
Commiphora stocksiana Engle.	Phanerophyte	Infrequent	-	+
Caesalpiniaceae				
Cassia holosericea Fresen	Chaemophyte	V. common	+	+
Capparidaceae				
Capparis cartilaginea Decne.	Phanerophyte	infrequent	+	+
Capparis decidua (Forssk.) Edgew.	Phanerophyte	V. common	+	+
Cleome scaposa DC.	Therophyte	Common	+	-
Cleome viscosa L**.**	Therophyte	Common		
Celastraceae				
Maytenus senegalensis (Lam.) Exell	Chaemophyte	Common		

Table 1. (Cont'd.)

Species	Life Form	Abundance	Phenological status	
			Flowering	Fruiting
Illecebraceae				
Cometes surattensis Burm.	Therophyte	Rare		
Convolvulaceae				
Cressa cretica L.	Chaemophyte	V. common	+	-
Seddera latifolia Hochst. & Steud.	Chaemophyte	Common	-	-
Convolvulus spinosus Burm. f.	Chaemophyte	Common	-	-
Cucurbitaceae				
Cucumis prophetarum L.	Therophyte	Infrequent	-	-
Euphorbiaceae				
Euphorbia caducifolia Haines	Therophyte	Common	+	+
Euphorbia prostrata Ait.	Therophyte	Common	+	-
Euphorbia granulata Forssk.	Therophyte	Common	+	+
	Therophyte	Common	+	+
Labiatae				
Salvia santolinaefolia Boiss.	Chaemophyte	Infrequent	-	-
Malvaceae				
Hibiscus micranthus L.f.	Chaemophyte	Common	+	+
Pavonia arabica Hochst. ex Steud.	Chaemophyte	Infrequent	-	+
Menispermaceae				
Cocculus pendulus (J. R. & G. Forst.) Diels	Chaemophyte	Infrequent	-	-
Mimosaceae				
Acacia senegal (L.) Willd.	Phanerophyte	V. common	+	+
A. nilotica (L.) Delile.	Phanerophyte	Common	+	-
Nyctaginaceae				
Commicarpus boissieri (Heinsen) Cufod.	Chaemophyte	Infrequent	+	-
Boerhaavia procumbens Banks ex Jaub. & Spach	Chaemophyte	Infrequent	-	-
Papilionaceae	Chaemophyte	Infrequent	+	+
Alhagi maurorum Medic.	Chaemophyte	Infrequent	+	
Argyrolobium roseum (Camb.) Jaub. & Spach.	Chaemophyte	Infrequent	+	-
Crotalaria burhia Ham. ex Benth.	Chaemophyte	Infrequent	+	
Tephrosia uniflora Pers.	Climber	Infrequent	+	+
Rhynchosia minima (L.) DC.	Chaemophyte	Common	+	-
Indigofera oblongifolia Forssk.	Therophyte	Common	-	-
Indigofera cordifolia Heyne ex Roth	Therophyte	Common		
Poaceae				
Aristida adscensionis Hk.f.	Therophyte	Common	-	+
A. hystricula Edgew.	Therophyte	Infrequent	-	+
Cenchrus ciliaris L.	Therophyte	Common	+	+
*Cenchrus setigerus*Vahl.	Therophyte	Common	-	+
Chrysopogon aucheri (Boiss.) Stapf	Therophyte	Common	+	+
Desmostachya bipinnata (L.) Stapf	Hemicryptophyte	Rare	+	-

Table 1. (Cont'd.)

Species	Life Form	Abundance	Phenological status	
			Flowering	Fruiting
Dicanthium annulatum (Forssk.) Stapf	Hemicryptophyte	Common	+	+
Eragrostis pilosa (L.) P. Beauv.	Therophyte	Common	+	-
Elionurus royleanus Nees ex A. Rich	Therophyte	Infrequent	-	-
Tetrapogon villosus Desf.	Hemicryptophyte	Infrequent	-	+
Panicum turgidum Forssk.	Chaemophyte	Infrequent	-	+
Saccharum griffithii Munro ex Boiss.	Chaemophyte	Common	+	-
Polygonaceae				
Pteropyrum olivieri Jaub. & Spach.	Chaemophyte	Infrequent	-	+
Polygonum plebejum R.Br.	Chaemophyte	Infrequent	+	-
Resedaceae				
Reseda aucheri Boiss.	Chaemophyte	Infrequent	-	-
Rhamnaceae				
Ziziphus nummularia (Burm.f.) W. & Arn.	Phanerophyte	V. common	-	+
Salvadoraceae				
Salvadora oleoides Decne.	Phanerophyte	V. common	-	-
Solanaceae				
Solanum surattense Burm. f.	Chaemophyte	Rare	+	+
Lycium edgeworthii Dunal	Chaemophyte	Common	+	-
Tamaricaceae				
Tamarix dioica Roxb. ex Roth	Phanerophyte	Common	+	+
Tamarix aphylla (L.) Karst.	Phanerophyte	Common	-	-
Tamarix stricta Boiss.	Phanerophyte	Common	+	+
Tiliaceae				
Corchorus depressus (L.) Stocks.	Hemicryptophyte	Infrequent	+	-
C. tridens L.	Phanerophyte	Common	+	-
Grewia tenax (Forssk.) Aschers & Schweinf	Phanerophyte	V. common	-	+
Typhaceae				
Typha domingensis Pers.	Phanerophyte	Common		
Zygophyllaceae				
Fagonia indica Burm. f.	Chaemophyte	V. common	+	-
Seetzenia lanata (Willld.) Bullock	Chaemophyte	Infrequent		-
Zygophyllum propinquum Decne.	Chaemophyte	V. common		
Different life form occurring in Hub duraji road	Dureji			
Life form	**% age**			
Chaemophyte	46			
Therophyte	25			
Phanerophyte	22			
Hemicryptophyte	5.26			
Climbers	1.3			

Table 2. Phytosociological attributes of plants communities occurring in stony plain Locality: Hub Dureji Road (District Lasbela).

Name of species	D3	F1	F3	C3	IVI
Capparis decidua	26.41	70	26.92	40.27	31.20
Salvadora oleoides	7.54	30	11.53	16.55	11.87
Ziziphus nummularia	11.32	20	7.69	15.66	11.55
Blepharis sindica	15.09	30	11.53	3.53	10.05
Aerva javanica	11.32	20	7.69	5.33	8.11
Maytenus senegalensis	5.66	20	7.69	9.12	7.49
Cassia holosericea	9.43	20	7.69	3.63	6.91
Fagonia indica	7.54	20	7.69	3.35	6.19
Crotalaria burhia	3.77	10	3.84	1.69	2.53
Heliotropium ophioglossum	1.88	10	3.84	3.84	2.20

Table 3. Phytosociological attributes of plants occurring in dry rocky stream bed Locality: Hub Dureji Road (District Lasbela).

Name of species	F1	F3	D3	C3	IVI
Rhazya stricta	60	26.08	35.10	33.90	31.69
Alhagi maurorum	40	17.39	21.27	6.35	15.00
Ziziphus nummularia	30	13.04	8.51	13.50	11.68
Salvadora oleoides	20	8.69	5.31	14.16	9.38
Grewia tenax	20	8.69	7.44	7.44	7.85
Maytenus senegalensis	10	8.69	4.25	7.77	6.90
Aerva javanica	20	8.69	5.31	3.58	5.86
Periploca aphylla	10	4.34	4.25	7.60	5.39
Fagonia indica	10	4.34	5.31	3.21	4.28
Panicum turgidum	10	4.34	2.12	0.53	2.33
Polygonum plebejum	10	4.34	1.06	0.29	1.89

Table 4. Phytosociological attributes of plant occuring in dry sandy stream bed Locality: Hub Dureji Road (District Lasela).

Name of Species	D3	F1	F3	C3	IVI
Salvadora oledoides	8.1632	12.50	6.25	12.505	8.97
Salvia santolinaefolia	12.244	25.00	12.50	2.5427	9.095
Rhazya stricta	8.163	25.00	12.50	8.17	9.611
Indigofera oblongifolia	8.163	12.50	6.25	15.923	10.112
Acacia Senegal	2.0408	6.25	31.25	0.0416	12.51
Boerhavvia procumbens	4.0816	6.25	31.25	0.125	12.54
Aerva javanica	4.0816	6.25	31.25	0.7919	12.763
Iphiona grantioides	2.0408	6.25	31.25	0.833	12.777
Zygophyllum propinquum	16.326	18.75	9.38	15.506	13.731
Pteropyrum olevieri	12.244	25.00	12.50	20.341	15.028
Grewia tenax	22.448	25.00	12.50	12.546	15.831
Tamarix stricta	59.183	31.25	15.63	19.174	31.327

Within the study area, following types of habitats have been found viz. Rocky slopes, Dry stream beds (sandy and rocky), Plains (sandy and stony) and wetland. Rocky slopes mostly consist of limestones. It is dominated by *Acacia senegal* (L.) Willd., *Rhazya stricta* Decne., and *Convolvulus spinosus* Burm. The other common associates are *Zizyphus nummularia* (Burm. f.) W. & Arn. *Blepharis sindica* Stocks ex T.Ander., *Grewia tenax* (Forsk.) Fiori, *Withania coagulans* Dunal., *Barlaria acanthoides* Vahl. The vegetation in this community is very sparse. The total cover on the slopes is less than 15%. Due to prolonged drought and grazing pressure, the condition of the vegetation is rather poor.

Stream beds are often notably species-rich habitats and are responsible for higher rates of biomass production when compared with adjacent habitats (Brinson, 1990; Decamps & Tabacchi, 1994). The dominant species of dry sand stream beds are *Salvadora oleoides* Decne., *Salvia santolinaefolia* Boiss., *Rhazya stricta* Decne., whereas *Acacia senegal* Burm. f., *Indigofera oblongifolia* Forssk. *Pteropyrum olevieri* Jaub. & Spach., *Grewia tenax* (Forssk.) Anchers & Schweinf are some common associates. Dry rocky stream beds are dominated by *Rhazya stricta* Decne., *Alhaji maurorum* Medic., *Zizyphus nummularia* (Burm.f.), W. & Arn., and some of the common associates are *Grewia tenax* (Forssk.) Anchers & Schweinf., *Fagonia indica* Burm.f., *Salvadora oleoides* Decne., and *Periploca aphylla* Decne (Tables 3-4).

Sandy plains with undulating topography with high fraction of sand, in depression more soil is collected which is loamy with a better moisture conditions. The vegetation cover is higher than the stony plains but lesser than stream beds. It is dominated by *Rhazya stricta* Decne., *Acacia nilotica* (L.) Delile., *Salvadora oleoides* Decne, while *Zizyphus nummularia* (Burm. f.) W. & Arn., *Grewia tenax* (Forssk.) Anchers & Schweinf, *Fagonia indica* Burm. f. *Seddera latifolia* Hochst. & Steud. are some associates of sandy plains. *Capparis decidua* (Forssk.) Edgew., *Salvadora oleoides* Decne., *Zizyphus nummularia* (Burm.f.) W. & Arn. are the dominant species of stony plains. Some of the common associates are *Blepharis sindica* Stocks ex Ander., *Aerva javanica* (Burm. f.) Juss. ex Schult., *Maytenus senegalensis* (Lam.) Exell., *Cassia holosericea* Fresen (Table 1).

Wetland habitat is also found in the study area. It is dominated by *Typha domingensis* Pers. , *Tamarix aphylla* (L.) Karst., *Tamarix dioica* Roxb. ex Roth.

Goats and sheeps are the main grazing animals of the study area. Grazing pressure, becoming more intense each year and the habitat is being modified as a result in many regions of the Dureji. In addition, the cutting of trees and shrubs by people and the digging of valuable medicinal herbs are increasingly altering the composition and distribution of plants on the study area and its surrounding valleys.

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