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PLANT BIODIVERSITY AND PHYTOSOCIOLOGICAL ATTRIBUTES OF GORAKH HILL (KHIRTHAR RANGE)

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Abstract

A study was conducted for the plant biodiversity and phytosociological attributes of the Gorakh hill. Gorakh hill is located in Dadu district and is about 5,688 ft high above the sea level. The primary goal of this study is to provide comprehensive inventory of the area. The study area was thoroughly surveyed throughout the year from time-to-time in order to study the plant biodiversity. Gorakh hill has never been explored for its plant biodiversity. Plants were collected from the study area, in different parts of the year particularly in winter, summer, and monsoon. Phenological status of each species i.e. flowering and fruiting condition was also observed. Quantitative analyses on species diversity in addition to phytosociological attributes analysis were conducted. Some ecological parameters such as, life forms, species density, species cover, species relative density and frequency were calculated. Within the study area 74 plant species representing 62 genera and 34 families were found.

Introduction

Biodiversity is way of describing the diversity of life on earth, it includes all life forms and the ecosystem of which they are part. It forms the foundation for sustainable development, constitutes the basis for the environmental health of our land and is the source of economic and ecological security for our future generations. In the developing country, biodiversity provides the assurance of food, many raw materials such as fiber for clothing, materials, for shelter, fertilizer, fuel and medicines, as well as source of work energy in the form of animal traction. In addition, biodiversity maintains balance for planetary and human survival (Jafferies, 1997). The current contraction of biodiversity is cause for alarm, while disappearance is most serious. Biodiversity is continuously declining due to the activities of human kind (Krishnmurthy, 2003).

Pakistan is one of the few places on earth with such a unique biodiversity, comprising of different climatic zones with a wide range of plant species. Approx. 6000 plant species with medicinal properties are found in Pakistan. In Pakistan the continuous and progressive loss, fragmentation and degradation of natural habitats is leading to the disappearance of countless species. The forest area is already fragmented and degraded and is being subjected to further destruction, as are most rangelands and freshwater and marine ecosystems. Pakistan has five significant mountain systems: Western Himalayas, Karakoram, Hindukush, Suleiman and Khirthar range. It is typical of arid and semi-arid mountain terrenes. The mountains of Khirthar Range were 380 million years old while other mountains in Sindh were not older than 193 million years. Khirthar range is the evolutionary bed of Sindh civilization (Anon., 2005). Gorakh hill station is the second highest point of Khirther range, c. 5,688 ft. high. The entire Khirthar Range fall under Saharo-Sindian region (Ali & Qaiser, 1986). The vegetation and climatic conditions are different from the rest of the study area. The day temperature is between 25-30°C and at

night 10-12°C. There is no proper way points so working in the Gorakh hill station is very difficult. The area is mostly surrounded by High Mountain. Gorakh is 33 Km away from Wahi Pandi. Rocky slope and Hilltops are dominant habitat of the area. Gorakh hill never been explored botanically and the present study is the first attempt (Fig. 1).

There is no published report on flora of the region. However baseline study of Khirthar National Park was carried by Enright & Miller (2000), Environmental impact assessment for the Exploratory wells on Dumber-Khirthar was examined by Qaiser *et al*. (2002), Akhter, (2003) reported 502 species in plant guide of Khirthar National Park

Fig. 1. Map of Johi-Dadu showing Gorakh Hill.

Materials and Method

The study area was thoroughly surveyed throughout the year from time to time to study the botanical and ecological conditions. However, it was not possible to survey quantitatively the entire project area, even then every effort was made to include the entire representative, topographic and physiographic condition in the study area. The area was sampled by quadrate method, Random stratified sampling was done using 10 x 10 ft quadrate and in each community 5 to 10 quadrate were taken, frequency cover of each species was noted. The initial point of the first quadrate was randomly selected by tossing a nail. We made quadrates at regular interval of 10 steps. In some cases quadrate sampling linear was adjusted in shape but not size. Plants collection was done from each quadrate and also associate species, which were not even present in the quadrate. Plants were identified with the help of Flora of Pakistan. (Ali & Qaiser, 1995).

The important value Index (IVI) of all the plant species noted in the quadrates were manipulated. During the study some significant findings were noted. In addition to Phenological status of each species i.e., flowering and fruiting periods were also noted (Tables 1-4). The appropriate size for a quadrate was selected to give an accurate estimation of the number of individuals per unit area. The quadrate size was chosen to be large enough to include significant numbers of individuals, but small enough to separate, count and measure individual plants without duplication or omission of individuals.

Results and Discussion

The Khirthar ranges consist of an ascending series of ridges running generally north. The highest ridge of ranges is from the boundary between Sindh and Balochistan. Gorakh hill is the second highest point of Khirthar range. The present condition of the area is not satisfactory due to many reasons. Little rainfall, poor soil condition, deforestation and grazing. These all factors neither support rich species diversity nor progressive growth. The indigenous people continuously cutting and chopping large shrub and trees for their fuel requirement.

During the present study 74 species belonging to 62 genera and 34 families are collected. Out of 34 families 3 families belong to monocot i.e., Poaceae, Palmae and Liliaceae and 31 to Dicots viz., Aizoaceae, Amaranthaceae, Apocynaceae, Asteracerae, Asclepiadaceae, Bignoniaceae, Boraginaceae, Caesalpiniaceae, Capparidaceae, Convolvulaceae, Cucurbitaceae, Euphorbiaceae, Labiatae, Malvaceae, Menispermaceae, Mimosaceae, Nyctaginaceae, Oleaceae, Papilionaceae, Rhamnaceae, Salvadoraceae, Sapindaceae, Scrophulariaceae, Solanaceae, Tamaricaceae, Tiliaceae, Umbelliferae, Verbenaceae, Urticaceae, Violaceae and Zygophyllaceae.

Rhazya stricta (Apocynaceae), *Withania coagulans* (Solanaceae), *Dodonea viscose*, (Spindaceae), *Fagonia indica* (Zygophyllaceae), *Grewia tenax* and *Grewia villosa* (Tiliaceae), were the common plants of the study area (Figs. 2&3).

Poaceae is the most dominant family with c.9 species, Asteraceae is the second largest family followed by Papilionaceae, Solanaceae, Boraginaceae, Capparidaceae and Mimosacea, whereas other families are rare in distribution.

No endemic species has been found from the study area, however, *Sophora alopecuroides* L. (Paplionaceae), *Asparagus gharoensis* Blatt (Liliaceae), *Salvadora persica* L. (Salvadoraceae), *Olea ferruginea* Royle (Oleaceae) were the significant finding from the study area.

Result and Observations

Table 1. List of the plant species found in the Gorakh Hill Station along with their life form, Abundance and Phenology studies.

Taxa	Life form	Abundance	Phenological status	
			Flowering	Fruiting
Aizoaceae				
Corbichonia decumbens Scop.	Therophyte	Common	-	-
Limeum indicum Stocks ex T. Anders.	Therophyte	Infrequent	+	-
Amaranthaceae				
Aerva javanica (Burmf.) Juss. ex Schult.	Chaemophyte	Infrequent	-	+
Apocynaceae				
Rhazya stricta Decne.	Phanerophyte	Common	+	+
Asteracerae				
Dicoma tomentosa Cass.	Chaemophyte	V. Common	-	+
Echinops echinatus Roxb.	Chaemophyte	Infrequent	-	-
Eclipta prostrata (L.) L.	Chaemophyte	Common	-	-
Iphiona grantioides (Boiss.) A. Anderberg	Chaemophyte	Common	+	+
Asclepiadaceae				
Caralluma edulis (Edgew.) Benth. & Hook f.	Chamemophyte	Rare	-	-
Leptadenia pyrotechnica (Forssk.) Decne.	Phanerophyte	V. Common	+	-
Periploca aphylla Decne.	Phanerophyte	V. Common	-	+
Bignoniaceae				
Tecomella undulata (Roxb.) Seem.	Phanerophyte	Infrequent	+	-
Boraginaceae				
Heliotropium crispum Desf.	Chaemophyte	Common	-	+
Heliotropium ophioglossum Boiss.	Chaemophyte	Common	+	+
Trichodesma africanum (L.) R. Br.	Therophyte	Common	-	-
Caesalpiniaceae				
Senna holosericea (Fresen.) Greuter	Chaemophyte	V. Common	-	-
Capparidaceae				
Capparis decidua (Forssk.) Edgew.	Phanerophyte	Common	+	+
Cleome scaposa DC.	Therophyte	Common	-	-
Convolvulaceae				
Convolvulus glomeratus Choisy	Chaemophyte	Infrequent	+	-
Convolvulus spinosus Burm. f.	Chaemophyte	Common	+	-
Evolvulus alsinoides L.	Chaemophyte	Rare	+	-
Seddera latifolia Hochst. & Sted.	Chaemophyte	Common	+	+
Cucurbitaceae				
Citrullus colocynthis Mill.	Therophyte	Infrequent	-	+
Cucumis prophetarum L.	Therophyte	Infrequent	-	-
Euphorbiaceae				
Euphorbia caduicifolia Haines	Phanerophyte	V. Common	-	+
Euphorbia prostrata Ait.	Therophyte	Common	-	-
Euphorbia hirta L.	Therophyte	Infrequent	+	-
Euphorbia granulata Forssk.	Therophyte	Common	+	+
Labiatae				
Salvia santolinaefolia Boiss.	Chaemophyte	Infrequent	+	-
Liliaceae				
Asparagus gharoensis Blatter	Climber	Rare	+	+
Malvaceae				
Hibiscus micranthus L.f.	Therophytre	Common	+	+
Pavonia arabica Hocht. & Steud.	Chaemophyte	Rare	+	+
Senra incana Cav. ex Boiss.	Chaemophyte	Infrequent	-	+
Menispermaceae				
Cocculus pendulus J. R. & G. Forst.) Diels.	Chaemophyte	Infrequent	-	-
Cocculus hirsutus L.	Climber	Infrequent	-	+

Table 1. (Cont'd.).

Taxa	Life form	Abundance	Phenological status	
			Flowering	Fruiting
Mimosaceae				
Acacia senegal (L.) Willd.	Phanerophyte	V. Common	+	+
A.nilotica (L.) Delile	Phanerophyte	Common	-	-
A.jacquemontii Benth.	Phanerophyte	Infrequent	+	+
Mimosa hamata Willd.	Phanerophyte	Rare	-	-
Nyctaginaceae				
Boerhaavia procumbens Banks ex Roxb.	Chaemophyte	Infrequent	-	-
Oleaceae				
Olea ferruginea Royle	Phanerophyte	Rare	+	+
Palmae				
Nannorrhops ritichieana (Griff.) Aitch.	Phanerophyte	Common	-	-
Papilionaceae				
Sophora alopecuroides L.	Chaemophyte	Common	-	-
Tephrosia uniflora Pers.	Chaemophyte	Infrequent	+	+
Rhynchosia minima (L.) DC.	Climber	Infrequent	+	+
Indigofera oblongifolia Forssk.	Chaemophyte	Common	+	-
Poaceae				
Aristida adscensionis L.	Therophyte	Common	-	+
A.hystricula Edgew.	Therophyte	Common	-	-
Cenchrus setigerus Vahl	Therophyte	Infrequent	+	-
Cenchrus ciliaris L.	Therophyte	Common	-	-
Crysopogon aucheri (Boiss.) Stapf	Therophyte	Common	+	+
Dicanthium annulatum (Forssk.) Stapf	Therophyte	Infrequent	-	-
Tetrapogon villosus Desf.	Hemicryptophyt	Infrequent	-	+
Panicum turgidum Forssk.	Chaemophyte	Infrequent	-	-
Urochondra setulosa (Trin.) C.E.Hubb.	Therophyte	Rare	-	-
Rhamnaceae				
Ziziphus nummularia (Burm.f.) W. & Arn.	Phanerophyte	V. Common	-	-
Salvadoraceae				
Salvadora oleoides Decne.	Phanerophyte	V. Common	-	-
Salvadora persica L.	Phanerophyte	Rare	-	-
Sapindaceae				
Dodonea viscosa (L.) Jacq.	Phanerophyte	V. Common	-	-
Scrophulariacerae				
Kickxia ramosissima (Wall.) Janchen	Chaemophyte	Infrequent	+	-
Solanaceae				
Solanum surattense Burm.f.	Chaemophyte	Rare	+	+
Withania coagulans Dunal	Chaemophyte	V. Common	-	+
Tamaricaceae				
Tamarix dioca Roxb. ex Roth.	Phanerophyte	Common	+	+
T. stricta Boiss.	Phanerophyte	Common	+	+
Tiliaceae				
Corchorus depressus (L.) Stocks	Hemicryptophyte	Infrequent	+	-
C. tridens L.	Phanerophyte	Common	-	-
Grewia tenax (Forssk.)	Phanerophyte	V. Common	-	+
Grewia villosa	Phanerophyte	V. Common	+	+
Umbelliferae				
Psammogeton cabulicus (Wog.) E. Nasir.	Therophyte	Infrequent	-	+
Verbenaceae				
Chascanum marrubifolium Fenzl. ex Walp.	Chaemophyte	Rare	+	+
Urticaceae				
Forskahlia tenacissima L. Decne.	Chaemophyte	Infrequent	-	-
Violaceae				
Viola stocksii Boiss.	Therophyte	Rare	+	-
Zygophyllaceae				
Fagonia indica Burm f.	Chaemophyte	V. Common	-	-
Peganum harmala L.	Chaemophyte	V. Common	+	+
Tribulus terrestris L.	Chaemophyte	Common	+	+

Table 2. Phytosociological attributes of plants occurring on dry rocky stream bed community.

Name of species	Locality: Gorakh Hill				
	F1	F3	D3	C3	IVI
Tamarix dioca	50	10.53	4.40	40.068	18.3229
Salvadora oleoides	50	10.53	2.20	22.162	11.628
Euphorbia caducifolia	25	5.26	1.10	16.706	7.689
Seddera latifolia	50	7.53	61.54	4.873	7.58
Ziziphus nummularia	25	5.26	1.10	12.274	6.211
Iphonia grantioides	50	10.53	4.40	0.014	4.978
Grewia tenax	50	10.53	3.30	0.555	4.792
Dicoma tomentosa	25	5.26	1.10	0.123	2.161
Rhazya stricta	25	5.26	1.10	0.123	2.161
Hibiscus micranthus	25	5.26	1.10	0.013	2.125

Table 3. Phytosociological attributes of plants occurring in rocky-slope.

Name of species	Locality: Gorakh Hill				
	F1	F3	D3	C3	IVI
Aristida funiculate	40	14.81	14.00	29.86	19.55
Rhazya stricta	45	16.66	18.66	20.76	18.69
Convolvulus spionsus	40	14.81	13.33	16.30	14.81
Corbichonia decumbens	35	12.96	24.66	3.35	13.65
Echinops echinatus	20	7.40	8.00	6.30	7.23
Acacia senegal	15	5.55	2.00	10.11	5.88
Withania coagulans	20	7.40	3.33	4.72	5.15
Aerva javanica	10	3.70	4.00	5.13	4.27
Ziziphus nummularia	10	3.70	1.33	7.10	4.04
Fagonia indica	10	3.70	2.66	2.63	2.99
Trichodesma africanum	10	3.70	1.33	1.95	2.32
Grewia tenax	5	1.85	1.33	0.195	1.12
Cleome scaposa	5	1.85	1.33	0.09	1.09
Periploca aphylla	5	1.85	0.66	0.39	0.96

Table 4. Phytosociological attributes of plants occurring in hill top community.

Name of species	Locality: Gorakh Hill				
	F1	F3	D3	C3	IVI
Grewia tenax	100	8.695	23.728	16.764	16.395
Capparis deciduas	50	4.347	3.389	24.880	10.872
Salvadora oleoides	50	4.347	1.694	19.123	8.388
Indigofera oblongifolia	50	4.347	5.084	11.713	7.048
Fagonia indica	100	8.695	6.779	3.474	6.316
Aerva javanica	50	4.347	13.559	0.191	6.032
Withania coagulans	50	4.347	1.694	11.713	5.918
Dodonea viscosa	100	8.695	5.084	3.251	5.676
Ziziphus nummularia	50	4.347	10.169	0.203	4.906
Rhynchosia minima	50	4.347	8.474	0.089	4.303
Grewia villosa	100	8.695	3.389	0.442	4.175
Trichodesma indicum	50	4.347	3.389	1.960	2.898

Abbreviation: + = Present, – = Absent, F1 = Frequency, F3 = Relative frequency, D3 = Relative density, C3 = Relative cover, IVI = Importance value index

Fig. 2. *Rhazya stricta*: A key species of Gorakh hill.

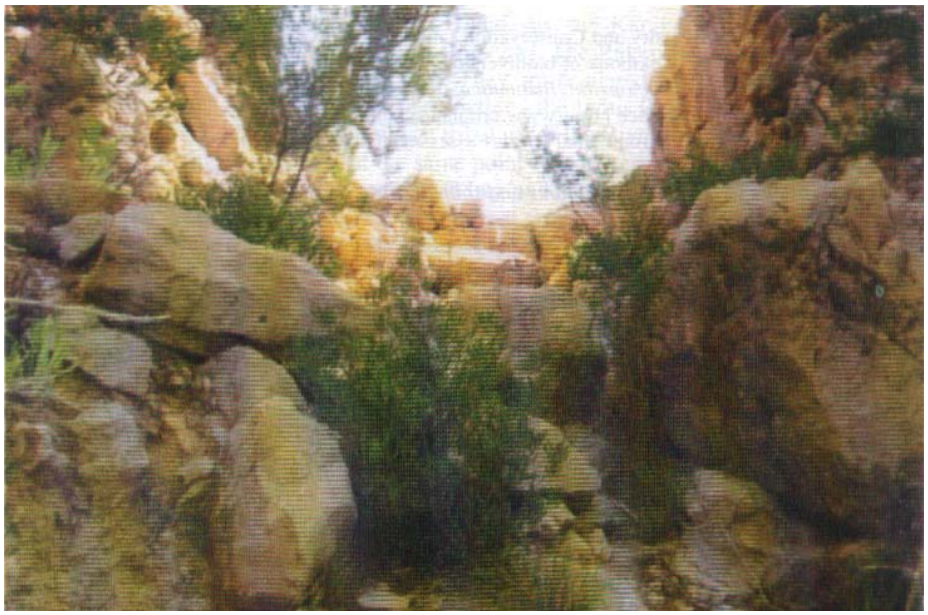

Fig. 3. *Dodonea viscose*: dominant species of the Gorakh gill.

The life form of each species depending on the position of perennation buds has also been determined according to Raunkiaer system of classification (Raunkiaer, 1934). Within the flora chameophytes are the most dominant class of life forms, followed by Phanerophytes, Therophytes and Hemicryptophytes (Table 1). The grazing pressure is slightly low at higher altitude as compared to lower altitude in the study area.

There are 10 rare species found in the study area viz., *Viola stocksii*, *Chascanum marrubifolium*, *Solanum surattense*, *Salvadora persica*, *Urochondra setulosa*, *Olea ferruginea*, *Caralluma edulis*, *Evolvulus alsinoides*, *Asparagus gharoensis* and *Mimosa hamata*.

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