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THE VEGETATION OF ASTOLA ISLAND BALOCHISTAN, PAKISTAN

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ABSTRACT

Astola Island locally known as Haft-Talar (means seven rocks) is a small-uninhabited island with an isolated rock a short distance to the south of Pasni in the Northern Arabian Sea. The island has its significance for maintaining the genetic and ecological diversity of the area. The natural vegetation is composed of xerophytic species that are able to survive the arid climate. The vegetational composition of the island was analyzed using Bruan-Blanquet abundance classes. Biological and leaf size spectra of the flora were also determined.

Forty-one plant species were recorded and collected from Astola Island. The biological spectrum revealed that chamaephytes were the dominant life-form while the leaf size spectrum showed the dominance of leptophyll species. Many of the plants from the island are known to have medicinal value.

Key words: Astola island, biological spectrum, leaf size spectrum, medicinal plants.

INTRODUCTION

The coastline of Pakistan is 1050 km long, out of which 800 km belongs to the province Balochistan on the western side and 250 km to the province of Sindh on the eastern side. The coastline has various landforms, such as deltas, flourishing with mangrove vegetation, sandy beaches, rocky beaches, and headlands, etc. These diverse physiographic features provide set of conditions suitable for various plant and animal communities. Many small islands, either connected with the main coastline or disjunct from the coast exist, e.g., Manora Island, Churna Island (along Sindh coast) and Astola Island (along Balochistan coast).

Astola Island (25° 07' N, 63° 52' E) is the largest, significant and splendid off-coast island entrenching with unpolluted blue water of Northern Arabian Sea. The total area is 5000 ha. It is about 38 nautical miles Southeast of Pasni. Locally it is known as Haft Talar (meaning seven rocks) (Fig.1). A small mountain about 90-120 meters above sea level occupies the greater part of the island. It covers an area of about 4.15 km in length and 1.25 kilometre in width. The eastern portion of the island is subjected to continuous process of erosion due to wave action and high wind velocity during the Southwest monsoon.

The island was designated as the Ramsar site – wetland of international importance in 2001 (RIS sheet , 2001). Currently the Island is temporarily used as a stopover by fishermen Between September and May the fishermen coming from Karachi, Gadiani, Sonmiani, Ormara, Pasni and Gawadar use the island as a base camp before going to deep water for lobster and fish catch.

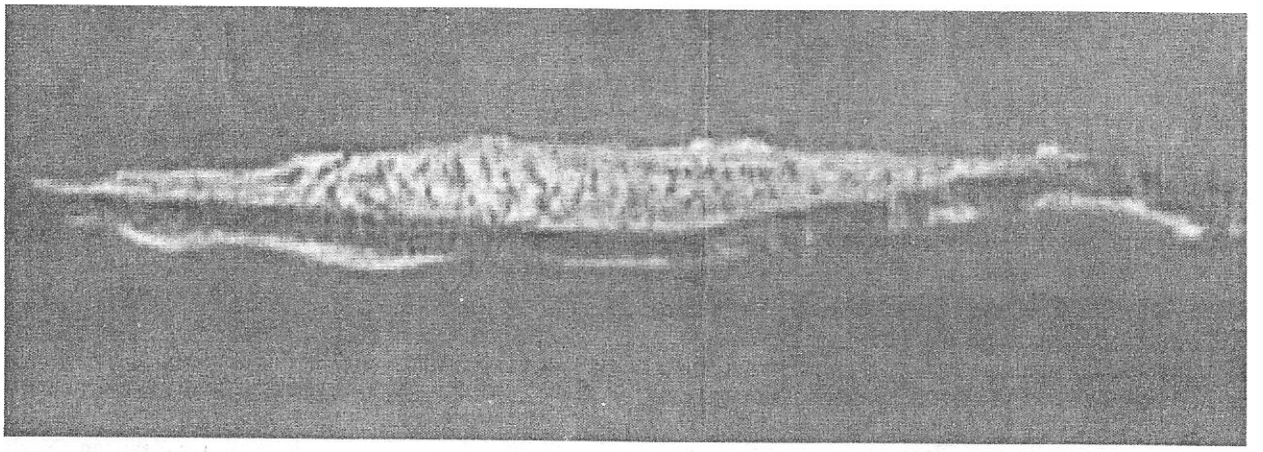

Fig.1. An aerial view of Astola Island.

The heterogeneity of the soil supports a variety of flora and fauna and the island can be physiographically divided into 1) the coast line, 2) elevated rocky-cum-sandy habitat and 3) upper plain area of the cliff.

The Coastline:

It is a small area (50 to 70 meter) comprising of sandy-cum-rocky beach, inhabited by a variety of marine fauna and seaweeds. Populations of halophytic species like *Suaeda fruticosa* and *Hammada recurva* inhabit the area, which is close to the sea but beyond the supra littoral region.

Elevated Rocky-cum-Sandy Habitat:

Boulders of various sizes are scattered from the foothill to the upper edge of the cliff. These boulders cover only one-third of the slope while the rest is a sharp cliff. Lithophytes such as lichens, (foliose and crustose) are seen on the rock edges and boulders. Wherever sand has accumulated within the rock crevices, *Iphiona grantioides* grows luxuriantly. It has a peculiar fragrance and when flowering gives a characteristic appearance to the vegetation.

Upper Plain Area of the Cliff:

The upper plain area seems to have a mosaic of rocky and sandy patches and a variety of plants give a phasic structure to the vegetation. Some deep crevices are also present towards the northern aspect. Perennial halophytes like *Suaeda fruticosa, Hammada recurva,*and *Sporobolus* species occupy the saline sandy soils while certain plants flourish after the monsoon rains. The vegetation is not continuous and there are bare areas between vegetation patches. Moreover, the patches vary in density. The depressions have relatively dense vegetation than the rocky plain areas.

As the island is markedly away from the main coastal belt, it can be considered as a separate ecosystem. As yet no information is available regarding the vegetation composition of Astola Island, a survey was conducted by WWF-Pakistan in February 1996 to explore its biodioversity. Along with the faunal studies the vegetation was also investigated. This report is a part of the survey and is expected to provide the preliminary information of the flora and the vegetation of the island which would be helpful in long-term conservation of the flora and fauna and the management of the island ecosystem.

Oceanographic Conditions:

Balochistan coast is known for its upwelling phenomenon. During the Southwest monsoon cold and nutrient rich water upwells along the shelf from a depth of about 100 meters as a result of offshore winds (Banse, 1968). This results in increase in productivity of the shelf area. Burney *et al.* (1986) have reported a large fish production in the area. Saifullah (1979, 1994) reported high values of chlorophyll 'a' from the area.

The continental shelf of the island is narrow and the depth of the sea increases rapidly after the shelf which give rise to a steep continental slope. Water temperature around Balochistan coast ranges between 22-23°C in January and between 27-29°C in May at 10 m depth of the shelf. However, low temperatures of 23-24°C are reported for June on the western Balochistan shelf due to upwelling of cold water from below the surface (Saifullah and Rasool, 1995).

Salinity values do not show such seasonal variation but remain around a value of 36.5 ppt. High salinity water of adjacent Persian Gulf enters the deep sea at a depth of 150 m and the Red Sea water at even greater depth (Saifullah and Rasool, 1995).

Climate:

The general climate of Balochistan coastal areas is subtropical arid and maritime. According to Köppen's (1936) system of climates the area belongs to hot desert. Rainfall is very scanty and irregular and mean annual value range between 100-230 mm/yr. In western part along the Balochistan coast rainfall occurs during October-April. Air temperature is high with a mean annual value ranging between 20-28°C. There was no meteorological station at the island, the nearest one is situated at Pasni.

Air temperature shows a unimodal annual distribution with peak values in mid-summer and lowest values in January. Maximum precipitation occurs during winter.

Methodology:

The reconnaissance survey preceded the main survey. Different patches of vegetation were noted for their abundance classes according to Braun-Blanquet (1932) and Mueller-Dombois and Ellenberg (1974). Voucher specimens were collected. Plants were identified upto species. Nomenclature follows the Flora of Pakistan (Nasir and Ali, 1972-onwards).

The life form of each species was determined (Raunkiaer, 1934). The biological spectrum was compared with the normal spectrum. The regional biological spectrum is often compared with a more or less arbitrary standard, the normal spectrum. For the study of leaf size spectrum, the system of Raunkiaer (1934) has been followed. The leaf area was calculated by the methods described by Cain and Castro (1959).

RESULTS AND DISCUSSION

The Vegetation:

The vegetation analysed for abundance classes (Table 1) shows that class 3 (In) has more species diversity (31.7%) while class 1 (Vr) has the least diversity of the species (4.87%). Class 4 (a) 29.26% is nearly equal to class 2 (r) 19.51% in species diversity while class 5 (Va) has 14.53% in the species proportion.

The biological spectrum of the flora of Astola Island shows the dominance of chamaephytes (56.09%) (Table 2). The proportion of phanerophyte and hemicryptophyte is nearly equal; they are 9.7% and 7.3% respectively. The therophytes form 26.82% of the flora. The cryptophytes are completely absent.

A comparison of the biological spectrum of Astola Island with the normal spectrum revealed a marked degree of deviation. The vegetation is dominated by chamaephytes; hence the vegetation of the island may be designated as chamaephytic formation.

The study of leaf size spectrum (Table 3) showed the dominance of leptophyll 39.02%. The percentage of microphyll is also fairly high 34.14%. Nanophylls form 21.95% of the flora. The proportion of mesophyll is as low as 4.87%. The plants with macrophyll and megaphyll are totally absent.

Oosting (1956) suggested that the knowledge of leaf size helps in understanding the physiological processes of plants and plant communities. Considering this viewpoint the dominance of smaller leaf size classes found in the area under study correlates very well with the arid climate of Balochistan (Köppen, 1936) and the rugged and xeric condition of the area. The smaller total leaf area of plants should be looked upon as an adaptation to minimise transpiration (Shaukat and Qadir, 1972).

The diverse and geographically isolated Astola island flora also contains some plants of medicinal value. Nine plants out of forty one (21%) possess some medical importance. It is not the main task of this report to evaluate the therapeutic qualities of these plants. However, we briefly report the general utility, healing qualities, remedies and treatments with these plants.

Medicinally important plants:

***Chenopodium murale* L.** Vernacular name: Bathua.

The leaves of this plant are consumed as fresh vegetable. It is also used as fodder for cattle as well as sheep and goats. It is also considered as a medicinally important plant.

***Suaeda fruticosa* Forssk.** Vernacular name: Sorag, Lanni.

It is given to new-born children as a tonic. Fresh and fleshy leaves of *Suaeda* crushed and the juice is extracted. After the child is born, before commencing the mother milk, infant is given a teaspoonful of the extract thrice after one hour each for the next three days. Burkill (1956) noted that it is a multipurpose plant but did not give any specific information on the medicinal value. Baquar (1989) mentioned that the leaves of *S. fruticosa* are emetic. It is also given in opthalmia in the form of poultice.

***Seddera latifolia* Hochst. and Steud.** Vernacular name: Tussu.

It is given to children upto five years who have stomach gas and improper mild digestion. The fresh leaves and flowers collected, dried and ground into the powder form. About ¾ teaspoonful of the grinded powder is given to the children especially before going to bed (Goodman and Ghafoor, 1992). The drug is prescribed when child is vomiting the undigested milk.

***Iphiona grantioides* (Boiss.) Andb.** Vernacular name: Naro (Lasbela), Kolmur

The herb is useful for curing wounds. The paste prepared from fresh crushed leaves is directly applied to a new or infected wound. This treatment is given upto five days or until the wound is completely healed (Goodman and Ghafoor, 1992).

Burkill (1956) remarked that this plant is also used as fodder especially for camels and also used as detergent, and steeped in water for the treatment of asthma. Discussing with the locals it was found that the fragrance of the plant keeps away the snakes from the house. Therefore, people also call it "Sanp booti". This species contains some

volatile compounds in its leaves that are allelopathic to other neighbouring plant species. Baquar (1989) also reported its effectiveness in asthma.

Table 1. Show the abundance classes among the flora of the Astola Island

Very rare (Vr)	Rare (r)	Infrequent (In)	Abundant (a)	Very abundant (Va)
Maerua crassifolia	*Phyllanthus rotundifolius*	*Launaea procumbens*	*Atriplex griffithii*	*Convolulus prostratus*
Capparis cartilaginea	*Sidatiagii*	*Lotus garcinii*	*Convolvulus glomeratus*	*Haloxylon recurvum*
	Corchorus depressus	*Commicarpus helenae*	*Convolvulus microphyllus*	*Suaeda fruticosa*
	Seddera latifolia	*Euphorbia granulata*	*Aerva javanica*	*Senna italica*
	Spergula fallax	*Medicago laciniata*	*Abutilon fruiticosum*	*Pentatropis nivalis*
	Echinops echinatus	*Lactuca remotiflora*	*A. pakistanicum*	*Iphiona grantioides*
	Aizoon canariense	*Tribulus terestris*	*A. indicum*	
	Astragulus fatmensis	*Chenopodium murale*	*Cenchrus biflorus*	
		Mollugo lotoides	*Sporobolus tentrophyllus*	
		Zaleya pentandra	*Dactyloctenium cindicum*	
		Lycium makranicum	*Polygala erioptera*	
		Senna holosericea	*Cenchrus ennisetiformes*	
		Heliotropium ramosissimum		

***Lactuca remotiflora* D.C.** Vernacular name: Shamahur.
It is known to be a cure for chest congestion. The recipe for making the drug is simple. About 100 g plant material is boiled in two glasses of water. When half of the water remains some sugar is added as sweetener. The prepared dose is used twice a day, once in the morning and again in the evening. Internal injuries caused by heavy physical strain and symptoms resulting from severe cold are cured by this drug (Goodman and Ghafoor, 1992).

Table 2. Biological spectrum and their total percentage.

Leaf form classes	Total No. of plants	%
Chamaophytes	23	56.09
Therophytes	11	26.82
Phanerophytes	4	9.70
Hemicryptophytes	3	7.30
Cryptophytes	0	
Total	41	100

***Corchorus depressus* (L.) Stocks**
Vernacular names: Munderi, baphali, bahu phali (Urdu), babuna (Punjabi)
The plant is used by local to relieve irritation and pain in urinary tract. It also acts as a cooling agent during severe summer. The total plant (shoot + root) are soaked in one cup of water overnight. At morning the extract is drunk orally. In urinating problem it is advised to take it twice a day at morning and evening upto one and half week. Baquar (1989) states that the seeds serves as a tonic and the mucilage of imbibed seeds is used as a tonic and also in gonorrhoea.

***Euphorbia granulata* Forssk.**
Vernacular names: Shimsh, Khirwal (Punjabi)
This plant is used as hair oil, which gives a shine to hair. It is also know to straighten hair. The shoot is crushed along with *Plantago lanceolata* leaves and the paste is applied to hair (Goodman and Ghafoor, 1992). This herb is also used for purifying blood (Baquar, 1989). It also serves as fodder for goats.

Table 3. Leaf size classes and their percentage.

Leaf size classes	Total No. of Plants	%age
Leptophylls	16	39.02
Nanophylls	9	21.95
Microphylls	14	34.14
Mesophylls	2	4.87
Total	41	

Table 4. Showing Life form and life size classes among the flora of the Astola Island.

Species	Life form	Leaf-size
Abutilon fruticosum Guill.	Chamaephyte	Nanophyll
Abutilon indicum (L.) Sweet	Chamaephyte	Mesophyll
Abutilon pakistanicum Jafri and Ali	Chamaephyte	Microphyll
Aerva javanica (Burm. F.) Juss.	Chamaephyte	Microphyll
Aizoon canariense L.	Therophyte	Microphyll
Astragalus fatmensis Hochst. ex Blatter	Therophyte	Microphyll
Atriplex griffithii Moq.	Chamaephyte	Microphyll
Copparis cartilaginea Dene.	Phanerophyte	Microphyll
Cenchrus biflorus Roxb.	Therophyte	Leptophyll
Cenchrus pennisetiformis hochst. And Steud.	Therophyte	Leptophyll
Chenopodium murale L.	Therophyte	Microphyll
Commicarpus helenae (Roem. & Schuttes) Meikle	Chamaephyte	Nanophyll
Convolvulus glomeratus Choisy	Chamaephyte	Nanophyll
Convovulus microphyllus Sieb. ex Spreng.	Chamaephyte	Leptophyll
Convolvulus prostratus Forssk.	Chamaephyte	Microphyll
Corchorus depressus (L.) Stocks	Chamaephyte	Microphyll
Dactyloctenium scindicum Boiss.	Hemicryptophyte	Nanophyll
Echinops echinatus Roxb.	Therophyte	Microphyll
Euphorbia granulate Forssk.	Chamaephyte	Leptophyll
Haloxylon recurvum Bunge ex Boiss.	Chamaephyte	Leptophyll
Heliotropium ramosissimum Lehm.	Chamaephyte	Leptophyll
Iphiona grantioides Boiss.	Chamaephyte	Leptophyll
Launaea procumbens Roxb.	Chamaephyte	Microphyll
Lactuca remotflora D.C.	Therophyte	Mesophyll
Lotus garcinii D.C.	Therophyte	Leptophyll
Lycium makranicum Schoenbech. Temesy	Chamaephyte	Leptophyll
Maerua crassifolia Forssk.	Chamaephyte	Microphyll
Medicago laciniata (L.) Mill.	Therophyte	Microphyll
Mollugo lotoides (L.) O.Kutze	Therophyte	Leptophyll
Pentatropis nivalis (J.F. Gmel) Field & I.R.I	Phanerophyte	Nanophyll
Phyllanthus rotundifolius	Phanerophyte	Nanophyll
Polygala erioptera DC	Phanerophyte	Leptophyll
Seddera latifolia Hochst. And Steud.	Chamaephyte	Leptophyll
Senna holocerisea	Chamaephyte	Leptophyll
Senna italica Mill.	Chamaephyte	Nanophyll
Sida tiagii Bhandari	Chamaephyte	Nanophyll
Spergula fallax Lowe	Therophyte	Leptophyll
Sporobolus tentrophyllus (K.Schum.)W.D. Clay.	Hemicryptophyte	Leptophyll
Suaeda fruticosa Forssk	Chamaephyte	Leptophyll
Tribulus terestris L.	Hemicryptophyte	Leptophyll
Zaleya pentandra L. Jeffry	Chamaephyte	Microphyll

***Tribulus terestris* L.**
Vernacular names: Glur, gan, Chota Gokhru (Urdu)
Especially used to relieve irritation that occurs during urination. It helps to dissolves kidney stones. It is also used to increase the menstrual cycle in females while males often use it as aphrodisiac (Goodman and Ghafoor, 1992). Zaman and Khan (1970) also reported same uses of this plant. According to Baquar (1989) fruits of this herb are used in urinary disorders, cough and heart diseases, while seeds are useful for the cure of diseases of the bladder, kidney stones and gout.

***Senna italica* Mill.**
Vernacular names: Mano, maz, chota taroda (Urdu)
In case of severe fever and internal heat the paste of the shoot (grounded material mixed with water) of the plant is applied to the forehead and the lower parts of the feet which acts a cooling agent. The application of the paste is repeated daily until symptoms disappear. Burkill (1956) noted that in Balochistan it is often used as a dye.

Table 5. List of plant species collected from the Astola Island along with their family and local names.

Latin names	Family	Local names
Abutilon fruticosum	Malvaceae	Jhangbar
Abutilon indicum	Malvaceae	-
Abutilon pakistanicum	Malvaceae	-
Aerva javanica	Amaranthaceae	Balishto, Buh, Boh
Aizoon canariensis	Aizoaceae	-
Astragalus fatmensis	Leguminoseae	-
Atriplex griffithii	Chenopodiaceae	-
Copparis cartilaginea	Capparidaceae	Kirap
Cenchrus biflorus	Graminae	Khurnal
Cenchrus pennisetiformis	Graminae	Khurnal
Chenopodium murale	Chenopodiaceae	Bathua, Gorago
Commicarpus helenae	Nyctaginaceae	-
Convolvulus glomeratus	Convolvulaceae	Richak
Convolvulus prostratus	Convolvulaceae	-
Corchorus depressus	Tiliaceae	Munderi
Dactyloctenium scindicum	Graminae	-
Echinops echinatus	Asteraceae	Guraj, Chingam wali
Euphorbia granulata	Euphorbiaceae	Shimsh
Haloxylon recurvum	Chenopodiaceae	Lanroon, Khar
Heliotropium ramosissimum	Boraginaceae	-
Iphiona grantioides	Asteraceae	Naro
Launaea procumbens	Asteraceae	Kharra, Bhattri, Mahari
Lactuca remotiflora	Asteraceae	Shamahur
Lotus garcinii	Papilionaceae	-
Lycium makranicum	Solanaceae	--
Maerua crassifolia	Capparidaceae	--
Medicago laciniata	Papilionaceae	--
Mollugo lotoides	Aizoaceae	Katok
Pentatropis nivalis	Asclepiadaceae	--
Phyllanthus rotundifolius	Euphorbiaceae	--
Polygala erioptera	Polygalaceae	--
Seddera latifolia	Convolvulaceae	Tussu
Senna holocerisea	Caesalpinaceae	--
Senna italica	Caesalpinaceae	Mairo, maz
Sida tiagii	Malvaceae	--
Spergula fallax	Caryophyllaceae	--
Sporobolus tentrophyllus	Graminae	--
Suaeda fruticosa	Chenopodiaceae	Sorag, Lanni
Tribulus terestris	Zygophyllaceae	Ghur, gan
Zaleya pentandra	Aizoaceae	Indarkhah, Wahu

Recommendations

Astola Island is a small island but has considerable ecological significance. In July 1998 in Mauritius a conference was held on the protection, conservation and management of the small islands of the world. Various

recommendations were made in that conference and in the light of those recommendations we suggest following points for the conservation and management of the Astola Island.

- Government and all the stakeholders should adopt a strategy known as Island System Management (ISM). The ISM includes the interactions of the various ecosystems, development plans for the island and to use available resources to achieve the sustainability.
- Government should take appropriate action to adopt ICZM Integrated coastal zone management approach to conserve the island for present and future generations. The sustainable use of coastal resources along the island should be promoted. The Astola Island is famous for the lobster fishing ground along the Pakistan coast.
- Government should promote the programmes for the protection and improvement of the biodiversity of the island. It should include efforts not only to protect all existing flora, fauna and ecosystems in general but also improve public awareness of its biodiversity. The comprehensive biodiversity action plan of the Astola Island should be established.
- Government should take active role in the island network.

Table 6. Abundance classes and their percentage.

Abundance class	Total number of species	Percentage
Class 1 Very rare (Vr)	2	4.87
Class 2 Rare (R)	8	19.51
Class 3 Infrequent (In)	13	31.70
Class 4 abundant (A)	12	29.26
Class 5 Very abundant (Va)	6	14.63
Total	41	

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