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On the ecology of mangal vegetation of the Saudi Arabian Red Sea coast

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ABSTRACT

The mangal vegetation of the Saudi Arabian Red Sea coast is represented by *Avicennia marina* community type. The presence of *A. marina* plants is recorded along the whole coast. The gradual decrease in air temperature northwards is associated with a reduction in density and cover of *A. marina* community. The luxuriant stands are usually present in the southern swamps of the Saudi Red Sea coast.

The soils of the studied mangal vegetation are relatively rich in organic matter and generally sandy, calcareous and saline-alkaline.

Valuable organic compounds (terpenes, sterols, coumarins, carotins and xanthophylls) have been determined in the different parts of *A. marina* plants. This may indicate the medicinal importance of this species.

Silviculture of *A. marina* and other mangrove trees and shrubs, e.g. *Rhizophora*, *Bruguiera*, *Kandelia*, etc. along the Saudi Arabian Red Sea coast may play an important role in its environmental development.

INTRODUCTION

Saudi Arabia is a vast desert ($2{\cdot}2 \times 10^6$ km^2) extending between Lat. 16°–32°N and Long. 35°–56°E. It occupies about four-fifths of the Arabian Peninsula (Fig. 1). It is bordered on the west by the eastern coast of the Red Sea and that of the Gulf of Aqaba and on the east by the western coast of the Arabian Gulf.

The mangal vegetation of the western (African) coast of the Red Sea was studied by Ferrar (1914), Hemming (1961), Kassas (1957), Kassas & Zahran (1965, 1967) and Zahran (1965, 1967, 1974, 1977, 1982). On the other hand, ecological studies carried out by Draz (1956) and Vesey-FitzGerald (1955, 1957) on the eastern (Asian) Red Sea coast also provide a basic knowledge of its mangrove vegetation.

The present paper is the first in a series on the mangroves of the Saudi Red Sea coast. It gives an account of topographic, climatic and soil conditions of the shore-line

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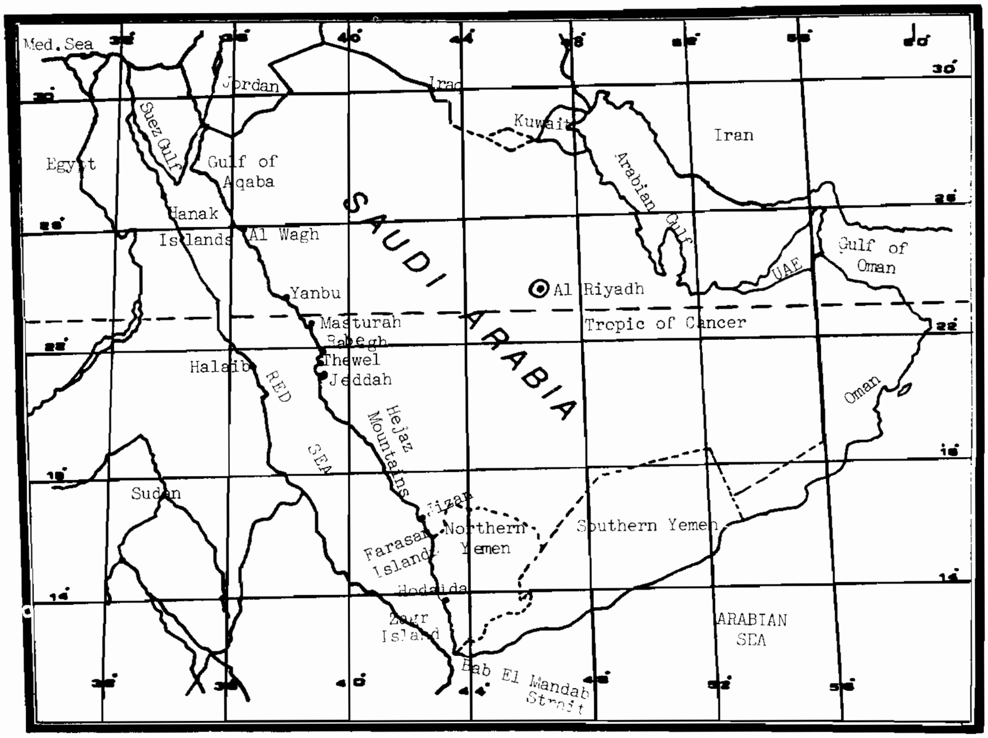

Fig. 1. Map of the kingdom of Saudi Arabia.

as well as the distribution of the mangrove plants along the coast. The importance of silviculture of introduced mangrove plants for shore-line development is discussed.

ECOLOGICAL CHARACTERISTICS

Location and geomorphology (Fig. 1).

The Red Sea occupies the East African Rift Valley between Africa and Asia. It lies between Lat. 12° and 29°N. Its eastern (Asian) coast extends from Aqaba southwards to Bab El-Mandab Strait for approximately 2600 km, of which 2140 km lie in Saudi Arabia and 460 km in Yemen. This coastal strip is locally raised slightly due to recent deposits of silt washed down from the mountains or to accumulation of sand. 'The shore is flat, but in several places creeks penetrate the land, and since practically no flood water flows into the sea, coral occurs in these inlets' (Vesey-FitzGerald 1957).

The coral rocks have been superficially decomposed into a fine silt, which is soft and dusty when dry and slimy when wet. In such areas the drainage is usually bad and surface flood water tends to accumulate in pans. The tidal amplitude along the Saudi Red Sea coast is low but wind often drives sea water far inland over sand flats which become encrusted with salts as the surface dries. These areas are usually practically barren or dominated with scattered halophytes.

The Saudi Red Sea coast is fringed by series of mountains known as Hejaz, locally exceeding 2000 metres a.s.l. Their height generally decreases northwards. The drainage system of these mountains is formed of several wadis, e.g. Wadi Hamdh, Wadi Aqiq, Wadi Rabegh, Wadi Jizan and Wadi Al-Gooze. These wadis eventually find their way westwards to the Red Sea.

Few islands are found facing the Saudi Red Sea coast. Some are very close to the coast, e.g. Hanak Islands facing Al-Wagh (670 km north of Jeddah), while others are far from the coast, e.g. Farasan Islands which are located at about 20–25 km from Jizan coast (800 km south of Jeddah).

Climate

Table 1 shows the main climatic particulars (temperature, air humidity and rainfall) at four meteorological stations along the Saudi Red Sea coast namely: Jeddah, Yanbu (330 km north of Jeddah), Al-Wagh (670 km north of Jeddah) and Jizan (800 km south of Jeddah). Generally, in this coastal area, rainfall is low, whereas air humidity and temperature are high. The highest mean annual precipitation (220·4 mm) falls in Al-Wagh and the lowest (10·8 mm) in Yanbu. In Jeddah and Jizan, the mean annual rainfall is 78 and 42 mm respectively. Highest mean annual temperature (29·4°C) is that of Jizan, followed by that of Jeddah (27·8°C), then Yanbu (26·4°C) and Al-Wagh (25·2°C). The absolute maximum (48·4°C) and the absolute minimum (9°C) temperatures are recorded in Jeddah and Yanbu respectively. Humidity is generally high except in winter and early spring. The mean annual relative humidity is: 57%, 59%, 52% and 60% while the absolute maxima are of about 100% at all stations and the absolute minima are: 3%, 7%, 8% and 29% in Jeddah, Yanbu, Al-Wagh and Jizan respectively.

SOIL CHARACTERISTICS

Materials and methods

Collection of soil samples was carried out in three stands where *Avicennia marina* predominates. In Jizan and Sibya swamps two profiles have been made; from each profile two soil samples (surface and subsurface) were collected. From Rabegh swamps, only one soil sample was collected (0–30 cm).

Total soluble salts (TSS), calcium, magnesium, sodium, potassium, chloride, sulphate, carbonate and bicarbonate ions in 1:5 soil–water extracts, pH in 1:2·5 soil–water suspension and cation exchange capacity (CEC) were determined as described by Richards (1954). Calcium carbonate content was determined using Collins' calcimeter (Piper 1950). Mechanical analysis was made by the pipette method as indicated by Richards (1954).

Results

The few data of mangrove soils (Table 2) show that soils have considerable amounts of salts. The total soluble salts do not decrease in the lower layers. In all samples the pH is lower than 8·5, showing a slight increase in the lower horizon. The analysis of soluble cations and anions indicates that sodium is the chief cation, while chlorides dominate the anions, followed by sulphates. Bicarbonates are very low. Calcium carbonate content is high (24·0–47·3%) in all soil samples. The organic matter content is relatively high. The highest value is noticed in Sibya which shelters tall dense mangal vegetation.

Table 1. Climatic particulars of four stations along the Red Sea coast of Saudi Arabia (taken from the climatic normals of Saudi Arabia, 1968–78)

	Station																											
	Jeddah (Lat. 20° 30′N)							Yanbu (Lat. 24°N)							Al-Wagh (Lat. 26°N)							Jizan (Lat. 16°N)						
	Temp. (°C)			RH (%)			Ppt	Temp. (°C)			RH (%)			Ppt	Temp. (°C)			RH (%)			Ppt	Temp. (°C)			RH (%)			Ppt
Month	Max	Min	Mn	Max	Min	Mn	(mm)	Max	Min	Mn	Max	Min	Mn	(mm)	Max	Min	Mn	Max	Min	Mn	(mm)	Max	Min	Mn	Max	Min	Mn	(mm)
Jan.	32·5	15·2	22·5	91	12	51	7·0	30·0	9·0	20·2	83	17	57	0·0	31·0	12·3	20·9	95	18	48	0·5	31·5	20·4	25·6	94	49	72	Tr.
Feb.	35·2	16·2	24·4	90	10	58	67·0	34·4	12·0	22·2	88	13	57	0·0	31·8	11·5	20·2	85	14	50	19·9	32·6	19·0	26·9	91	51	70	0·0
Mar.	37·0	18·5	25·5	88	13	60	Tr.	35·0	12·0	23·7	92	7	53	0·0	33·5	12·6	22·4	86	12	49	0·0	34·0	20·6	28·2	95	51	71	11·4
Apr.	38·3	14·4	20·5	93	8	53	0·0	39·8	15·0	25·8	91	12	59	0·0	34·2	14·4	23·5	92	12	63	100·0	39·6	21·0	29·9	89	30	64	0·0
May	41·8	19·4	29·0	97	11	55	0·0	44·6	21·0	29·2	96	7	59	0·0	38·6	14·9	26·8	92	11	69	0·0	41·0	19·3	32·2	100	24	61	Tr.
June	48·4	22·0	30·5	92	5	51	0·0	43·5	18·0	29·2	95	11	59	0·0	43·2	20·3	28·1	92	13	73	0·0	39·5	27·4	32·8	91	40	66	0·2
July	43·6	23·0	30·8	94	11	49	0·0	40·0	22·0	31·3	100	20	67	10·6	34·2	20·2	28·7	97	35	74	0·0	40·7	27·2	33·3	80	29	57	0·0
Aug.	41·0	24·0	33·1	93	15	59	0·0	39·0	23·6	30·8	97	29	65	0·0	35·2	22·6	29·5	99	20	72	0·0	40·0	27·4	32·9	83	36	62	Tr.
Sept.	46·6	21·0	30·7	98	3	63	0·0	44·0	21·5	30·4	93	7	57	0·0	33·4	20·4	28·1	97	27	73	0·0	39·4	25·6	32·2	92	34	68	0·0
Oct.	44·5	16·2	28·6	100	6	63	0·0	37·5	18·5	28·5	100	18	62	0·0	32·7	19·5	27·1	94	20	65	0·0	37·4	19·0	30·6	92	43	68	6·6
Nov.	36·4	15·8	26·7	88	10	56	4·0	33·0	12·0	23·4	91	17	56	0·0	37·6	16·4	25·8	88	8	53	100·0	34·7	17·0	28·1	98	34	72	23·8
Dec.	33·5	11·4	23·6	95	21	61	0·0	33·6	11·4	21·9	91	9	57	0·2	32·0	12·2	20·9	82	37	52	0·0	32·4	21·2	26·4	89	50	73	0·0
Max	48·4	24·0	33·1	100	21	63	67·0	44·6	23·6	31·3	100	29	67	10·6	43·0	22·6	29·5	99	37	52	100·0	41·0	27·4	33·3	100	51	73	23·8
Min	33·5	11·4	22·5	88	3	49	0·0	30·0	9	13·4	83	7	53	0·0	31·0	11·5	20·2	87	8	48	0·0	31·5	17·4	25·6	80	29	57	0·0
Mn	40·1	17·9	27·8	94	11	57		37·9	14·7	26·4	93	14	59		34·8	16·6	25·2	92	19	52		36·2	22·4	29·4	90	40	60	

RH = Relative humidity, Ppt = Precipitation, Max = Maximum, Min = Minimum, Mn = Mean, Tr. = Traces.

Table 2. Characteristics of soils collected from mangrove swamps of the Saudi Red Sea coast

Location	Profile No.	Sample No.	Depth (cm)	pH	TSS %	$CaCO_3$ %	OM %	CEC meq/100 g soil	Soluble cations and anions (meq/l in 1:5 soil–water extract)								Particle size distribution			Texture class
									Ca^{++}	Mg^{+}	Na^{+}	K^{+}	Cl^{-}	SO_4^{--}	CO_3^{--}	HCO_3^{-}	Clay %	Silt %	Sand %	
Jizan	1	1	0–10	7·9	4·73	29·3	1·85	8·7	24·3	16·2	67·1	4·47	86·2	24·8	Nil	1·98	8·10	11·3	80·6	Loamy sand
		2	10–50	8·2	4·62	32·5	0·92	5·2	23·7	15·9	64·3	3·92	85·3	22·6	Nil	1·64	4·40	87·1	87·1	Sand
Sibya	2	3	0–15	7·6	4·28	24·0	2·95	10·3	22·8	13·7	61·1	3·20	81·9	22·3	Nil	1·32	9·70	14·6	75·7	Sandy loam
		4	15–60	8·1	4·12	26·2	1·45	6·3	21·9	12·9	59·8	3·10	79·3	21·8	Nil	1·15	5·20	9·6	85·2	Loamy sand
Rabegh		5	0–30	8·1	3·83	47·3	1·09	—	—	—	—	—	—	—	—	—	—	—	—	

TSS = Total soluble salts, $CaCO_3$ = Calcium carbonates, OM = Organic matter, CEC = Cation exchange capacity.

This high organic matter content could be attributed to an exceptionally high supply, mainly from the root system, as well as a slow rate of decomposition and mineralisation under the prevailing anaerobic conditions.

Cation exchange capacity varies from 5·2 to 10·3 meq/100 g of soil. These low values are partly due to the sandy nature of these soils. However, values obtained for the surface layers appear to be relatively high. This could be attributed, to some extent, to their relatively high content of organic matter. The data obtained for particle size distribution show that the sandy fractions constitute most of the soil solid components, having values of more than 75%.

It may be concluded that the mangrove soils are sandy, calcareous and saline–alkaline, and that they had developed over loose deep calcareous saline marine sands with very poor drainage. It is also apparent that areas of dense mangal vegetation receive alluvial materials (especially in Sibya) from the surrounding highlands. These alluvial materials originate mainly from Hejaz mountains and run towards the Red Sea along the wadis.

The mangrove soils studied are only slightly developed (Entisols). On the sub-group level these hydromorphic soils could be included in the typic psammaquents (USDA 1973). The impeded drainage conditions prevailing in mangrove soils and the high evaporation rate of sea water may cause temporary salt concentration on or near the surface (salic horizons), resulting in hypersaline soils (USDA 1973).

VEGETATION

Most of the Red Sea (3/5ths of its basin) is located south of the Tropic of Cancer, i.e. within the limits of the region known to be favourable for the occurrence of mangroves. Geomorphologic features, climatic conditions, soil characteristics and other important local ecological conditions (relief, wave action, tidal movement, etc.) seem to be suitable for the growth of mangroves. Vesey-FitzGerald (1955) states: '*Avicennia marina* is not common north of Jeddah (Lat. 20° 30′N) but a few small shrubs of this species do occur in sheltered creeks even as far north as Yanbu (Lat. 24°N).' This is more or less correct, but during the present study it was found that *Avicennia marina* extends northwards as far as Al-Wagh (Lat. 26°N) where these plants form dense vegetation in Hanak Islands (Fig. 1). This means that mangroves are growing in areas beyond the Tropic of Cancer. The same was recorded along the western shore-line of the Red Sea (Zahran 1974, 1977), and along the western coast of the Arabian Gulf (Migahid & Al-Sheikh 1977; Dickson 1955; Halwagy 1973). These findings ascertain Chapman's statement (1977) that 'mangal reaches its optimal development in the tropics but it extends to the subtropics described as warm temperate'.

The Saudi Red Sea coast south of Jeddah is characterized by a more or less continuous fringe of mangal vegetation which extends southwards covering the shore-line of Yemen (Fig. 1). In fact mangroves are present along almost the whole Saudi Red Sea coast.

The mangal vegetation of the Saudi Arabian Red Sea coast is dominated mainly by *Avicennia marina* (Fig. 2). According to Migahid (1978), few individual trees of *Rhizophora mucronata* were recorded associated with *Avicennia marina* trees in Jizan swamps (Lat. 16°N). Draz (1956) mentioned that *Bruguiera gymnorhiza* forms dense thickets on the off-shore islands at Hodeida in Yemen (Lat. 13° 30′ N). Neither

Fig. 2. Rabegh swamps (160 km north of Jeddah), where *Avicennia marina* predominates (May 1980).

Rhizophora mucronata nor *Bruguiera gymnorhiza* was recorded during the present study.

Density, stratification, height and vigour of *Avicennia marina* vary in different stands of the coastal stretch studied. In the swamps north of Jeddah (except in Hanak Islands) mangroves form scattered patches of low bushes, rarely trees. Such green patches are usually present in the lagoons, e.g. those of Thewel and Rabegh (100 km and 160 km north of Jeddah, respectively). In such habitats plants are protected from strong waves and winds. Unprotected shore-lines north of Jeddah are practically barren of mangroves.

Hanak Islands, which face Al-Wagh, are characterized by thickets of *Avicennia marina*. Local ecological conditions are suitable for the development of these dense thickets.

In the southern section of the Saudi Red Sea coast (south of Jeddah) mangal vegetation flourishes. Dense shore-line forests are present. Height of trees reaches 5 m (Fig. 3). In Jizan and Sibya coasts, the mangrove forests are the most luxuriant. Plant cover is high and the branches of trees are so closely intermingled that it is difficult to pass through.

Mangrove swamps of the Saudi Red Sea coast extend landwards up to the highest tidal level. They are followed landwards by a salt marsh (Fig. 4), mostly dominated by *Halopeplis perfoliata* (Chenopodiaceae). Other halophytes recorded are: *Aeluropus* spp., *Sporobolus spicatus* (Gramineae); *Zygophyllum album*, *Z. coccineum* (Zygophyllaceae); *Limonium axillare* (Plumbaginaceae); *Salsola tetrandra* (Chenopodiaceae) and *Tamarix mannifera* (Tamaricaceae). Vesey-FitzGerald (1957) mentioned: 'Along the beach just above high water mark, there may be an open fringe of *Atriplex farinosa*'. In

Fig. 3. *Avicennia marina* trees, Jizan coast (c. 800 km south of Jeddah). The height of plants is about 5 m (May 1980).

Fig. 4. *Halopeplis perfoliata* community type, salt marsh of Jizan coast (May 1980).

Fig. 5. Burned mangrove trunks, Jizan coast (May 1980).

certain limited areas of Jizan coast, the mangrove swamps are fringed inland by low sand-dunes dominated by *Halopyrum mucronatum* (Gramineae). This salt marsh grass is a new record to the Flora of Saudi Arabia (Migahid 1978). It is of interest to mention that along the western coast of the Red Sea, *Halopyrum mucronatum* is dominant in similar limited sandy areas (Hemming 1961; Kassas & Zahran 1967).

Avicennia marina trees vary in height and vigour in the different locations of the same swamp. Trees of seaward locations, inundated with sea water, are taller and their trunks bigger (girth up to 2 m) than those of the landward locations. The trees of the latter locations are easily reached by people and camels. They are constantly browsed by camels and bedouins often damage them for use as firewood (Fig. 5). Such uncontrolled interference obviously affects and even arrests the normal growth of mangrove trees.

CHEMICAL ANALYSIS OF *AVICENNIA MARINA*

Materials and methods

The methodology of screening follows that of Wall *et al.* (1961) and Farnsworth (1966). Samples of stem, bark, leaves, fruits and pneumatophores (respiratory roots) of *Avicennia marina* plants were collected at random from the Saudi Red Sea coast. The plant material was air dried, finely ground, extracted with 80% ethanol and the extracts were subjected to various tests. These included: alkaloids, leucoanthocyanidins, mavonoids, terpenes and sterols, cardiac glycosides, coumarins, non-steroidal carotins and xanthophylls and flavonoids. The different groups tested were recorded according to the intensity of colour or precipitate produced.

Table 3. Chemical screening of the parts of *Avicennia marina* in the mangrove swamps of the Red Sea shore-line, Saudi Arabia

	Parameter							
Plant part	A	L	M	T (%)	Cg	Cm (%)	N (%)	F
Stem	0	0	0	0·1–0·3	0	0·1–0·3	0·01–0·1	0
Bark	0	0	0	0·01–0·1	0	0	0	0
Leaves	0	0	0	>0·3	0	0·1–0·3	0·01–0·1	0
Fruit	0	0	0	0	0	0·1–0·3	0·01–0·1	0
Pneumatophores (respiratory roots)	0	0	0	0	0	>0·3	0·01–0·1	0

A = Alkaloids, L = Leucoanthocyanidins, M = Mavonoids, T = Terpenes and sterols, Cg = Cardiac glycosides, Cm = Coumarins, N = Non-steroidal compounds, e.g. carotins and xanthophylls, F = Flavonoids.

Results

The results of chemical analysis of the different parts of *Avicennia marina*, shown in Table 3, elucidate the following:

1. Alkaloids, leucoanthocyanidins, mavonoids, cardiac glycosides and flavonoids are absent from all plant parts.
2. Terpenes and sterols are recorded in the stem (0·1–0·3%), bark (0·01–0·1%) and leaves (more than 0·3%) but absent from fruits and pneumatophores.
3. In all parts (except the bark) coumarins are present. The highest amounts (more than 0·3%) of coumarins are those of the pneumatophores. The other parts contain equal amounts (0·1–0·3%).
4. Comparable amounts (0·01–0·1%) of non-steroidal compounds e.g. carotins and xanthophylls, are present in stems, leaves, fruits and pneumatophores.

Walsh (1977) states: 'Nearchus (325 BC) and Theophrastus (305 BC) referred to seedlings of *Rhizophora* as having an aphrodisiac effect.' The presence of terpenes and steroids, which are sources of hormones, in the different parts of *Avicennia marina*, suggests that this species has the same effects as *Rhizophora*. The same author (Walsh 1977) mentioned also that mangroves were used in ancient times as a source of drugs aiding in curing skin and liver diseases. The presence of coumarins in *A. marina* parts confirms this statement.

DISCUSSION AND CONCLUSIONS

The arid and semi-arid regions of the world cover about one-third of the earth's surface (UNESCO 1977). Saudi Arabia represents about 5% of the total of the world's arid lands (Hajrah 1979). In this vast area of about $2{\cdot}2 \times 10^6$ km^2, no running river exists.

For its water supply, Saudi Arabia depends upon three resources: rainfall, underground water and the sea. Rainfall is generally scarce and exhibits a large degree of monthly and annual variability. Abdel Rahman & Balegh (1974) state that most of the area receives less than 100 mm/year. The aridity index of the country (Pluviothermic Quotient, Emberger 1952) varies between 1·4 and 4. Rainfall is not a reliable source of water in Saudi Arabia.

Ground water (springs and wells) are used in the coastal and near-coastal zones of the western part of the country. 'The continuous increase of the consumption rate of this type of water for household and drinking purposes results in the decrease of available water for agriculture' (Hajrah 1978). As such, the underground water also cannot be considered as a reliable and permanent source of water for agriculture and/or industrial purposes.

The largest water resource potentially available to the western region of Saudi Arabia is the Red Sea. It seems likely that this condition will continue in the foreseeable future. Desalination for domestic use is now effective for Jeddah and in the near future for all cities of the Saudi Red Sea coast. For other purposes, e.g. agriculture, desalination seems unlikely to be economic. However, attempts to utilize sea water *per se* for irrigation should be considered. Research experiments must be oriented to halophytes (including mangroves) which may have a promising role in shore-line development. Teas (1977) mentioned that mangroves have been widely acknowledged to be important as protectors of shore-lines from erosion and also as attenuators of storm waves. The mangrove forests of the world provide habitats for a great variety of organisms which include: bacteria, fungi, algae, ferns, epiphytic organisms, fishes, birds and mammals. This may stress the importance of the role that can be played by mangroves in shore-line development.

The ecologic characteristics (geomorphology, climate, soil, etc.) of the Saudi Red Sea coast are suitable for the growth of many mangrove species, particularly *Avicennia marina* which is the commonest. The reason for the paucity of mangrove species in the area may be attributed to topographic barriers. The Red Sea can be considered as a more or less closed ecosystem. It is connected with the other wide and open water bodies (the Arabian Sea and Indian Ocean) through its narrow southern end called Bab El-Mandab Strait (Fig. 1). This factor may hinder the migration of propagules of other mangrove species which are carried by water to the shore-lines of the Red Sea and thus the number of woody genera and species is reduced to a few only.

Successful artificial mangrove propagation in certain areas of the tropical zone, e.g. in Hawaii (Teas *et al.* 1975), Florida (Teas 1977) and the Andaman Islands (Benerji 1958) have been carried out. Such results encourage us to suggest the introduction of mangrove trees e.g. *Rhizophora*, *Kandelia*, *Bruguiera*, *Laguncularia*, *Ceriops*, *Aegiceras* and *Xylocarpus* along the Saudi Red Sea coast.

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دراسة بيئية لعشائر نبات الشورة في الساحل السعودي للبحر الأحمر

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خلاصة

تعتبر نباتات الشورة من نباتات المناطق المدارية وذلك لانها لا تنمو الا على سواحل البحار والمحيطات الواقعة ما بين مداري السرطان والجدي حيث درجات الحرارة المرتفعة نسبيا ، وهذا ما يفسر تواجد تلك النباتات على الساحل السعودي للبحر الأحمر .

يتكون الغطاء النباتي لمستنقعات الشورة بالساحل السعودي للبحر الأحمر من شجيرات وأشجار نباتات الافيسينيا مارينا التي تكون عشيرة نباتية على طول الساحل ، ولا يقتصر تواجدها على الساحل فقط وانما تنمو أيضا بغزارة في الجزر المتاخمة له . وحيث ان نباتات الشورة تتأثر أساسا بعامل درجة الحرارة ، فان ضخامتها وكثافة غطائها الخضري تزدادان تدريجيا كلما اتجهنا جنوبا ، وتتواجد أغزر غابات الشورة وأكثفها في منطقتي جيزان وصبيا في أقصى الجنوب . وتتميز تربة هذه العشيرة بأنها رملية قلوية مالحة غنية بالمواد العضوية . وقد أوضحت التحاليل الكيميائية للأجزاء المختلفة لنباتات الشورة أنها تحتوي على مواد عضوية هامة مثل الكومارنيات ، والستيرولات ، والكاروتينات ، والتيربينات ، مما قد يشير إلى أهمية هذه النباتات كمصدر متجدد لصناعة الأدوية .

ونظرا لأهمية هذه النباتات ، فان التوسع في زراعتها على الساحل السعودي للبحر الأحمر وادخال أنواع جديدة منها سيؤدي إلى انشاء غابات ساحلية تعمل على تطوير البيئة بالمنطقة .

* العنوان الحالي : قسم النبات بكلية العلوم ، جامعة المنصورة ، المنصورة ، ج . م . ع .
** العنوان الدائم : مختبر التربة والمياه ، المركز القومي للبحوث ، الدقي ، القاهرة ، ج . م . ع .
*** العنوان الحالي : بلدية جدة ، جدة ، المملكة العربية السعودية .