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PRELIMINARY NOTES ON THE VEGETATION OF HORMUZGAN (SOUTHERN IRAN) *

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Keywords: Iran-Flora, Vegetation.

Abstract: The authors give preliminary observations on the main features of the flora and vegetation of Hormuzgan (Southern Iran).

Introduction.

Research carried out between the months of March and April, 1983, as well as the analysis of the data available in the literature, has led us to describe and identify the principal vegetation types - defined on a structural basis - of Hormuzgan (Southern Iran).

Geomorphology

The present-day administrative district of Hormuzgan, to which the observations performed during the March-April 1983 expedition refer, lies in Southern Iran, between 25° and 28° latitude N., and 54° and 58° longitude E. from Greenwich. Its coastline faces the Hormuz Strait for a lenghth of approximately 600 km. (Fig. 1).

A series of ridge lines parallel to the coast-line, and interspersed with large flat valleys, covers the entire area.

The elevation of the ridges is conspicuous, and it tends to increase from the coast towards the interior, where its maximum values of about 2500-3000 m above sea level are reached (Kuh-e Bibi Gilan, 2645 m.a.s.l.; Kuh-e Shab, 2680 m; Kuh-e Gerdu, 3267 m.

Geologically, the area belongs to the Zagros Mountains, a recent range whose origin can be traced to the collision between the Continental Arabian Plates and Central Iranian Plates.

The range, with a total lenght of about 1500 km, stretches from the Tauri Mountains in Turkey to Souther Iran, where it reaches the Hormuz Strait (Stoklin &

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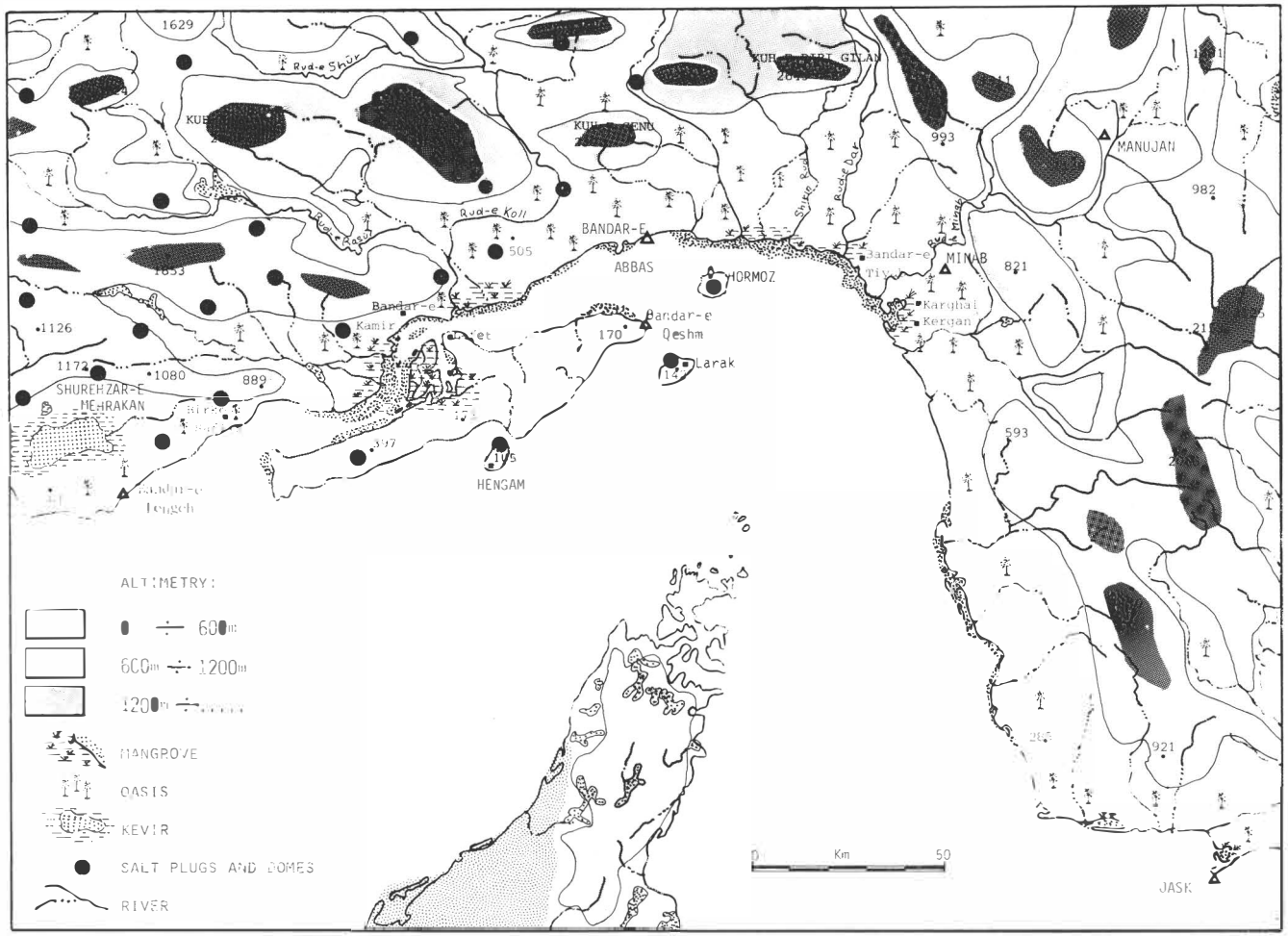

Fig. 1 — Enviromental characteristics of the district of Hormuzgan (Southern Iran).

Nabavil 1973; Falcon 1974).

The emergent salt domes which occur over the entire range, are due to remarkable saline diapirism phenomena, a distinctive feature of the Zagros Mountains (Fig. 3). The domes have originated from the uplift of low-density salt masses of the infracambrian age, of considerable plasticity and subject to hydrostatic thrust, which have intruded into the overlaying sedimentary series, piercing a layer 5000 to 7000 meters in thickness and, eventually, reaching the topographical surface. (Fig. 4). (Ala 1974; Kent 1970).

"Kevir" are typical forms of the plains. They are low, broad fields, towards which a series of transient watercourses flow. These watercourses tend, during the rainy season, to turn into typical marshes. During the dry season, the considerable insolation causes the water to evaporate; the consequent deposition of the salts which were previously dissolved into water results in the formation of a saline crust, several centimeters thick.

The hydrographical features of the area include the presence of several important watercourses, which originate in the inner mountain regions, such as the Rud-i Mehran, the Rud-i Kul, the Rud-i Sirhun and the Rud-i Minab. They represent the principal collectors of a very close hydrographical network which, on the whole, shows a typical trellis trend. (Fig. 1).

Main Climatic Features

Thermometric and pluviometric data recorded at the meterological stations of Bandar Lengeh, Queshm, Bandar Abbas, Minab and Jask, have been analyzed in order to outline the climatic features of the area.

The stations which have been studied are the only ones to be found in the region. Unfortunately, neither their small number nor their geographical positions (they are all located close to the sea shore, at an altitude never exceeding 50 meters a.s.l.), have enabled us to gain full insight of the local bioclimatic conditions and, in particular, of those of the innermost hilly and mountainous regions.

Temperature

Temperature values are given in Table 1. It may be seen that monthly maximum and minimum temperatures show analogous trends and, on the whole, are quite similar in the different stations.

Mean monthly values of the maximum temperature (M) are always greater than 23° C, whereas mean monthly values of the minimum temperature (m) are never less than 12° C. The variation of (m) is recorded in the interval 12°.4 C to 30°.6 C; these values have been recorded, respectively, in January and July at Bandar Abbas. The range of the mean monthly middle temperature (M-m) is 17°.4 (January, at Bandar Lengeh) to 43°.5 C (July, at Minab).

The annual middle temperature always exceeds 26° C; its minimum and maximum values are, respectively 26°,1 C (Bandar Lengeh) and 27°,3 C (Bandar Abbas).

Monthly thermal excursions of each station are also given in Table 1. They are

	BANDAR LENGEH altitude: m. 13 Lat. 26° 35' N Long. 54° 50' W year: 1966-75					BANDAR ABBAS altitude: m. 10 Lat. 27° 13' N Long. 56° 22' W year: 1957-83					QESHM altitude: m. 31 Lat. 26° 57' N Long. 56° 15' W year: 1965-74					MINAB altitude: m. 29 Lat. 27° 08' N Long. 57° 05' W year: 1965-75					JASK altitude: m. 4 Lat. 25° 38' N Long. 57° 46' W year: 1965-75				
	M	m	M-m	M_a	m_a	M	m	M-m	M_a	m_a	M	m	M-m	M_a	m_a	M	m	M-m	M_a	m_a	M	m	M-m	M_a	m_a
JAN.	22.4	12.4	10.0	28.6	6.0	23.9	12.7	11.2	32.0	3.0	22.2	15.5	6.7	29.0	7.0	23.5	12.7	10.8	32.5	4.0	23.1	15.1	8.0	28.0	6.0
FEB.	23.0	13.3	9.7	30.0	7.0	24.8	14.6	10.2	30.6	6.0	23.0	15.8	7.2	28.0	9.2	24.5	13.9	10.6	31.0	7.0	23.2	15.6	7.6	30.0	10.0
MAR.	27.2	16.8	10.4	36.0	10.0	27.9	17.9	10.0	35.0	8.0	26.8	18.8	8.0	33.0	13.6	29.3	17.4	11.9	37.5	8.0	26.8	19.3	7.5	33.0	13.0
APR.	31.1	20.0	11.1	40.0	11.0	31.5	21.4	11.1	39.0	14.0	30.5	21.2	9.3	38.6	15.0	33.3	20.4	12.9	41.0	11.0	30.5	22.6	7.9	39.0	14.0
MAY	35.7	24.3	11.4	49.0	16.0	36.3	25.0	11.3	47.8	20.0	35.1	24.5	10.6	40.8	20.2	38.3	24.6	13.7	46.0	18.5	33.6	25.8	7.8	43.0	21.5
JUNE	36.7	26.9	9.8	49.0	20.0	38.5	28.4	10.1	51.2	20.0	37.1	27.3	9.8	45.6	24.0	40.2	27.3	12.9	46.5	19.0	35.1	28.4	6.7	43.0	18.0
JULY	37.3	29.3	8.0	46.0	22.0	38.1	30.6	7.5	47.5	27.0	37.5	29.4	8.1	45.4	25.0	40.2	28.7	11.5	48.0	18.0	34.7	29.2	5.5	43.0	22.0
AUG.	37.2	29.6	7.6	42.0	24.0	37.9	30.3	7.6	45.5	25.0	37.3	29.9	7.4	44.0	22.2	39.5	28.3	11.2	46.5	18.0	34.0	28.8	5.2	40.0	20.0
SEPT.	36.0	26.8	9.2	42.0	22.0	37.1	28.1	9.0	44.5	22.0	36.0	28.3	7.7	41.6	24.0	38.7	26.1	12.6	45.5	15.0	33.3	26.8	6.5	40.0	22.0
OCT.	33.4	22.5	10.9	42.0	17.0	35.0	24.2	10.8	42.0	14.0	34.5	25.5	8.6	40.6	21.0	36.2	23.1	13.1	43.0	11.0	32.1	23.5	8.6	39.0	18.0
NOV.	29.1	17.6	11.0	35.0	9.0	30.6	17.7	12.9	37.5	10.0	29.0	21.1	7.9	34.5	15.0	30.9	18.0	12.9	38.9	6.0	28.5	19.7	8.8	32.0	14.0
DEC.	24.7	13.9	10.8	32.0	6.0	25.8	13.9	11.9	32.0	2.0	24.5	17.4	7.1	29.0	10.8	25.7	13.9	11.8	32.0	3.0	25.5	7.3	8.2	29.0	9.0

Tab. 1 — Analysis of temperatures (°C) at different stations. M= mean of maximum; m= mean of minimum; M-m= thermic excursion; Ma= absolute maximum; M_a = absolute minimum.

	BANDAR LENGEH altitude: m. 13 year: 1966-77			BANDAR ABBAS altitude: m. 10 year: 1957-83			QESHM altitude: m. 31 year: 1965-74			MINAB altitude: m. 29 year: 1965-75			JASK altitude: m. 4 year: 1965-75		
	P mm	R.D. > 1 mm	R.D. > 10 mm	P mm	R.D. > 1 mm	R.D. > 10 mm	P mm	R.D. > 1 mm	R.D. > 10 mm	P mm	R.D. > 1 mm	R.D. > 10 mm	P mm	R.D. > 1 mm	R.D. > 10 mm
JAN.	41.6	3.6	1.4	58.7	3.6	1.0	50.4	4.0	2.0	60.7	4.0	2.0	64.1	3.9	2.3
FEB.	21.8	3.1	0.8	42.3	3.1	0.9	34.5	3.0	1.0	46.6	3.0	1.0	28.7	2.0	0.9
MAR.	11.7	1.0	0.4	34.1	2.5	0.5	19.1	1.0	1.0	14.8	1.0	1.0	12.3	0.8	0.5
APR.	7.4	1.1	0.2	10.7	1.2	0.3	1.2	1.0	0.0	5.2	1.0	0.0	0.6	0.1	0.0
MAY.	0.2	0.1	0.0	5.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JUNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JULY	0.3	0.3	0.0	0.7	0.2	0.0	1.3	0.1	0.0	0.0	0.0	0.0	0.8	0.3	0.0
AUG.	10.3	0.2	0.2	2.3	0.2	0.1	0.8	1.0	0.0	2.6	0.6	0.0	0.4	0.4	0.0
SEPT.	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCT.	0.8	0.1	0.0	2.8	0.1	0.1	0.5	0.0	0.0	0.9	0.7	0.0	13.4	1.3	0.3
NOV.	1.3	0.5	0.0	6.5	0.5	0.3	8.1	1.0	0.0	6.8	1.0	0.0	1.5	0.3	0.0
DEC.	18.6	2.0	0.6	22.1	2.0	0.5	10.0	1.0	0.0	14.8	1.0	0.0	31.4	1.9	0.6
YEAR	114.0	12.0	3.6	186.1	13.7	3.8	125.9	12.1	4.0	152.4	12.3	4.0	153.2	11.0	4.6

Tab. 2 — Monthly average precipitation (P= mm) and rainy days (R.D.).

	BANDAR ABBAS	JASK	MINAB	BANDAR LENGEH	QESHM
JAN./31	3.7	4.9	4.7	4.3	4.7
FEB./28	3.0	2.4	4.0	2.5	3.6
MAR./31	2.2	0.9	1.1	1.2	1.8
APR./30	0.7	0.0	0.4	0.8	0.1
MAY/31	0.3	0.0	0.0	0.0	0.0
JUNE/30	0.0	0.0	0.0	0.0	0.0
JULY/31	0.0	0.1	0.0	0.0	0.1
AUG./31	0.1	0.0	0.2	1.1	0.1
SEPT./30	0.1	0.0	0.0	0.0	0.0
OCT./31	0.2	1.0	0.1	0.1	0.0
NOV./30	0.4	0.1	0.5	0.1	0.8
DEC./31	1.4	2.4	1.1	1.9	0.9

Tab. 3 — Pluviometric coefficient of Angot.

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
BANDAR ABBAS	24.9	17.1	12.4	3.5	1.5	0.0	0.2	0.6	0.2	0.8	2.3	8.9
JASK	29.1	11.7	4.5	0.2	0.0	0.0	0.2	0.1	0.0	4.3	0.5	12.0
MINAB	25.9	19.2	5.3	1.7	0.0	0.0	0.0	0.7	0.0	0.3	2.4	6.0
BANDAR LENGEH	18.2	9.3	4.4	2.5	0.1	0.0	0.1	2.8	0.0	0.3	0.5	7.6
QESHM	20.9	14.1	7.0	0.4	0.0	0.0	0.4	0.2	0.0	0.2	2.8	3.9
BANDAR ABBAS	S.U.	S.A.	A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	A.
JASK	S.U.	A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	A.
MINAB	S.U.	S.A.	A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	A.
BANDAR LENGEH	S.A.	A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	A.
QESHM	S.U.	A.	A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.	E.A.

Tab. 4 — Monthly Aridity Index of De Martonne. (S.U. = Subhumid; S.A. = Semiarid; A. = Arid; E.A. = Extremely Arid.

considerably different from station to station: 5,2° C to 8,8° C at Jask, 6,7° to 10° C at Qeshm; 7,5° C to 12,7° C at Bandar Lengeh and Bandar Abbas, and 10,6° to 13,8° C at Minab. These may be explained in terms of geographical differences which exist between the stations. The lowest value of the monthly excursion in found at Jas, which is locate by the sea shore, at a lower latitude than the other stations, and which has the coolest summer among all stations. The highest value of the monthly excursion is found at Minab, located about 20 Km away from the coast, towards the interior; it is the only station which lies very far from the sea shore.

Precipitations

Precipitation values are reported in Table 2. Mean monthly values show similar trends in all stations: maxima always fall in January - with values ranging from 64,1 mm (Jask) to 41,6 mm (Bandar Lengeh) - and an almost completely dry period occurs between May and September (some unimportant interruptions may occur in July and in August).

Mean annual values are very low. They range from a minimum of 114 mm (Bandar Lengeh) to a maximum of 186, 1 mm (Bandar Abbas). There are just a few rainy days during the year: 11-14 days with more than 1 mm of rain, and approximately 4 days with more than 10 mm of rain.

We have outlined the seasonal regimen by ordering the seasons according to decreasing rainfall, in such a way that quarterly intervals include a solstice and an equinox. The results are, as follows:

- W, A, Sp, S, in Queshm, Minab, Bandar Abbas, Jask;
- W, Sp, S, A, in Bandar Lengeh;

(W = Winter; S = Summer; A = Autumn; Sp = Spring).

Winter is therefore the most rainy season, with precipitation ranging from 82,2 mm (Bandar Lengeh) to 124,2 mm (Jask); whereas summer, which shows little or no precipitation, is always the driest season.

In order to determine the pluviometric regimen of the region, we have calculated Angot's Pluviometric Coefficient, by means of the expression $p=m/a$, where $A = (P.n)/365$, m = mean monthly rainfall and n = number of days in the month. The values obtained are given in Table 3. Some 50% of the rain distribution is concentrated in January, and the next highest percentage in February.

Aridity index

In order to outline the bioclimatic features of the area, we have calculated the Aridity Index, using the equation of De Martonne (1926) for the annual index, $A = P/(T + 10)$, and the expression $a = 12p/(t+10)$ for the monthly index; where P = mean annual precipitation, T = mean annual temperature, p = mean precipitation, t = mean monthly temperature.

Table 4 shows that all the stations posses features which are proper of the extremely arid bioclimate; Bandar Abbas, however, shows transition towards the arid bioclimate.

Monthly analyses demonstrate that January is the only fairly moist month, at all

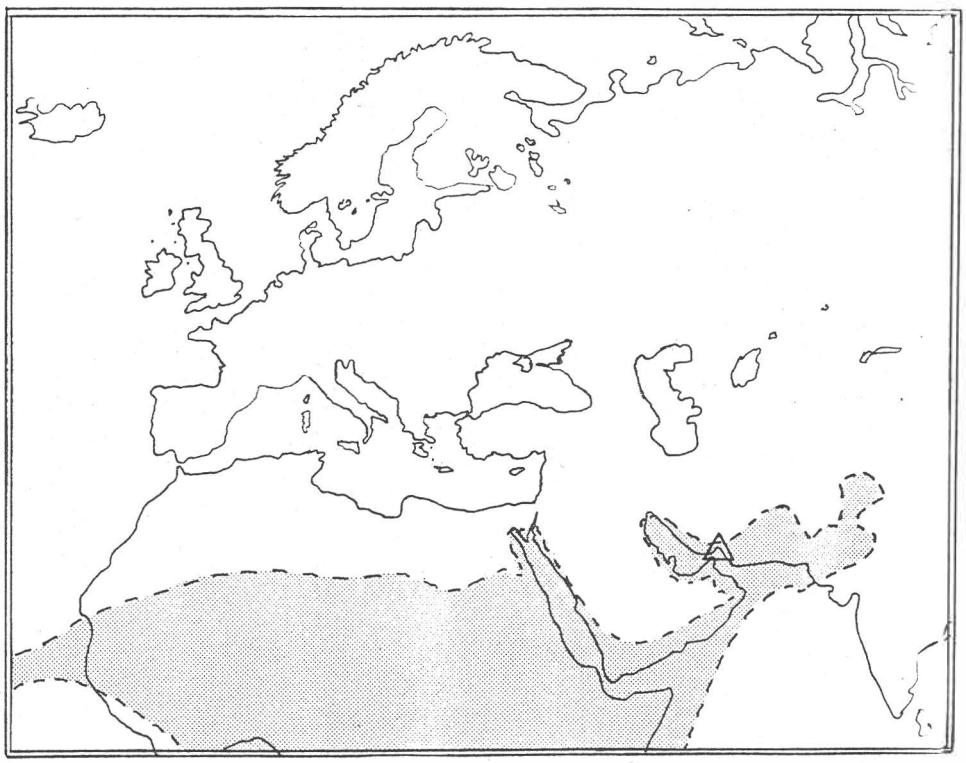

Fig. 2 — Map of the Sudanian Region (Zohary, 1973).

stations, except Bandar Lengeh, which is the most arid one.

Flora and Vegetation

The observations on the vegetation of Souterhn Iran which are given in the present work are, as said, preliminary. This is also due to the fact that field and laboratory identifications of the species which have been collected, has been quite arduous; this in turn, is due to the almost total lack of adequate basic documentation concerning the physical and biological environments of the region.

The region possesses several species, proper of the Nubo-Sindian Province (Sudanian region) (Zohary 1973), (Fig. 2) namely: *Calligonum crinitum, Zilla spinosa, Koelpinia linearis Peryploca aphylla, Tephrosia hausknecthii, Anabasis setifera, Salvadora persica, Heliotropium strigosum, Calotropis procera.*

Several species are of African origin, whereas other are typical of tropical Asia; the latter include *Prosopis spicigera, Euphorbia larica, Stocksia brahuica.*

The presence of several species of tropical origin is explained by the local bioclimatic conditions (i.e. high winter temperature, greater rainfall in the central plateau, and lower altitude, as previously discussed). The vegetation is extremely

discontinuous and irregular; preferential sites for plant growth are the zones with a richer water supply. Hence, the vegetation tends to concentrate in wadis and oases, the most favourable areas as far as the availability of water is concerned.

The vegetation is always extremely specialized (xerophytic) and selected, as it must face the drastic irrigularities of the hydrographical system, as well as the excessive summer heat.

Distinctive features of the plant species include their rather short period of biological activity, the possibility of entering into a state of quiescence during the adverse periods - by means of different mechanisms - and special morphoanatomic features, e.g. an extremely marked growth of the root apparatus. A number of species, including several Gramineae of sea-shore and interior sandy environments (e.g. *Pennisetum divisum, Panicum turgidum)*, are nevertheless able to benefit from the water condensation caused by thermal variation. Other adaptations to the environment include wax formation of the epidermal tissues, and the reduction of the area of the surface which are likely to lose considerable amounts of water as a consequence of evaporation); the latter adaptation is found in *Euphorbia larica* (Fig. 5). Cutinization of leaf epidermis occurs in the majority of trees of the region *(Prosopis spicigera, Acacia tortilis, Salvadora persica, Ziziphus spina-christi, ecc.)*.

The vegetation structures which have been identified during the present preliminary investigation of Southern Iran, are referred to the vegetation structures identified by Giacomini & De Marco (1975) in Saudi Arabia.

Basically, geobotanical and geomorphological criteria have been used to outline the prominent features of the vegetation structures; this approach has also provided a basis for the field work methodology.

Pseudo-steppes

Pseudo-steppes have been found in a coastal environment and in the innermost alluvial plains.

A distinctive feature of pseudo-steppes is the presence of several deep-rooted phanerogams, including *Calligonum crinitum* (Photo 4), *Acacia tortilis, Rhazia stricta, Fagonia sp.pl., Calotropis procera, Cyperus conglomeratus, Haloxylon salicornicum, Aristida coerulescens,* etc.

This community is found on sandy and muddy substrata.

Several ephemeral species (mostly Gramineae), highly palatable for cattle, cover the soil especially after showers. On the whole, this formation supplies a good quantity of plant biomass for stock-raising; it also contributes greatly to the stabilization of sand.

Scrub-steppes

Scrub-steppes have been found in the coastal area and, to a greater extent, in the alluvial plains.

The floristic composition of the scrub-steppes is not significantly different from the one of the pseudo-steppe. The differences lie in the increase of the number of trees and shrubs, which are always isolated, and of herbaceous plants. The latter,

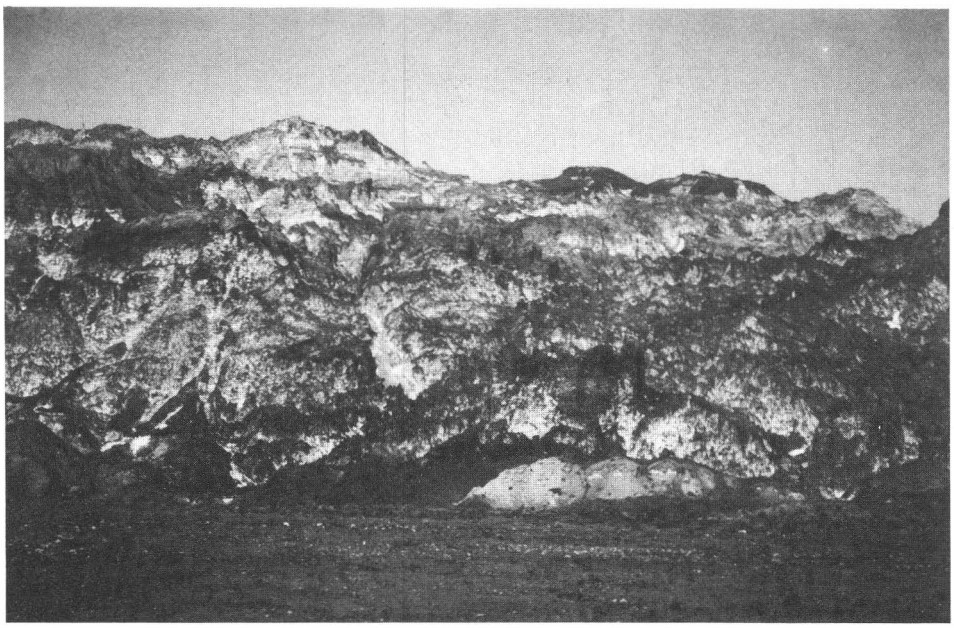

Fig. 3 — A landscape of salt plug domes.

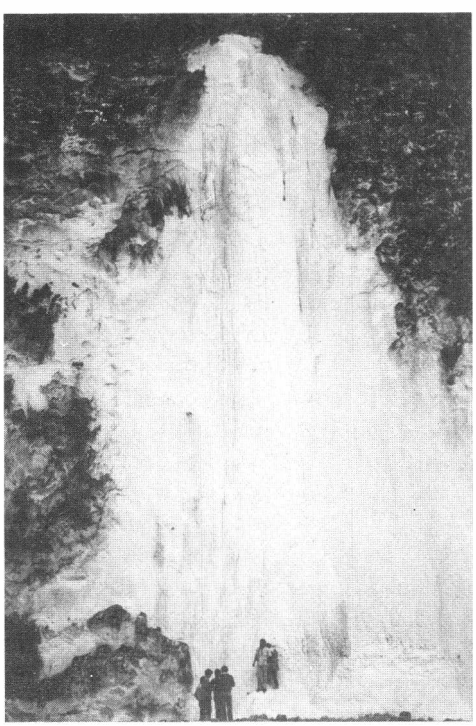

Fig. 4 — Salt fall of a salt dome.

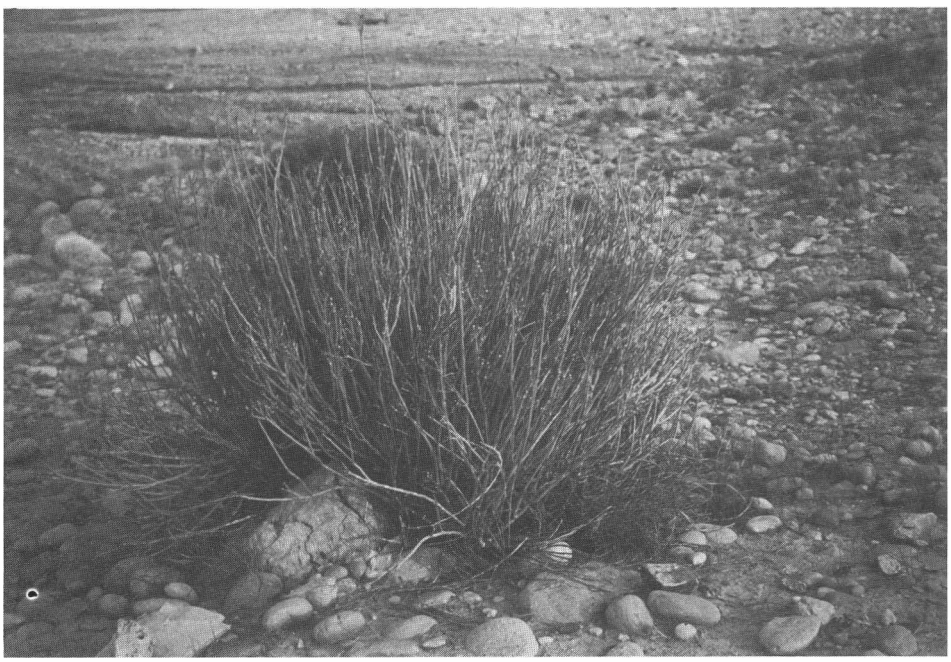

Fig. 5 — Euphorbia larica Boiss.

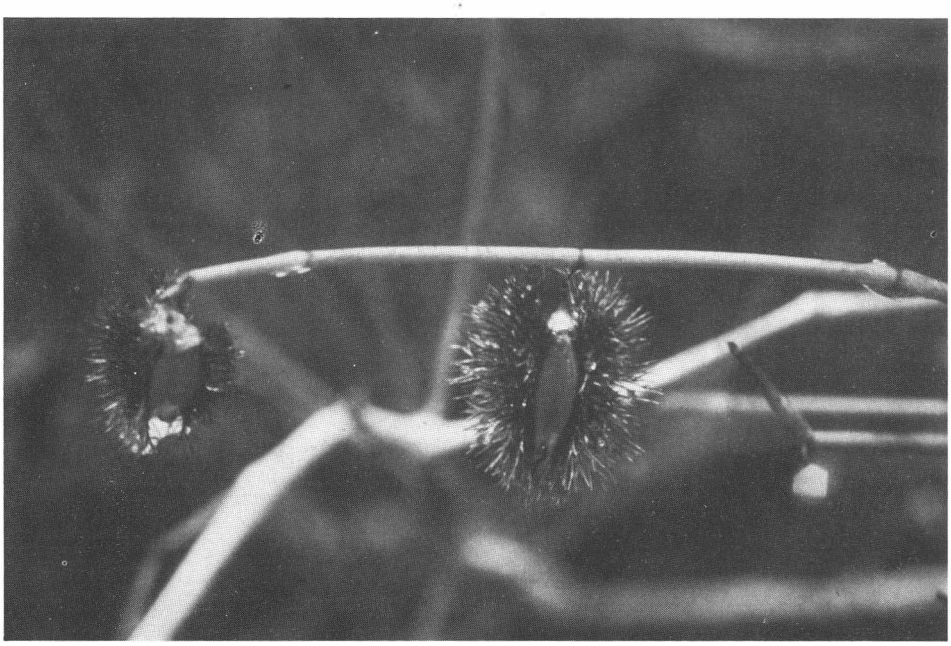

Fig. 6 — Calligonum crinitum Boiss.

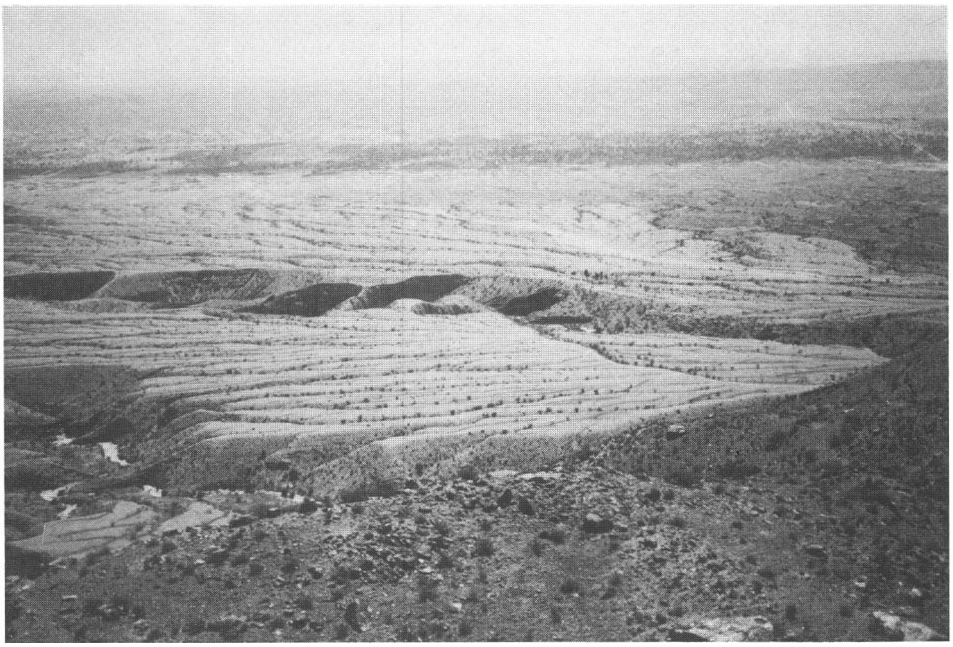

Fig. 7 — Typical rocky xerophilous scrub.

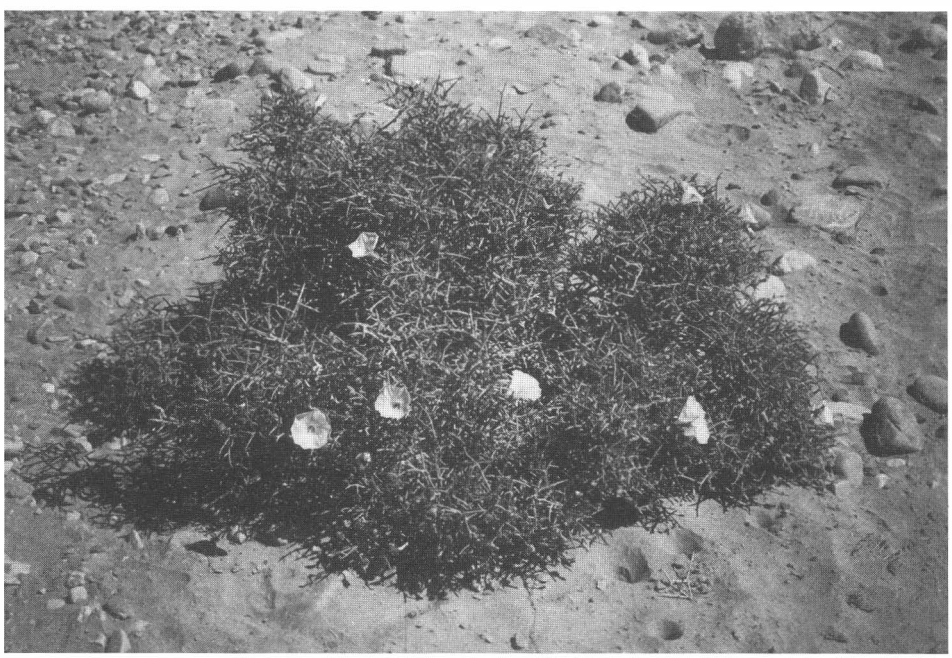

Fig. 8 — Convolvulus spinosus Burm.

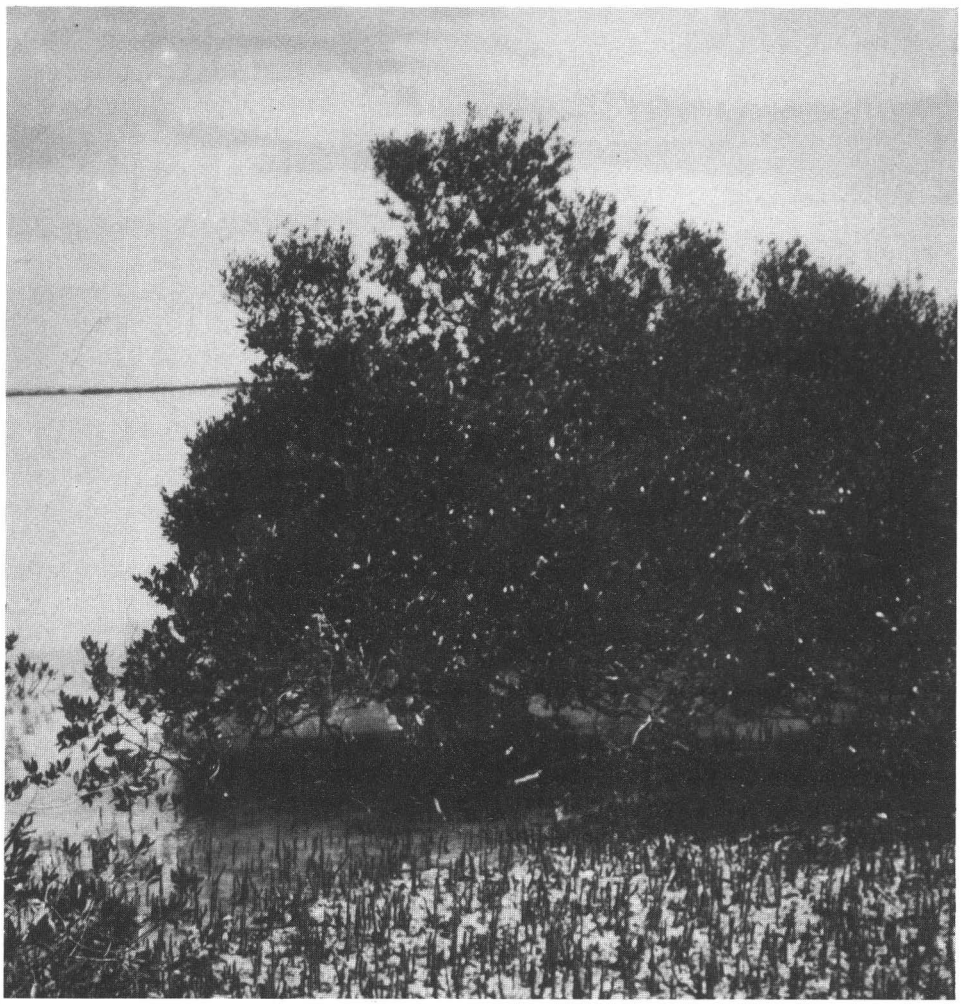

Fig. 9 — Avicennia marina (Forsk.) Vierh.

which have a suffrutescent habit, are found in small colonies; they include *Haloxylon salicornicum, Rantherium epapossum.*

The herbaceous-shrubby layer is similar to the one of the pseudo-steppes. Just as pseudo-steppes, scrub-steppes provide good quantitaties of plant biomass for stock-raising and human utilization.

Rocky xerophilous scrub

This type of community grows where rocky outcrops interrupt the continuity of the ground or where the ground surface is composed of rather coarse material (e.g. cones, Fig. 7).

It is a very open shrubland where trees occur sporadically. The latter are simply shrubs which are developed in particular morphologically more favourable zones.

The most representative species are *Acacia tortilis, Ziziphus spina-christi, Calotropis procera, Ziziphus nummularia, Periploca aphylla, Amygdalus arabica, Aerva persica, Prosopis spicigera, Euphorbia larica,* etc..

The presence of ephemeral species, - mostly Gramineae and Leguminosae is almost entirely confined to the rainy periods. They represent an excellent forage.

In the piedmont zone and the alluvial plains, and in the presence of noticeable quantities of detritus material, this formation takes a peculiar appearance which is connected with copious presence of *Euphorbia larica* (Fig. 5), a large, semiglobular pale-green shrub. Several species coexist with it, including *Ephedra pachyclada, Convolvulus oxysepalus, C. acanthoclados, C. spinosus* (Fig. 8), *Gaillonia aucheri.*

Riparian formation

Riparian formations, which are located along the wadis, are lusher formations than the ones already examined. This is due to more favourable environmental conditions and to the greater availability of water. The presence of trees, such as *Acacia tortilis, Prosopis spicigera, Ziziphus spina-christi,* is a distinctive feature of these formations. *Tamarix gallica* is the dominant species where water is available in greatest quantity. It may, at times, originate dense bushes, and it is frequently used for house-building if it reaches tree-like dimensions. *Calotropis procera, Salvadora persica, Aerva persica, Cyperus conglomeratus*, etc., may be found in the oases and along the channels.

Sabkas formation

Sabkas formations occur in areas where many plains, generally of a considerable extension, are present.

These areas are located along the coast, or in some depressed zones of the interior. They have flat morphology, and possess a saline crust on the ground surface. The vegetation may be monophytic and discontinuous; completely bare zones of considerable extension may be found. Typical species are: *Suaeda vermiculata, Halocnemum strobilaceum, Siedlitzia rosmarinus, Zygophyllum coccineuma, Limonium sp.*.

Hydro - and halophytes are found in the areas where water comes to, or at least close to, the ground surface. They include *Tamarix gallica, Cyperus conglomeratus.*

At the border of the Sabkas formations, pseudo-steppes are frequently found. Aeolian deposition processes on the salt plains have originated a microdunal morphology similar to the one of pseudo-steppes. However, the vegetation of these areas shows some striking differences with the one of true pseudo-steppes, being strongly influenced by the underlying saline substratum.

The dominant species in these areas is *Haloxylon salicornicum* stabilizer of the dunes. Other phreatophytes, which are typical of a sandy environments, are found with it, namely *Calligonum crinitum, Limonium sp., Cyperus conglomeratus, Panicum turgidum.*

Oases

Towards the wasi zone downhill, the alluvial plains consist of pebble, sand and mud material which has been deposited by the watercourses, the flow of which is extremely variable. The most important oases are Minab and Bandar Abbas, which lie at the foot of the Kuh-e Ghenu.

Presently, the cultivation of the oases is rather diversified; culture of *Phoenix dactylifera* predominates, although *Citrus* fruits and other tropical and sub-tropical fruits are cultivated in some oases where environmental conditions are suitable *(Carica papaya, Cocos nucifera, Mangifera indica, Ficus religiosa).*

In the oases with a limited availability of water (Bandar Lengeh and Demilu), *Phoenix dactylifera* is the only feasible culture.

Vestiges of cultivated fields - presentely deserted and invaded by spontaneous species - have frequently been found within the boundaries of oases and ex-oases close to Minab and all along the way to Jask.

Mangroves

In proximity of the mouths of the most important rivers of the region, conspicuous deposition of muddy sediments has originated a coastline with a peculiar morphology, of modest depth, presenting small islands which are partially or totally submerged according to the tide.

In the Strait of Clarence, (formed by a syncline lying between the anticline of Qeshm Island and the terra firma) the contribution of fine sediments from the Rud-e Kull, two important rivers, has caused the formation of a large shallow submerged delta, where the most important mangrove formation of the region is present. This formation has a geomorphological action, since it tends to stabilize the fine sediments and, consequently, to favour the constant advance of the coastline.

The above mentioned formation, which probably had a certain economic importance in the past, is decreasing nowadays; its vestiges are found at the mouths of the rivers of the entire region. The regression may be explained in terms of the global decrease of the freshwater flow originating in the mountains behind the area.

The presence of one single woody species *(Avicennia marina)* (Fig. 9) is a distinctive feature of this formation. It is well adapted to its environment, as it possesses a special glandular system for eliminating salts in excess over its requirements. Similar structures are also found in several species of the genus *Tamarix.* It is extremely frequent in the sea tract between the northwest coast of Qeshm Island and the deltas of the rivers Rud-e Kul and Rud-e Mehran, where it forms very dense populations.

Several attributes make this environment extremely interesting for the naturalist, as witnessed by the fact it is a Natural Park and, since 1976, a UNESCO Biosphere Reserve within the MAB Project.

It is the favourite nesting site for numerous species of birds; to these, and to the plants themselves, the conspicuous production of organic matter - which causes the development of very dense phyto - and zooplankton populations - may be ascribed. The abundant plankton, in turn, accounts for the presence of numerous

species of fishes and crustaceans.

The economic potential of mangroves (e.g. timber and forage production), of equal importance nowadays as in the past, may be partly explained in terms of their proximity to the terra firma and of the exiguous depth of the areas where they are found, which make them quite easy to exploit.

Floristic list

The list reported in the appendix contains a first set of 174 species, belonging to 48 families, which have been collected during the March-April 1983 expedition. Particular attention has been given to the species found in the following areas: Bandar Abbas, Bandar Lengeh, Minab, Jask and the Kuh-e Genu.

Taxonomical identification has been accomplished by using the works of: Rechinger (1963-1982), Parsa (1951-1960), Ozenda (1958), Zohary (1955-1978) Boissier (1867-88), Pignatti (1982).

Whenever possible, the nomenclature follows K.H. Rechinger's "Flora Iranica" not yet finished.

The coupling of the plant species with their life form has enabled us to elaborate the following biological spectrum:

P = 10, 91 %; Ch = 20,11%; H = 14,36%

Pn = 15,51%; G = 2,87%; T = 36,20%

It may be seen that Therophytes are present in a high proportion; this is probably due to the fact that the specimens have been collected in March, immediately after the rainy season.

The percentage of Chamaephytes and Nano-Phanerophytes, is also quite high, its cumulated value being of 35,62%.

Chorologically, the species hereby reported belong to the following phytogeographical classes: Mediterranean (20,11%), Saharo-Sindian (20,11%), Tropical (10,34%), Irano-Turanian (6,32%), Endemic (2,87%), Cosmopolitan (3,44%), Cultivated (3,44%), Circumboreal (0,57%), Eurasiatic (0,57%), Ibero-Macaronesian (0,57%), Paleotemp. (0,57%).

Among the Saharo-Sindian we recall: *Koelpinia lineris, Salvia aegyptiaca, Senecio desfontanei, Fagonia bruguierii, F. olivierii, Matthiola longipetala, Trigonella stellata, Maerua crassifolia, Calligonum crinitum, Anabasis setifera, Cornulaca monacantha.*

Several endemic species have been found, e.g. *Fortuynia bungei, Convolvulus acanthoclados, C. spinosus, C. oxysepalus.*

The most representative Mediterranean species are, *Emex spinous, Rumex cyprus, Halopeplis perfoliata, Mesembrianthemum nodiflorum, Erodium laciniatum, Helianthemum salicifolium, Teucrim polium, Crupina crupinastrum, Aeluropus lagopoides.*

For some 24% species, it has not been possible to determine the phytogeographical classes to which they belong, since the data available in the literature was not sufficient for attaining asatisfactory conclusion.

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Appendix: Floristic list

PTERIDOPHYTAE

PHILOGLOSSACEAE
G Ophioglossum vulgatum L. Circumbor.-

SINOPTERIDACEAE
H Cheilanthes pteridioides Reinhardt - Medit. Iran. Turan.

GYMNOSPERMAE

CUPRESSACEAE
P Juniperus excelsa M.B. - Iran. Turan. - Kuh-e - Geni.

EPHEDRACEAE
Pn Ephedra ciliata Fish et Mey ex C.A. Mey - Kuh-e Geni
Pn Ephedra pachyclada Boiss. - Kuh-e - Geni

ANGIOSPERMAE

MORACEAE
P Ficus religiosa L. - Cult.

POLYGONACEAE
T Emex spinosus (L.) Campd. - Medit.
T Rumex vesicarius L. - Sah. Sind.
T Rumex cyprius Murb. - Medit. Trop.
Pn Calligonum crinitum Boiss. - Sub. Sah. Sind.
T Polygonum aviculare L. - Cosmop.

CHENOPODIACEAE
T Chenopodium murale L. - Subcosmop.
Ch Halopeplis perfoliata Forsk. - Medit.
Pn Halocnemum strobilaceum (Pall.) M.B - Medit. Iran. Tur.
Ch Salicornia fruticosa L. - Medit. Afr.
Ch Suaeda cfr. fruticosa Forsk. - Sah. Arab.
T Suaeda maritima (L.) Dumort - Cosmop.
Pn Suaeda vermiculata Forsk. - Sah. Arab.
Pn Seidlitzia rosmarinus (Ehrenb.) Bge. - Sah. Sind.
Ch Anabasis setifera Moq. - Sah. Sind.
Pn Salsola vermiculata L. - S. Medit.
Pn Haloxylon aphyllum Minkv.
Ch Cornulaca monacantha Del. - Sah. Sind.

AMARANTHACEAE
Ch Aerva persica (Burnm.) Merr. var. bovei (Webb.) Chiov. - Paleotrop.

NYCTAGINACEAE
H Boerhavia diffusa L. - Paleotrop.

AIZOACEAE
T Mesembrianthemum nodiflorum L. - Medit. Afr.

PORTULACACEAE
Pn Gymnocarpos decander Forsk. - Sah. Arab.

CARYOPHYLLACEAE
T Polycarpon tetraphyllum (L.) L. - Medit.
T Spergula fallax (Lowe) E.H.L. Krause - Medit. Atl.
T Silene villosa Forsk. in Parsa

PAPAVERACEAE
H Oxylobum vitellinum Boiss. et Buhse - Kuh-e - Genu

CAPPARIDACEAE

Pn Maerua crassifolia Forsk. - Sah. Sind.
Pn Capparis decidua (Forsk.) Edgew. - Trop.
Pn Capparis spinosa L. - Subtrop.
Ch Cleome oxypetala Boiss.
Ch Dipterygium glaucum Decne

CRUCIFERAE

T Diplotaxis griffithii (Hook. et Thoms.) Boiss - Bandar-Abbas
Ch Physorrhynchys brahuicus Hook. - Sah. Sind.
T Eruca sativa Miller - Medit. Tur.
Ch Fortuynia bungei Boiss. - Endem. (Iran. Pakistan)
T Moricandia clavata Boiss. et Reut - E Sah. Arab.
Ch Stroganowia persica N. Bush
Pn Farsetia longisiliqua Decne
Ch Farsetia heliophila Bge.
H Diceratella canescens (Boiss.) Boiss.
H Matthiola farinosa Bge. ex Boiss. - Iran. Tur.
T Matthiola longipetala (Vent.) DC. - Sah. Sind. - Gemi Park
T Malcomia bungei Boiss. var. glabrescens Boiss. (ex Parsa)

RESEDACEAE

T Reseda muricata Presl. cfr. var. undulata Post. - E. Sah. Sind.

ROSACEAE

P Crataegus meyerii A. Pojark (= C. pectinata Meyr) - Iran. Tur.
Pn Amygdalus arabica Olivier - Iran. Tur.

LEGUMINOSAE

H Astragalus cfr. schahrudensis Bge. - Endem.?
Pn Astragalus cfr. fascicolifolius Boiss. - Iran. Tur.
Pn Astragalus cfr. strictifolius Boiss. - Iran. Tur.
T Astragalus cfr. camptoceras Bge. - Iran. Tur.
T Medicago ridigula (L.) All. - Eurimedit.
T Medicago denticulata Willd. - Eurimedit. M.t Gemù
T Scorpiurus sulcata L. - Medit.
T Trigonella uncata Boiss. et Noe - Iran. Tur.
T Trigonella teheranica Bornm.
T Trigonella stellata Forsk. - Sah. Sind.
T Hippocrepis bornmuelleri Hskn.
Pn Indigofera intricata Gouan. - Paleotrop.
T Lotus cfr. schimperi Steud.
P Acacia tortilis (Forsk.) Willd.
P Acacia arabica (Lam.) Willd. - Afr. Trop.
P Acacia nubica Benth.
P Acacia ehrenbergiana Hayne
P Cassia obovata Collad. - Sud Dec. Sah.
Pn Tephrosia hausknechtii Bornm. - Trop. Mt. Gemù
P Prosopis spicigera L.
Ch Taverniera spartea DC.
T Vicia angustifolia L. - Eurimedit.
T Artyrolobium trigonelloides Jaub. et Sp. var. subuniflorus Bornm. - Sah. Arab.

GERANIACEAE

H Monsonia heliotropioides (Cav.) Boiss. - Medit.
T Geranium mascatense Boiss.
T Erodium laciniatum (Cav.) Willd. - Medit.

ZYGOPHYLLACEAE

H Fagonia olivierii DC. - Sah. Sind.

H Fagonia indica Burm. fil. - Sah. Sind.
H Fagonia bruguierii DC. - Sah. Sind.
T Zygophyllum simplex L. - Afr. Trop. Arab.
Ch Zygophyllum eurypterum Boiss. et Buhse - Iran. Tur.
Ch Zygophyllum propinquum Decne
T Tribulus terrestris L. - Cosmop.

EUPHORBIACEAE
Ch Chrozophora obliqua (Vahl.) Juss. ex Spreng. - Iran. Tur.
T Euphorbia turcomanica Boiss.
Pn Euphorbia tirucalli L.
Pn Euphorbia larica Boiss.
Pn Euphorbia osyridea Boiss.

RUTACEAE
Ch Haplophyllum pedicellatum Bge. ex Boiss.
Ch Haplophyllum tuberculatum (Forsk.) Juss. - Sah. Arab.

ANACARDIACEAE
P Mangifera indica L. - Cult.

SAPINDACEAE
P Dodonaea viscosa (L.) Jacq.
Pn Stocksia brahuica Benth.

SALVADORACEAE
Pn Salvadora persica L.

RHAMNACEAE
P Ziziphus spina-christi (L.) Willd. - Trop.
P Ziziphus nummularia (Burm. fil.) Wight. et Arn

MALVACEAE
Ch Abutilon muticum (Delile ex DC.) Sweet - Trop.
T Malva parviflora L. - Medit.

CISTACEAE
Ch Helianthemum lippii Pers. - Sah. Sind.
T Helianthemum salicifolium (L.) Miller - Medit.

TAMARICACEAE
P Tamarix gallica L. - N. Trop.

CARICACEAE
P Carica papaya L. - Cult.

CUCURBITACEAE
T Citrullus colocynthis Schrad. - Trop. Medit.

PRIMULACEAE
T Anagallis arvensis L. - Medit.

APOCYNACEAE
Ch Rhazya stricta Decne.

ASCLEPIADACEAE
Pn Periploca aphylla Decne. - Sah. Arab.
P Calotropis procera (Wild.) R. Br. - Sahelo Sah.
Pn Leptadenia pyrotecnica (Forsk.) Decne. - Trop.

CONVOLVULACEAE

T Cuscuta sp.
T Cressa cretica L. - Subcosmop.
Ch Convolvulus acanthoclados Boiss. - Endem.
Ch Convolvulus spinosus Burm. - Endem.
Ch Convolvus oxysepalus Boiss. - Endem.
H Convolvulus sericeus Burm.
G Convolvulus arvensis L. - Euras.

BORAGINACEAE
Ch Heliotropium cfr. strigosum Willd. - Sah. Sind.
Ch Heliotropium cfr. ophioglossum Stocks - Sah. Sind.
Ch Heliotropium persicum Burm.
Ch Heliotropium rotundifolium Sieb.
T Arnebia hispidissima (Lehm.) DC; - Sah. Arab. Onosma sp.

AVICENNIACEAE (ex Rechinger)
P Avicennia marina (Forsk.) Vierh.

LABIATAE
Micromeria cfr. mirtifolia Boiss. et Hohen
Ch Teucrium polium L. - Medit.
Ch Salvia aegyptiaca L. - Sah. Sind.

SOLANACEAE
Pn Lycium cfr. intricatum Boiss. - Medit.
H Hyoscyamus nutans Shonebeck - Temesy - Sah. Sind.
T Solanum melongena L. - Cult.

OROBANCHACEAE
T Cistanche tubulosa (Schrenk.) R. Wight. - S. Medit.

RUBIACEAE
T Galium setaceum Lamk. - Medit. Euras.
Pn Gaillonia aucheri Guill.

PLANTAGINACEAE
T Plantago ovata Forsk. - Medit.
T Plantago bellardii All. - Medit.
T Plantago psyllium L. - Medit.

COMPOSITAE
Pn Rhanterium epapposum Oliver
Ch Phagnalon nitidum Fres.
T Anthemis cfr. gayana
Ch Artemisia herba-alta Asso - Iran. Tur.
T Senecio desfontanei Druce - Sah. Sind.
H Centaurea solstitialis L. - Medit.
T Crupina crupinastrum (Moris.) Vis. - Medit.
T Koelpinia linearis Pallas - Sah. Sind.
T Urospermum picroides (L.) Desf. - Medit.
Ch Launaea acanthodes (Boiss.) O. Kunze - Iber. Maur. Macar.

LILIACEAE
H Asphodelus fistulosus L.
N Asphodelus tenuifolius Cav. - Paleosubtrop.
G Tulipa violacea Boiss. et Buhse
G Nectaroscordum tripedale (Trautv.) Grossh. (= Allium roseum) L. - Medit.
G Gagea reticulata (Pall.) Meyr - Iran. Tur.

GRAMINEAE

T Lamarckia aurea (L.) Moench - Medit. Tur.
T Bromus tectorum L. - Paleotemp.
T Trachynia distachya (L.) Link (= Brachypodium d. Beauv.) - Paleosubtrop.
T Schismus arabicus Nees - S. Medit. Tur.
T Aristida coerulescens Desf. - Sahara - Sind.
T Aristida plumosa L.
T Stipagrostis hirtigluma (Steud.) De Winter - Trop.
H Stipa hausknechtii Boiss.
H Aeluropus lagopoides (L.) Trin ex Thawaites - S. Medit. Tur.
T Dactyloctenium aegyptium (L.) P. Beauv. -Paleotrop.
H Panicum turgidum Forsk. - Sah. Sind.
H Pennisetum flaccidum Griseb.
H Pennisetum divisum (Gmel.) Henrard
H Pennisetum orientale L. G. Rich.
T Cenchrus pennisetiformis Hochst. et Steud. ex Steud.
T Cymbopogon martinii (Rosb.) Watson

CYPERACEAE
H Scirpus wardianus J.R. Drummond
H Cyperus esculentus L. - Subtrop.
H Cyperus conglomeratus Rotb. - Sah. Sind.
H Cyperus rotundus L. - Subtrop. (Subcosmop.)

PALMAE
P Phoenix dactilifera L. - Cult.
P Cocos nucifera L. - Cult.

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