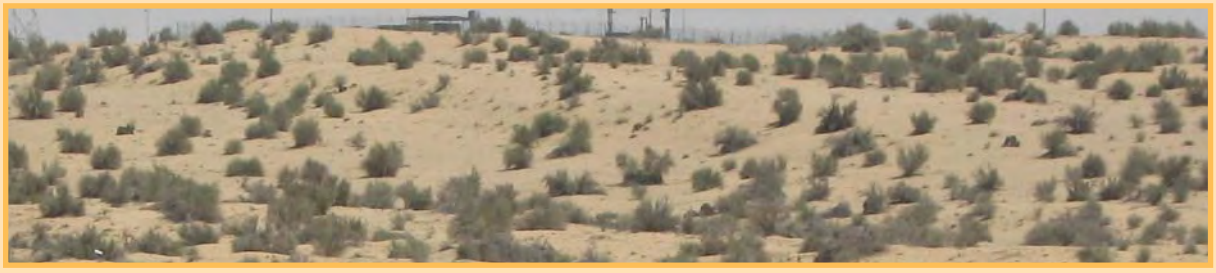
Salt-tolerant Plants of the United Arab Emirates



Fawzi M Karim
Abdullah J Dakheel

Published by the International Center for Biosaline Agriculture (ICBA)
PO Box 14660
Dubai
United Arab Emirates

Published, printed and bound in the United Arab Emirates

ISBN 92-95053-00-1

Note: As of 1 January 2007, ISBN numbers will contain 13 digits instead of the current 10 digits to make them compatible with the bar codes assigned to commercialized publications. Although non-profit publications like this one do not require bar codes, 13-digit numbers will be issued for all publications. The 13-digit ISBN for this book is 978-92-95053-00-7.

The photographs on the front cover and pages 10 (above), 13 (below), 14 (above), 15, 47, 115, 138 and 153 (left) were taken by Ghazi Al Jabri. All others were taken by Dr Fawzi Karim.

Correct citation:

Karim FM and Dakheel AG. Salt-tolerant plants of the United Arab Emirates. 2006. International Center for Biosaline Agriculture, Dubai, UAE.

SALT-TOLERANT PLANTS OF THE UNITED ARAB EMIRATES

FAWZI M KARIM
ABDULLAH J DAKHEEL

INTERNATIONAL CENTER FOR BIOSALINE AGRICULTRUE
2006

PREFACE

Several of the Gulf Cooperation Council countries, notably Kuwait, Oman, Qatar and Saudi Arabia, have published well-written scientific books about their flora and fauna. The UAE has also produced a good number of books about its plants and animals. However, until now no book has been published with a specific focus on the halophytes and salt-tolerant plants in the country. This book represents the first scientific documentation of these important plants in the UAE.

The authors, Dr Fawzi Karim and Dr Abdullah Dakheel, met in the mid nineties at United Arab Emirates University at Al Ain, where they were both employed. Dr Karim, a taxonomist, managed the university herbarium, and Dr Dakheel, an ecologist, was a lecturer. Their mutual interest in the flora of the UAE drew them together, and this book is the happy result of their collaboration.

With the blessing of the UAE Government, they set to work. Applying a standard scientific approach to their endeavor, the authors spent several years traversing the varied and rugged terrain that typifies the UAE. Their indefatigable efforts to record all the relevant plant species of the UAE's deserts, mountains, estuaries and salt marshes are to be heartily commended.

The work, initiated by Dr Karim, was elaborated and reviewed by Dr Dakheel, who subsequently left the university to take up a position at the International Center for Biosaline Agriculture (ICBA) in Dubai. Impressed by the scientific value and originality of the book, ICBA agreed to prepare it for publication and to distribute it internationally. *Salt-tolerant Plants of the United Arab Emirates* is an important addition to the scientific libraries of the UAE and beyond.

DR MOHAMMAD AL-ATTAR
DIRECTOR GENERAL
INTERNATIONAL CENTER FOR BIOSALINE AGRICULTURE

ACKNOWLEDGEMENTS

This survey was prepared on behalf of the International Center for Biosaline Agriculture (ICBA), Dubai, UAE. The authors are grateful to Dr Mohammad Al-Attar, Director General, and to Professor Faisal Taha, Director of Technical Programs, for the support and assistance they provided to complete this survey.

The authors also highly appreciate the efforts of Dr Sandra Child, and her successor Eric McGaw, Communications Specialists, for their editorial assistance. Finally, we offer our heartfelt thanks to Ghazi Al-Jabri for designing the book, as well as for his superb photography.

The authors are indebted to the Auckland Botanical Society, New Zealand, for their kind help.

FAWZI M KARIM
ABDULLAH J DAKHEEL

2006

CONTENTS

INTRODUCTION

Salt-tolerant plants, both cultivated and wild, have assumed an increased importance during recent decades. Scarcity of fresh water resources suitable for conventional agriculture, salinization of irrigated agricultural lands, intrusion of seawater to inland aquifers due to overexploitation of groundwater resources and other natural causes have all led to increased salinity problems in many parts of the world.

Arid environments are particularly susceptible to the problems of soil and water salinization. Water scarcity in such regions is a major constraint to further development, particularly with regard to meeting agricultural demands. The use of saline water resources and salt-affected soils in agricultural production is unavoidable in such environments.

The UAE, like many countries in the West Asia and North Africa region, is dominated by arid environments characterized by low rainfall, high temperatures and prolonged summers. Shortage of fresh water resources, natural salinization of vast areas and secondary salinization of agricultural land are widespread in the country. The exploitation of saline water and salt-affected land requires appropriate plant species and varieties with economic or environmental value. Identifying both conventional and nonconventional plants that can tolerate saline conditions is the first step in utilizing saline water resources and saline environments.

The UAE is characterized by three domains for the use of salt-tolerant plants.

1. *Farmlands salinized as a result of poor irrigation.* In parts of the UAE, huge areas of salinized farmland have resulted from poor irrigation practices. These lands normally require large (and mostly unavailable) amounts of water to leach away the salts before conventional crops can be grown. The possibility of growing salt-tolerant plants on these lands without any intervention is therefore worth serious consideration.
2. *Arid areas that overlie reservoirs of brackish water.* Many arid areas overlie saline aquifers or groundwater containing salt levels high enough to prohibit irrigation of conventional salt-sensitive crops. However, barren land can be made productive by growing selected salt-tolerant crops and employing special cultural techniques using brackish water for irrigation.
3. *Coastal deserts.* Extensive coastal deserts where seawater is the only water available typify the UAE. Although most farmers are reluctant to grow crops in sand with salty water, the disadvantages of these conditions for conventional crops become advantages when halophytes and salt-tolerant plants are cultivated.

Arid countries can benefit significantly from using saline water and soils in agriculture. Salt-tolerant plants can utilize water and land unsuitable for

salt-sensitive crops for the economic production of food, fodder and many other products.

This handbook provides a simple identification guide to 125 wild and cultivated plant species in the UAE, both common plants and rare ones. These plants are illustrated in color and described in detail to help naturalists, agriculturalists and scientists make positive identifications in the field.

The text describes the distinctive features of genera as well as of individual species according to habitat, stem, branches, leaves, inflorescence, flowers, fruit, taxonomic notes, ecological notes, flowering time, distribution, estimated salinity tolerance and potential uses. Scientific and local Arabic names are also provided.

The text has been arranged alphabetically according to family, genus and species. As far as we know, no previous attempt has been made to publish a comprehensive guide and checklist of salt-tolerant plants in the UAE.

Extensive plant and soil collections were made throughout the whole country by the senior author. These collections provided the raw material that enabled the preparation of this book and the new checklist of salt-tolerant plants.

Land and Climate of the UAE

Location

The UAE is a place of extremes, a dry land covered by sand dunes, plains, mountains, *wadis* and waterless riverbeds – a total land area of about 83,000 sq km. Desert lands comprise 90% of the whole area. The UAE is a federation of seven emirates: Abu Dhabi, Dubai, Sharjah, Ajman, Umm al-Qaiwain, R'as al-Khaimah and Fujairah. The UAE is located along the southeastern shore of the Arabian Gulf and is bordered to the east by Oman and to the south and west by Saudi Arabia (Figure 1).

Figure 1.

Topography

The UAE comprises three distinct geological zones:

1. *Mountains*: stretching from Dibba in the northeast to Al Ain in the southeast.
2. *Coastal lowlands*: the western coastline, extending the length of the country along the Arabian Gulf, and the eastern coastline, extending from northeast to southeast along the Gulf of Oman.
3. *Deserts*: including the southern and western dune plains and the central desert.

Saline flats, also known as *sabkhas*, were formed recently (in geological terms) along the northern coast between Sila and Umm al-Qaiwain. Another *sabkha* is in the eastern coastal area in Fujiairah. A few inland *sabkhas* are scattered and spread in different areas throughout the UAE, such as Umm al-Zumoul and Sueyhan. Normally, *sabkhas* are characterized by impermeable substrata and evaporation crusts of gypsum, anhydrites and calcites and support no vegetation except non-flowering plants. After floodwaters have evaporated, the surface is crusted with an unbroken layer of dazzling crystalline salt.

Sabkha in Tarif (above) and Ruwais (below), Abu Dhabi.

Climate

The climate of the UAE is characterized by low rainfall and high temperatures accompanied by high relative humidity (Table 1). Mean annual temperature for the country is 27°C. The maximum air temperature during the summer months can reach more than 48°C, while the minimum air temperature in the period from December to March can fall to 3°C in the interior. January is the coolest month with an average minimum 12°C. The average relative humidity (RH) in the country is high at 56.4%. Maximum RH is 84% for the whole country and higher in the coastal areas. The maximum humidity in coastal areas in the summer can reach 97%. The average minimum annual humidity is 28%. There are typically 8-12 hours of sunlight per day. The wind speed varies from 6 to 9 knots on normal days to 32 knots on windy days.

The annual evaporation rate is high, especially in the inland zones. In the Al Ain area, for example, it reaches around 4000mm annually, approximately 30 times the amount of annual rainfall (Table 1). Mean annual evaporation rate for the whole country is around 3350mm.

Table 1. Climate parameters in the UAE

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual mean
Mean air temp (^{O}C)	28.7	24.1	20.1	18.3	19.5	22.5	26.8	31.5	34.1	35.3	35.0	32.6	**27.4**
Mean max air temp (^{O}C)	35.9	30.8	26.0	24.0	25.2	28.7	34.1	39.5	41.8	42.0	41.4	39.7	**34.1**
Mean min air temp (^{O}C)	21.5	17.4	14.3	12.6	13.7	16.4	19.4	23.5	26.3	28.6	28.6	25.6	**20.7**
Mean RH (%)	55.0	59.0	64.0	64.0	63.0	59.0	52.0	46.0	50.0	54.0	56.0	55.0	**56.4**
Mean max RH (%)	85.0	87.0	89.0	90.0	90.0	87.0	81.0	74.0	79.0	81.0	82.0	84.0	**84.0**
Mean min RH (%)	24.0	31.0	40.0	39.0	36.0	31.0	22.0	18.0	20.0	26.0	29.0	24.0	**28.0**
Mean daily evap (mm)	8.6	6.2	4.5	4.1	5.2	6.9	10.1	13.0	14.0	13.3	12.6	11.2	**9.1**
Mean monthly evap (mm)	266	187	140	129	146	216	305	404	421	411	392	336	**279.3**
Mean wind speed (km/h) at 2m above ground	4.6	4.4	4.7	5.2	5.9	6.1	6.0	6.2	6.3	6.3	6.4	5.3	**5.6**
Mean monthly rainfall (mm)	3.1	4.5	16.9	22.1	32.1	34.4	8.0	1.5	0.6	3.6	2.4	1.5	**130.7**

Source: UAE Ministry of Agriculture and Fisheries, 2000 Yearbook.

Long-term monthly mean values of temperature, rainfall and evaporation for the whole UAE are presented in Figure 2, which clearly shows the extended period of high temperature and high evaporation rate.

Rainfall in the UAE is extremely variable. The mean annual rainfall for the country varies from 7 to 380mm (Table 2), with an average of 130mm. Long-term rainfall averages in four different ecological zones, representing major environmental variations in the UAE, show that rainfall average is highest in Mountain Region (153.1mm), followed by the East Coast (138.7mm), the Gravel Plains (123.8mm), and is lowest in the Desert Foreland (86.1mm).

Rainfall and temperature determine to a large extent the degree of dryness of the environment. One of the most common ways of characterizing the

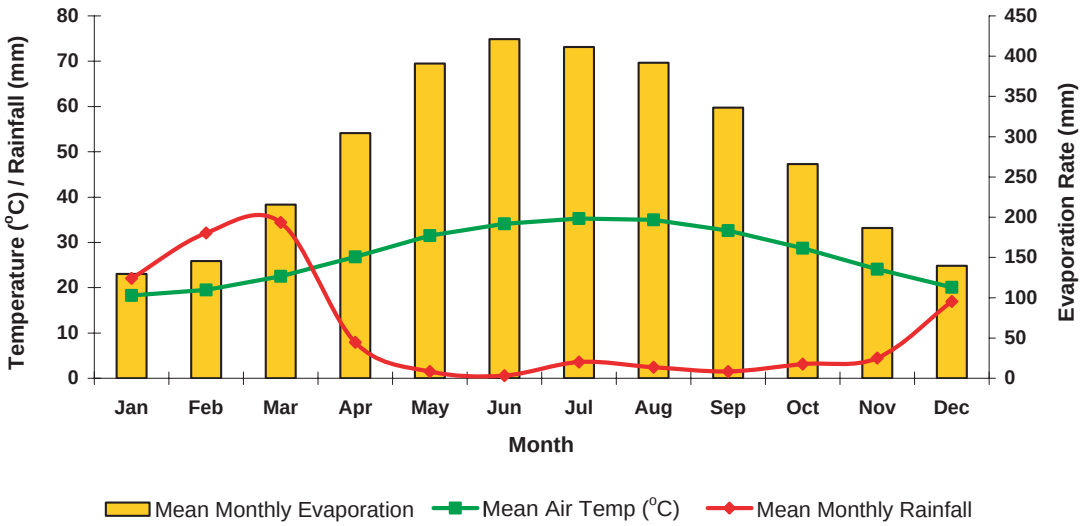


Figure 2. Long-term mean monthly record of temperature, rainfall and evaporation for the UAE.

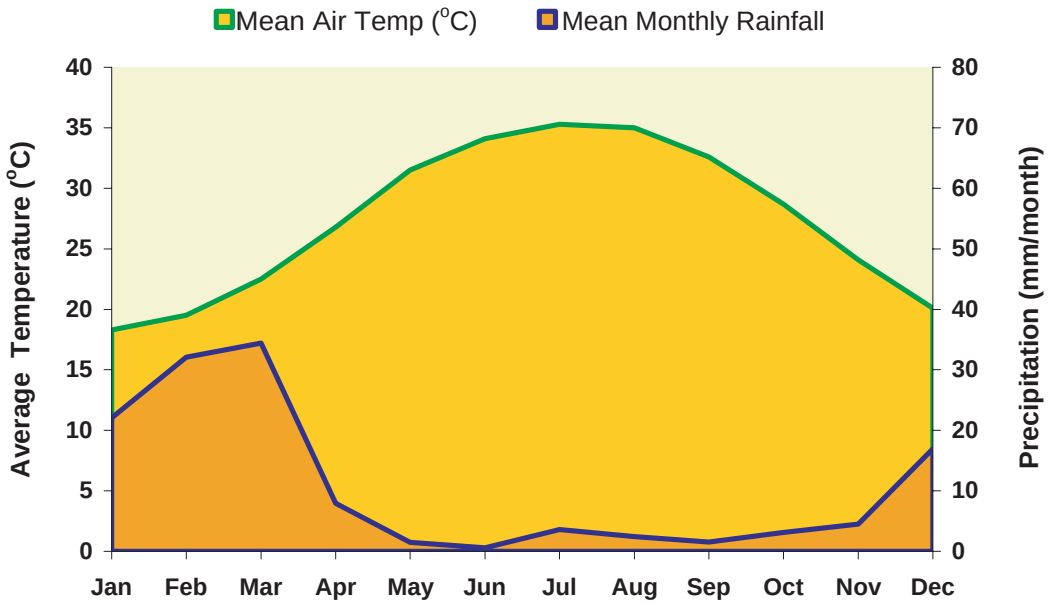


Figure 3. Climatic diagram for the UAE. Rainfall data from 1965 to 2000; temperature data from 1990 to 2000.

environment is a climatic diagram in which the scale of precipitation is double the scale of temperature (Figure 3). Wet periods are those when the rainfall line exceeds the temperature line. For the UAE, there are no truly wet periods, although when evaluating certain localities within some years, there might be periods when rainfall exceeds temperature. Also, the climatic diagram depicts the prevailing extent of dryness in the environment. The area between the temperature and rainfall lines, and the distance between them, indicate the extent of dryness. Figure 3 clearly shows that the degree of dryness in the UAE is high and spread over an extended period (April to November).

The harsh environmental conditions prevailing in the UAE have an enormous effect on all flora and fauna. Because the number of plant species adapted to such an extreme environment is limited, naturally occurring plants are unique. Conservation of such plants is therefore essential in order to manage them sustainably. Of the unique plants adapted to the dry environment of the UAE, the group of salt-tolerant plants is even more unique, and possess the greatest potential for exploitation. These plants and their potential uses are discussed in the later sections of this book.

Table 2. Average annual rainfall for four ecological zones in the UAE and mean annual rainfall for the country, 1965/66 to 1999/2000 (mm)

	Mountains	East Coast	Gravel Plains	Desert Foreland	Average
1965/66	87.7	66.6	74.0	45.1	**68.4**
1966/67	75.7	21.3	19.1	13.6	**32.4**
1967/68	107.9	106.9	88.8	97.1	**100.2**
1968/69	155.8	198.8	152.6	98.5	**151.4**
1969/70	45.1	76.4	56.5	35.2	**53.3**
1970/71	7.1	27.2	10.6	7.6	**13.1**
1971/72	172.3	198.0	181.8	128.9	**170.3**
1972/73	56.3	45.3	48.9	47.4	**49.5**
1973/74	39.1	18.6	38.2	16.9	**28.2**
1974/75	402.2	108.3	162.3	110.9	**195.9**
1975/76	315.1	231.1	223.6	126.9	**224.2**
1976/77	215.5	219.4	176.0	97.0	**177.0**
1977/78	94.3	90.9	73.3	58.5	**79.3**
1978/79	75.6	99.3	60.4	53.7	**72.3**
1979/80	160.6	91.6	137.5	78.2	**117.0**
1980/81	110.8	90.1	100.2	46.0	**86.8**
1981/82	339.7	307.6	283.0	207.5	**284.5**
1982/83	303.9	379.9	225.0	147.0	**264.0**
1983/84	46.1	31.4	27.2	11.5	**29.1**
1984/85	31.9	14.5	30.5	19.6	**24.1**
1985/86	75.9	64.8	61.8	36.0	**59.6**
1986/87	191.9	165.5	153.0	129.5	**160.0**
1987/88	262.3	269.4	188.0	198.5	**229.6**
1988/89	70.3	87.1	79.4	63.3	**75.0**
1989/90	230.8	155.1	184.2	159.1	**182.3**
1990/91	81.4	69.9	80.6	56.2	**72.0**
1991/92	179.9	135.4	153.3	127.1	**148.9**
1992/93	157.2	103.7	194.9	128.5	**146.1**
1993/94	72.3	137.0	55.1	22.1	**71.6**
1994/95	213.9	213.8	143.6	84.0	**163.8**
1995/96	418.3	531.5	349.7	231.7	**382.8**
1996/97	217.9	224.6	202.6	142.6	**196.9**
1997/98	262.8	199.4	246.8	155.2	**216.1**
1998/99	73.5	67.6	57.1	30.0	**57.1**
1999/00	6.7	6.4	13.2	1.8	**7.0**
Mean	**153.1**	**138.7**	**123.8**	**86.1**	**125.5**

Source: UAE Ministry of Agriculture and Fisheries, 2000 Yearbook.

The plants of the UAE

As described earlier, the UAE has an arid desert climate characterized by low rainfall, high temperatures and prolonged dry hot summers. The UAE's neighbors in the Gulf Cooperation Countries share the UAE's climate and its flora (Zohary 1973, Satchell 1978, Western 1989, Roshier et al. 1996 and Karim 2000). Natural vegetation is sparse and loose, saline soils are nutrient-poor, rainfall is low (and often localized in distribution and intensity), and high evaporation rates limit water availability for plant growth. These environmental factors, along with extreme summer temperatures and lack of moisture in the ground, result in severe growing conditions. However, some plants have adapted to these conditions, notably *Suaeda, Ziziphus, Zygophyllum, Panicum, Prosopis, Salvadora, Leptadenia, Acacia, Halopeplis* and *Phoenix dactylifera* (date palm).

Most landscaping and greening projects in the UAE use indigenous plant species such as those mentioned above. These species are planted mainly for their drought and heat tolerance. However, most of them are also salt-tolerant and most plantations use brackish water for irrigation.

The vegetation of the UAE can be classified into two groups.

1. **Natural vegetation**
2. **Cultivated plantations**

Cultivated plants are diverse in the UAE. Government agencies design agricultural plans for farmers in the various zones according to the salinity level of each farm. Important salt-tolerant crops in the UAE are discussed in subsequent sections of this book.

Farms in Abu Dhabi.

Mangrove stands in R'as al-Khor Wildlife Sanctuary, Dubai.

Major Vegetation Types in the UAE

A complex of physiographic and environmental factors determines the different habitat types and their associated vegetation types. This section highlights the major habitats and their associated plant species, as well as their adaptation aspects and distribution.

A. Mangrove forest habitat

Mangrove forests are the main feature of coastal UAE. They exist in scattered stands along the eastern and western coasts and on some of the islands. They usually thrive in sheltered localities protected from drastic fluctuations in environmental conditions. Mangrove stands are associated with tidal flats along the shores of lagoons or islets within the lagoons (Embabi 1993). They usually exist in areas sheltered from strong wind and wave action.

Mangrove exists in 17 documented localities in the UAE: 16 along the Gulf coast and one on the Gulf of Oman near Khor Kalba. Mangrove stands thrive in some localities such as Abu Dhabi and neighboring islands, Dubai Creek and Khor Kalba. In other areas, mangrove stands are under increasing pressure from environmental and development constraints.

A single species, *Avicennia marina* (black mangrove), dominates mangrove forests in the UAE. Many attempts are under way to evaluate the potential of introducing other species to the region.

Flamingos in mangrove forest, R'as al-Khor Wildlife Sanctuary, Dubai.

Sabkhat Matti, Abu Dhabi.

B. Salt marshes and saline habitats

This habitat type comprises all lowlands saturated with water either all year round or at certain times during the year. Such habitats are highly saline and usually dominated by special types of highly salt-tolerant or halophyte plants. The *sabkha* is a form of salt marsh very common in the coastal and inland parts of the UAE. The largest inland *sabkha* is Sabkhat Matti in western Abu Dhabi, which extends 120 km from the coast. Other inland *sabkhas* occur in the Al Ain area.

Salt marsh plant communities: *Suaeda vermiculate* and *Arthrocnemum macrostachyum*, Fujairah.

Salt marsh plant communities: mangrove (*Avicennia marina*) and *Panicum turgidum*, Khor Kalba.

Plant communities in salt marshes and *sabkha* environments differ according to soil type, type and amount of salt present, closeness to coastal areas (and degree of water saturation) and topography. Several plant associations and species are recognized for the different salt marsh/*sabkha* attributes. In coastal salty habitats, several halophytic plant communities and species are recognized, including the following (El-Ghonemy 1993).

Salt marsh plant communities: *Juncus rigidus* and *Avicennia marina,* Rams, R'as al-Khaimah.

- *Suaeda* spp. Association
- *Gymnocarpos decandrum - Cyperus conglomerates* Association
- *Arthrocnemon macrostachym - Halocnemum strobilaceum* Association
- *Phragmites australis* Association
- *Halopeplis perfoliata* Association

Other species common in coastal environment are *Juncus maritimus*, *Aleuropus lagopoides, Cressa cretica, Limonium axillare, Anabasis setifera,*

Salt marsh plant communities: *Zygophyllum hamiense* and *Salsola baryosma*, Umm al-Qaiwain.

Salt marsh plant communities: *Tamarix* spp., *Aleuropus* spp. and *Cyperus* spp., Al Ain Al Faidha, Al Ain.

Zygophyllum hamiense, Salsola baryosoma, Saueda aegyptiaca, Saueda vermiculata, Heliotropium kotschyi and *Cornulaca monocantha.*

In inland *sabkhas* and salt habitats, in addition to the species listed in the coastal environments, three communities are recognized.

- *Tamarix nilotica - Juncus rigidus* Association
- *Limonium stocksii* Association
- *Zygophyllum mandavellei - Salsola schweinfurthii* Association

Sand dune plantation, Ghantout, Abu Dhabi.

Coastal and dune habitat dominated by *Leptadenia pyrotechnica* plant community, Dubai.

C. Sand dune habitats

Sand formations cover extensive areas of the UAE; accordingly, their vegetation cover represents a major feature of the landscape. Sand formations can be categorized as coastal or inland dunes, the latter reaching extreme heights. The plant communities and species that inhabit sand dunes vary in chemical and physical characteristics. In coastal areas, sand vegetation overlaps with some of the salt marsh plants. Examples of plant species that dominate coastal sand areas

Massives sand dunes in Liwa (Western Area), with halophyte vegetation at the bottom due to high water table and salinity build-up.

Sand habitat dominated by *Prosopis cineraria* (ghaf).

are *Halopyrum mucronatum*, *Salsola baryosma, Atriplex leucoclada* and *Cornulaca monocantha*. Inland, other species predominate: *Leptadenia pyrotechnica, Calotropis procera, Pennisetum divisum, Cenchrus ciliaris, Coelochyrum piercii* and *Panicum turgidum.* Further inland, the dominant species are *Calligonum comosum, Cyperus conglomerates, Haloxylon* spp. and *Zygophyllum* spp. Vast areas of the inland sand formations are dominated by *Prosopis cineraria* (ghaf tree) in addition to many annual species. In many protected areas, several forage grasses and legumes also appear in sand formations.

Alluvial plains dominated by *Acacia tortilis* and *Haloxylon salicornicum* communities near Al Ain.

Acacia tortilis and *Haloxylon salicornicum* communities near R'as al-Khaima – ground vegetation severely grazed.

D. Desert plains and *wadis*

Wadis are temporary watercourses formed over a long period as a result of water erosion. Alluvial plains are wider flat formations created both by water and wind. These types of habitats occupy areas between sand formations and mountains. Dominant plant cover varies according to soil physical and chemical properties and water availability. Main plant communities and species, according to El-Ghonemy (1993), are as follows.

Desert *wadi* with gravelly water course.

- *Rhazya stricta* Association, which dominates in the interior southern plains. Many species are associated with this community type, including *Convolvulus pilosellifolius, Crotalaria persica, Fagonia ovalifolia, Panicum turgidum* and *Zygophyllum* spp.
- *Acacia tortilis - Haloxylon salicornicum* Association dominates in areas with shallow soil with gravel cover. Other common species are *Leptadenia pyrotechnica, Tephrosia persica, Cyperus conglomerates, Salvadora persica, Cassia italica, Crotalaria persica, Indigofera intricate, Aerva javanica, Panicum turgidum, Pennisetum divisum, Zella spinosa, Heliotropium kotschyi and Astragalus* spp.
- *Acacia nilotica - Rhazya stricta* Association is found mainly on the coastal plains.
- *Jaubertia aucheri* Association is a limited plant community found on both coastal and inland plains.

Other species associated with this habitat type are C*alotropis procera, Citrullus colocynthis, Chrozophora obbliqua, Convolvulus deserti, Dipterygium glaucum, Fagonia* spp*., Indigofera* spp*.* and *Plantago* spp.

In desert *wadis*, sand banks are covered with vegetation dominated by *Dyerophytum indicum* Association and *Nerium oleander - Ficus salisifolia* Association, the latter of which is found only in the *wadis* of the the northern Emirates. Other species associated with wadi vegetation include *Acacia tortilis, Acacia spp., Calotropis procera, Haloxylon salicornicum, Panicum turgidum, Pennisetum divisum Melilotus indicus, Rhanterium epapposum, Indigofera* spp*.* and *Zygophyllum* spp.

Acacia tortilis - Haloxylon salicornicum plant community dominates low elevations in mountain habitats.

E. Mountain habitat

Mountains are located in Al Ain area (Jabal Hafit) and in the northern Emirates. Plant communities in such habitats vary according to closeness to the sea and origin and structure of the rocks. Three plants that dominate in mountain environments are *Euphorbia larica*, *Capparis cartilaginea* and *Acacia tortilis*. Many other species are associated with these three. They are distributed in zones according to elevation from *wadi* level to the mountain summits. Several grasses and shrubs are common in this habitat, particularly in less disturbed areas.

Mountain habitats and farms.

Salt Tolerance

Plants in arid environments are faced with several environmental stresses: drought, salinity, high temperature and high irradiance. The ability of plants to adapt to these stresses is often related to both water and salinity. Plants in arid environments can be categorized in the following two groups.

- ***Mesophytes***. Plants without special adaptation to environmental extremes that require moderate water availability to grow well. In the UAE, this group is represented by the many weeds found in the irrigated areas and by ephemeral desert plants.
- ***Xerophytes***. Drought-resistant plants existing mainly outside irrigated areas. They comprise the thinly scattered perennial vegetation cover in the west, south and northeast of the UAE.

Similarly, with specific reference to salinity, plants are grouped into two categories.

- ***Glycophytes***. Plants incapable of growing normally in the presence of high concentrations of Sodium and other salts.
- ***Halophytes***. Plants adapted to saline soils. They are capable of attaining normal growth and development in the presence of high concentrations of salt in their growth media. In the UAE, they mostly occur on the saline flats and salt marshes along the coasts.

These plant groups frequently overlap. Many xerophytes are classified as halophytes, and many glycophytes as mesophytes. Similarly, the borderlines between mesophytes and xerophytes, and between glycophytes and halophytes, are blurred. Suffice it to say that within each group there is a tolerance gradient, and that salinity tolerance among plants is distributed along a gradient from extreme glycophytes to extreme halophytes.

The levels and thresholds of salinity tolerance have been studied extensively for economically important crop plants. Halophytes with proven economic importance have also received attention. However, natural plants are less characterized in terms of their salinity tolerance. This book highlights the species of UAE flora with known salinity tolerance, as well as those expected to be salt-tolerant based on their habitat. The potential uses of salt-tolerant plants are also mentioned.

Plant Adaptation to Drought and Salinity

Adaptations of desert plants to drought and salinity are very diverse. Several mechanisms – morphological, anatomical and physiological – are involved in adaptation to these two environmental stresses. Some plant species may possess only a few adaptation mechanisms; others may have a multitude of them. A comprehensive review of desert plant adaptations to drought and salinity is presented by El-Ghonemy (1993), a summary of which is provided below.

1. Adaptation to drought

Three main adaptation mechanisms are recognized in this category.

1.1 Desiccation-tolerant plants

This mechanism is dominant in lower plants like algae. Few higher plants fall into this category, and none of them are known to exist in the UAE deserts.

1.2 Drought-escaping plants

This plant group escapes the damaging effects of drought. These are usually short-lived plants that appear after seasonal rainfall and complete their life cycles (germination to flowering and seed setting) in a short time. They are known as *ephemerals.*

1.3 Perennial xerophytes

These long-lived plants are true desert plants that can withstand drought through either *resistance* or *avoidance* mechanisms. There are two recognized groups of perennial xerophytes.

1.3.1 Succulent perennials

- *True succulents*. Characterized by fleshy vegetative parts capable of water storage with thick cuticles and a crassulacean acid metabolism (CAM) photosynthesis pathway that reduces water consumption through stomatal closure during the day. Species belonging to the genus *Euphorbia* are the only representatives of this group in the UAE.
- *Non-true succulents*. Characterized by fleshy foliage capable of moisture storage that are not true succulents. Many species are present in the UAE, such as *Zygophyllum* spp., *Haloxylon* spp. and *Salsola* spp.

1.3.2 Non-succulent perennials

Such plants are capable of withstanding the harsh dry-hot desert environment. Their survival depends on one of two basic strategies: reducing water consumption and/or increasing water conservation. Their adaptation mechanisms depend on two strategies.

- Increasing their ability to absorb water from soils with very low water content
- Increasing their ability to reduce water loss through transpiration

These strategies can be achieved through three types of adaptation: morphological, anatomical and physiological.

a. Morphological adaptation

i. *Root system adaptation*

The basic adaptation in this category is the possession of an extensive and deep root system that enables the plant to exploit higher soil volume and absorb higher quantities of water. Examples are desert plants like *Leptadenia pyrotechnica*, *Prosopis* spp. and *Acacia* spp.

ii. *Shoot system adaptation*

Desert plants possess many traits that reduce the size of the transpiring surface, thereby reducing the amount of water loss. This usually achieved through:

- Shedding plant organs or tissue during times of severe water shortage
- Modifing large aerial parts (leaves and stems) into spines
- Protecting transpiration surface by old plant parts (ie, covering buds by old leaves or folding vegetative parts to reduce transpiration surface)

b. Anatomical adaptation

Generally, anatomical adaptation works by reducing the amount of water loss from the plant. Main adaptations are:

- Presence of cutin layer on the epidermis
- Waxy layer covering vegetative parts
- Presence of hair layer (trichomes) or cork layer on the epidermis
- Small and compacted epidermis cells
- Presence of silica in epidermis cells
- Cryptic (hidden) stomata
- Presence of water storing cells

c. Physiological adaptation

Similar to other types of adaptation, physiological adaptation also works by either reducing the amount of water loss from the plant or increasing the ability of the plant to absorb more water. However, this is achieved through various physiological and biochemical changes in plants, such as:

- *Control of transpiration*. Some plants are capable of controlling stomatal opening during the day. In periods of limited water availability, they open during periods of lower transpiration demands, like early morning and late afternoon, and close during midday.
- *High osmotic pressure*. This is a main physiological adaptation to both drought and salinity. It is related to the plant's ability to reduce its osmotic potential, and consequently total water potential, to lower levels compared with the water potential in the surrounding environment. Such a mechanism is achieved through increased concentration of cell solutes to a degree that the osmotic potential of the cell is lower than that of the soil. This enables the roots to absorb water from dry soil and to reduce water loss through the leaves.
- *Bound water*. Some tolerant plants have higher rates of water bound to the living cell components, thus reducing the ability of water to be lost through evaporation.
- *Proline accumulation*. Tolerant plants accumulate higher amounts of amino acids, like proline, when they are subjected to stress. Such organic compounds help in reducing osmotic potential and increasing the bonding of water to cell components, consequently reducing water loss.
- *Photosynthetic pathway*. C3, C4 and CAM are the three recognized carbon fixation pathways. C4 and CAM mechanisms are associated with higher water use efficiency and/or more water conservation. Many hot desert plants possess either of these two mechanisms. Many native grasses of tropical origin like *Panicum* and *Lasiurus* spp. and shrubs like *Atriplex* have the C4 pathway. Cacti and *Euphorbia*, for example, are CAM plants. Some CAM plants are capable of switching between C3 and CAM according to water availability.

2. Adaptation to salinity

As stated earlier, many adaptation mechanisms useful in tolerating drought are also effective in tolerating salinity. Salt-tolerant plants can usually withstand high salt concentrations in their protoplasm.

Several mechanisms of salinity control that differentiate between glycophytes and salt-tolerant plants and/or halophytes have been proposed. According to Poljakoff-Mayber and Lerner (1999), there are six main mechanisms.

- Ability to accumulate or exclude ions selectively
- Control of ion uptake by roots and control of transport to the shoot of the leaf
- Selectivity in xylem release

- Role of accumulated ions in osmotic adaptation/adjustment
- Compartmentation of ions at both the cellular and the whole plant level
- Accumulation of compatible solutes (like proline) and their role in salt tolerance

Salinity resistance mechanisms in plants can be grouped into two main strategies.

2.1. Avoiding the damaging effects of salts on cell components

2.1.1 Dilution

This mechanism is found in highly and moderately salt-tolerant plants. Succulent plants maintain high amounts of water in their tissue that help reduce the effects of salt accumulation in the cell, like *Zygophyllum* spp. and *Haloxylon* spp. (Hammada). In moderately or highly salt-tolerant crops like barley, fast growth rates and water absorption help to reduce salt concentrations.

2.1.2. Exclusion and extrusion

Exclusion refers to a passive mechanism of salt removal, while extrusion (excretion) is the active removal of salts from the plant, or prevention from entry. Since the differentiation between the two mechanisms is often unclear, here the two are considered together.

Salt-tolerant plants are capable of excluding salts at several levels.

- *At the root level*. Impermeability to salts; active exclusion outside the root
- *At the leaf and shoot level*. Salt glands (*Limonium* spp., *Tamarix* spp.); salt bladders (*Atriplex* spp.); hairs; shedding of leaves or whole shoots to eliminate accumulated salts (*Suaeda* spp., *Haloxylon* spp.)
- *At the cellular and membrane level*. Removal and compartmentation of Na and Cl from cytoplasm to vacuoles and cell walls through active mechanisms and existence of energy spending. Several Na/H^+ antiporter and ion transport channels are associated with salinity tolerance.

2.2. Osmoregulation (osmotic adjustment)

The first negative response of plants to salinity is the loss of turgor due to inability to withdraw water highly concentrated with salts. If the water is too salty, the plant is rendered incapable of growth, shrinks and die. Salt-tolerant plants overcome the dehydration effect caused by salinity by increasing the solute concentration in its cells to facilitate access to water from media with low osmotic potential.

Plants that utilize this mechanism must increase their solute concentration while reducing their osmotic potential (measured in the turgid state) to levels below that of their aqueous environments. The

maintenance of cell turgor by a sufficient increase in cell solutes to compensate for the external osmotic stress is called osmoregulation or osmotic adjustment. Osmoregulation can be achieved by:

- Active uptake of salt or salt ions, or
- Synthesis of organic solutes

Both mechanisms are important in osmoregulation. The first is more common in halophytes, the second in other types of salt-tolerant plants (Levitt 1980).

Potential Uses of Salt-Tolerant Plants

Salt-tolerant plants and halophytes found on seashores and in estuaries and saline seeps have many potential uses as food, fodder, fiber, fuel and other products. Economic consideration of these plants is receiving increased attention in the UAE and elsewhere.

1. Food

Salt-tolerant genotypes of important cultivated food plants offer the same value as traditional food crops. They can grow using saline underground water for irrigation and achieve economical return. Numerous salt-tolerant genotypes of several crop plants have been identified and exploited. Examples are carrots, melons, onions, tomatoes, beets, date palm, millets (especially *Pennisetum* spp.), maize, sorghum, oats, barley and wheat. Many naturally occurring plants also have the potential of being utilized as human food.

2. Fodder

- Halophytic and salt-tolerant grasses, shrubs and trees are excellent sources of fodder. Salt-tolerant grasses like *Chloris guayana (*Rhodes grass), *Panicum turgidum, Pennisetum* spp., *Lasiurus* spp. and many others are excellent natural forages, many of which have been converted into cultivated crops. Other halophyte grasses like *Sporobolus* spp., *Distichlis* spp., *Paspalum* spp. and *Spartina* spp. have also been successfully used as fodder. Many species are currently being evaluated for commercial large-scale production using highly saline water. Similarly, many trees and shrubs have been used in grazing, although they are generally less palatable than grasses when used for cattle.
- Many perennial saltbushes (*Atriplex* spp.) and other forage herbs like *Medicago* spp. and *Trifolium* spp. grow throughout the UAE. They tolerate salinity in both soil and water and remain fleshy and green all year. They are successfully used as fodder for livestock.
- Many salt-tolerant legume trees are widely cultivated in the UAE as windbreaks and supplementary sources of fodder for livestock, which consume their pods, leaves and branches. These include *Acacia* spp., *Leucaena leucocephala, Prosopis cineraria* and *Prosopis juliflora*.

3. Fiber

Some salt-tolerant plants are suitable for fiber. Examples are *Hibiscus* spp., *Juncus* spp., *Typha* spp. and common reed (*Phragmites australis*). The latter is a marsh plant much used for fencing, roofing, basketmaking and fuelwood. The branches of *Sesbania bispinosa*, a well-known salt-tolerant legume and fodder crop, can also be used as a source of fiber and fuel.

4. Fuelwood

Several halophyte and salt-tolerant trees and shrubs are used as fuel production in saline environments (eg, *Tamarix, Casuarina, Acacia, Prosopis, Eucalyptus, Avicennia* and *Rhizophora*).

5. Medicinal uses

As will be seen in later sections, many salt-tolerant plants and halophytes in the UAE have been used in folk medicine for a long time. The efficacy of several of these plants in treating certain illnesses, such as diabetes, high blood pressure, skin diseases, intestinal ailments, heart disease, arthritis and urinary tract disorders, is well documented. Others can be used as sedatives and antipyretics. Some chemical compounds in these plants have been identified and catalogued. Medicinal use of local plants is very popular in the UAE, and several specialized institutes focus on the subject. For an extensive review, refer to El-Ghonemy 1993.

Classification of Saline and Alkali Soils

Normal plant growth is severely damaged by salt, which in turn damages the soil's physical and chemical properties. One of the first effective classifications of saline and alkaline soils was developed by Sigmond (1927) and developed further by Hayward (1954). The classifications they proposed were as follows.

1. Saline soil

Soluble salts are present in such quantities that they inhibit the growth of most crop plants. The exchangeable sodium percentage is less than 15% and the conductivity of the saturation extract is greater than 4 deci Siemens per meter (d/Sm) at 25°C, whilst the pH is usually less than 8.2.

2. Saline alkali soil

This soil type contains sufficient exchangeable sodium to inhibit the growth of most crop plants and appreciable quantities of soluble salts. The exchangeable sodium percentage is greater than 15%, and the conductivity of the saturation extract is greater than 4 dS/m at 25°C, whilst the pH value is usually less than 8.5.

3. Non-saline alkali soil

This soil type contains sufficient exchangeable sodium to inhibit the growth of most crop plants but does not contain appreciable concentrations of soluble salts. The exchangeable sodium percentage is greater than 15% the conductivity of the saturation extract is less than 4 dS/m at 25°C, whilst the pH value usually exceeds 8.5.

Salinity in the UAE

The severe environmental conditions that prevail in the UAE are responsible for soil and water salinity. The increasing salinity of irrigated lands caused by limited rainfall, high evaporation rates and dissolved salts in native groundwater is a serious issue facing all arid countries. Salt is deposited on soil surfaces as a result of irrigation with salty groundwater, and excessive pumping of groundwater in coastal areas is the major cause of seawater intrusion.

Farms abandoned due to high salinity in soil and underground irrigation water.

The exact extent of salinity in the UAE remains uncertain because precise measurements of saline levels are still unavailable. The Food and Agriculture Organization of the United Nations (FAO) estimates that in 1994 about 12% of the total land area of the UAE was affected by salts of various origins. Recent estimates put the area affected by salinity around 25%. Some of these lands may be suitable for growing halophytic plants.

The amounts of salt dissolved in groundwater vary depending on location. In general, 50-70% is sodium chloride and 15-20% is calcium sulfate and magnesium sulfate. In coastal areas, sodium chloride content is higher due to the high water table. Total dissolved solid (TDS) concentrations vary from 500 to 6,000 ppm for most agricultural systems. However, TDS concentrations can reach 12,000 ppm on forage farms producing Rhodes grass, and 15,000 ppm in greening projects growing indigenous plants such as *Prosopis cineraria* and *Acacia tortilis*. It is estimated that there is over five times as much water with TDS concentration between 1,500 ppm to 15,000 ppm as there is water with TDS concentration lower than 1,500 ppm. Groundwater is mostly alkaline with a pH of 7.5 to 8.5 (Ali and Hasbini 1999, Shoji 1997).

Soils are mostly sandy to sandy-loam with significant calcium carbonate content. Infiltration rate is low as a result of the deteriorated soil structure (Glennie 1996).

Field measurements of soil electrical conductivity and pH in farms and natural locations in different parts of the UAE are shown in Table 3. Values are extremely variable; however, many of the sites are on the high side. Some good farming areas in Al Ain, Abu Dhabi, Dhaid and Dubai showed relatively low

Severe salinity kills date palms in abandoned farms.

values. On the other hand, salinity on many UAE farms is very high, especially on older farms. Most of the farms surveyed had salinity in the range of 15-20 dS/m. As a result, many of the country's older farms have been abandoned.

Salinity levels in salt flats, *sabkhas* and salt-affected areas are extremely high. Salinities in some extreme *sabkhas* are shown in Table 4.

Table 3. Measurements of soil electrical conductivity and pH in farms and natural locations in various parts of the UAE

	EC (dS/m)[a,b,c,d]	pH	Latitude [e]	Longitude[e]
1. Abu Dhabi Emirate				
Al Bateen	1.0	7.1	24° 26'	54° 27'
Al Dhabiaeah	82.5	8.0	24° 08'	54° 13'
Al Jamaniah	19.6	8.9	24° 05'	54° 05'
Al Qua	6.7	8.2	23° 00'	55° 20'
Al Wathba	6.5	8.5	24° 15'	54° 39'
Bainona	13.2	9.2	24° 06'	52° 57'
Bani Yas	4.0	8.4	24° 19'	54° 37'
Jebel al-Dhana	5.9	8.5	24° 09'	52° 36'
Jeser al-Maqata	11.6	8.4	24° 25'	54° 29'
Liwa	3.8	8.7	23° 05'	53° 52'
Marfa	54.0	8.1	24° 02'	53° 30'
Ruwais	72.5	8.0	24° 05'	52° 38'
Sabkhat Matti	98.0	7.8	23° 38'	51° 52'
Sila	36.7	9.0	24° 00'	51° 48'
Tarif	81.1	8.0	24° 03'	53° 45'
Al Ain District				
Ain al-Faydah	27.1	7.8	24° 04'	55° 43'
Al Hayer	0.4	8.8	24° 35'	55° 45'
Jebel Hafit	2.6	7.7	24° 02'	55° 46'
Khabisi	1.0	8.9	24° 15'	55° 43'
Maisuody	1.2	9.0	24° 15'	55° 44'
Markhaniyah	0.7	9.4	24° 14'	55° 40'
Saad	2.7	8.5	24° 14'	55° 28'
Shwayb	2.1	8.5	24° 44'	55° 48'
Sih al-Ragwa	61.3	9.0	24° 05'	55° 00'
Sueyhan	2.7	8.2	24° 28'	55° 20'
Umm al-Zumoul	15.9	8.6	24° 43'	55° 08'
Waggan	1.0	8.8	24° 36'	55° 27'
2. Dubai Emirate	15.5	9.3	25° 16'	55° 17'
Al Wassal	22.1	8.8	25° 13'	55° 19'
Al Faqa	7.2	8.5	24° 42'	55° 37'
Jebel Ali	4.8	8.3	25° 05'	55° 08'
Nad al-Sheba	60.7	8.8	25° 09'	55° 18'
R'as al-Khor Sanctuary	10.5	8.2	25° 10'	55° 19'
Al Ruwayyah	1.0	9.2	25° 05'	55° 23'
3. Sharjah Emirate	3.2	9.8	25° 22'	55° 23'
Dhaid	4.6	9.3	25° 17'	55° 53'
Khor Fakkan	0.2	9.5	25° 21'	55° 20'
NH Museum Desert Garden	10.8	9.0	25° 16'	55° 41'
4. Ajman Emirate	1.4	9.2	25° 23'	55° 27'
5. Umm al-Qaiwain Emirate	2.8	8.5	25° 35'	55° 34'

6. R'as al-Khaimah Emirate				
Berirat	0.7	8.9	25° 48'	55° 57'
Galila	16.6	8.4	25° 56'	56° 04'
Rams	17.7	8.2	24° 52'	56° 02'
Sha'm Beach	8.7	4.2	25° 01'	56° 04'
7. Fujairah Emirate				
Fujaira Beach	7.5	8.5	25° 07'	56° 25'
Dibba	0.4	9.3	25° 38'	56° 16'
Khor Kalba	10.5	8.6	25° 03'	56° 22'
Masafi	0.1	9.9	25° 18'	56° 09'
Sharam	4.2	8.0	25° 29'	56° 21'

[a] 1 dS/m = 1mmho/cm = (approx.) 0.06% NaCl = (approximately) mole per liter NaCl. 10,000 ppm = 10 o/oo (parts per thousand) = 10 grams per liter = 1.0%.
[b] In the International System of Units (SI), the unit of conductivity is the Siemens symbol (S) per meter. The equivalent unit commonly appearing in the literature is the mho (reciprocal ohm); 1 mho = 1 Siemen (Epstein 1983).
[c] Soil electrical conductivity values were measured by the two following devices:
· WTW - LF330
· Model 118 conductivity - 2
[d] WTW PH330 and PHep HI 98107 pH meters were used to measure soil pH values.
[e] Locations were navigated with a Magellan GPS 310 unit.

Table 4. Laboratory measurements of electrical conductivity (EC) and pH of various *sabkhas*

Location of *sabkha*/salt flat	pH	EC (dS/m)
Dubai	8.6	231.0
Sueyhan	7.9	223.0
Sharjah	9.1	67.4
Ajman	8.1	116.9
Umm al-Qaiwain	7.7	15.6
R'as al-Khaimah	8.5	191.6
Al Ain	8.0	300.0
Tarif	7.0	234.0
Sabkhat Matti	6.6	219.0
Fujairah	8.4	74.0

Description and Color Plates

AIZOACEAE
Aizoon canariense **L.**

HELMAH
حلمة

Annual or perennial, mat-green, papillose herb. Stems procumbent, thick woody at base, zigzag branched. Leaves alternate, fleshy, spathulate to oblong, obtuse at apex. Flowers small, solitary, axillary, sessile, stellate. Perianth 5-lobed, ovate to triangular, yellowish-green. Stamens in 5 bundles. Stigmas 5. Fruit a woody capsule, star-shaped. Seeds many, reniform, black.

Habitat & Distribution

This plant exists on light (sandy), medium and heavy soils. It tolerates acid and alkali soils. In the UAE it is found in shallow depressions and along roadsides of the east coast. Flowering from December to June. Common in the UAE: Shwayb, Dubai and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, edible herb.

AIZOACEAE

Sesuvium verrucosum **Rafin**

SABAH AL-KHAIR

صباح الخير

Low, glabrous, succulent herb, up to 35cm high. Stems prostrate or ascending, many branched. Leaves opposite, mostly lanceolate to spathulate. Flowers mostly solitary, in the axils. Calyx 5-lobed, each ovate, green outside, pink inside, with short horn near apex. Petals absent. Seeds numerous, black.

Habitat & Distribution

Grows on dry and wet saline areas (*sabkha*) along the road near Dubai. Flowering from December to June. Common in the UAE: Dubai, Jebel Ali, and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt-tolerant, up to seawater salinity, successful landscaping plant in harsh environments, grazed by camels.

ALOEACEAE
Aloe vera **L.**

SUBBAR
صبار

Green, succulent, perennial plant, up to 1 meter with single erect stem. Leaves fleshy, long, waxy, crowded at the base, lanceolate with pointed tip, mostly concave, spiny-toothed margins, 20-35cm long, 4-10cm wide. Inflorescence up to 70cm long with many flowers. Bracts short, membranous. Flowers showy, pendulous, reddish-yellow, 2-3cm long. Perianth petaloid, tubular, 3-veined. Filaments and anthers somewhat exserted. Fruit a capsule, smooth, rounded. Seeds many, small, gray to black.

Habitat & Distribution

Common in dry or salty places or cultivated as an ornamental in towns. Flowering January-April. Uncommon in the UAE. Often found in Masafi and Khor Fakkan.

Estimated Salinity Tolerance and Potential Uses

Highly salt-tolerant, lives near beaches. It has many uses: ornamental, cosmetic and medicinal uses recognized for centuries.

AMARANTHACEAE

Aerva javanica (Burm. f.) Juss. ex Schult.

ARA
الآرا – الراه

Grey, erect, tomentose, dwarf shrub, up to 120cm high. Stems branched, from woody base. Leaves variable in size, alternate, short petioled, oblong-lanceolate. Inflorescences long, terminal and axillary, spike-like. Bracts as long as flowers, membranous. Flowers white, small. Tepals 5-lobed, membranous, woolly; female flowers larger than male. Stamens 5, anthers 2-celled, staminodes 5. Fruit globular, 1-seeded, small black.

Habitat & Distribution

Usually on salty, rocky and desert areas of shallow sand-silt. Flowering January to May. Very common in the UAE: found in Masafi to Fujairah, and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Moderately to highly salt-tolerant, can be grazed, several folk medicinal uses.

AMARANTHACEAE
Amaranthus graecizans **L.**

SINDAR
سندار

Annual, glabrous herb, up to 30cm tall. Stem erect or decumbent, branched, more or less angular, green or reddish. Leaves 2-5cm long, alternate, ovate or elliptic, with conspicuous white-nerves beneath. Petiole long. Spikes short, axillary, overtopped by leaves. Bracteoles ovate to lanceolate. Perianth 3-lobed, shorter than capsule, greenish-white. Stamens 3. Utricle small, subglobose, wrinkled, circumscissile. Seeds tiny, ventricular, compressed, black, shining.

Habitat & Distribution

A weed of gardens, farms and salty waste ground. Flowering February-May. Very common in the UAE: Al Ain, Al Hayer and Dubai.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, edible with high nutrient contents (fiber, iron and calcium).

AMARANTHACEAE
Amaranthus viridis **L.**

ERF AL-DEEK
عرف الديك

Annual, erect, glabrous herb, up to 70cm. Stem simple or branched, green or reddish. Leaves 3-6cm long and 1-4cm wide, alternate, ovate-lanceolate to rhomboid, long petiole nearly as long as the lamina. Flowers in clusters, green, in naked axillary and terminal panicled slender spikes, 2-10cm long. Bracts and bracteoles present. Perianth 3-lobed, small, oblong, acute, with green midrib and white margins. Stamens 3. Utricle rugose, acute, indehiscent.

Habitat & Distribution

It is a common weed in the UAE mostly found in gardens, farms, roadsides and salty waste areas. Flowering from February to June. Common in the UAE: Al Ain, Dubai, Abu Dhabi.

Estimated Salinity Tolerance and Potential Uses

Low to moderate salinity tolerance, can be used as a vegetable.

ANACARDIACEAE
Schinus terebinthifolius **Raddi**

FILFIL AREED
فلفل عريض

A round-headed, evergreen, aromatic tree, 2-6 meters. Plants grown for their graceful habit and resistance to very dry conditions. Stems with many branches. Leaves pinnate, composed of 7 leaflets, each lanceolate-elliptical, entire, wavy margins, 3-6cm long, 2-4cm broad. Drooping panicles of tiny cream flowers (in clusters), male and female flowers on the same or separate trees. Fruit round red berries.

Habitat & Distribution

Cultivated, makes excellent shade tree in salty places. Flowering in spring. Uncommon in the UAE: Al Ain and Dubai.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, allelopathic, fruits are eaten by birds, used as an ornamental plant.

APOCYNACEAE
Catharanthus roseus **(L.) G.Don**

WINKA or VINKA
وينكا، فينكا

Shrubby perennial, up to 60cm high, with slender, erect, fleshy stems arising from woody base. Leaves oblong-lanceolate, entire, leathery, glossy, 3-5cm long, 1-2cm broad. Flowers clustered in upper leaf axils, somewhat oleander-like, with short tube opening to 5-flat, radiating petals. Flowers 1-2cm across, mostly white to rose, shading to a dark red in the centre.

Habitat & Distribution

Cultivated, grows in full sun and tolerates salinity. Flowering in spring. Very common in the UAE: Dubai, Abu Dhabi and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Moderately salt and drought tolerant, widely used as an ornamental plant for edging, groundcover and as a hanging plant.

APOCYNACEAE
Nerium oleander **L.**

HEBEN, DHEFLA
حبن – دفلة

Dense shrub with many branches, 1-4 meters high, poisonous. Leaves large, whorled, evergreen, 6-12cm long, 1-2cm wide, linear-lanceolate, acute, coriaceious. Flowers large, showy. Calyx small, densely glandular inside. Corolla 5-lobed, 2-4cm in diameter, pink, tube 1-2cm long, segments of the crown 3-4 toothed. Spurs of anthers linear, long, hairy or twisted. Follicles 5-12cm long and about 1cm broad, erect, reddish-brown, pod-like, tardily dehiscent. Seeds many, feathery.

Habitat & Distribution

In salty places or by streams and pools, also cultivated. Flowering from February to October. Common as wild plant in the UAE: Dubai, Al Ain, Fujairah and Abu Dhabi.

Estimated Salinity Tolerance and Potential Uses

Highly salt-tolerant, ornamental plant with many uses in folk medicine.

APOCYNACEAE

Plumeria alba **L.**

Syn. *Plumeria acutifolia* **Poiret**

FITNA or YASMIN-HINDI

فتنة، ياسمين هندي

Large green shrub or small spreading semi-deciduous tree, up to 4 meters. Stems many, branches knotty, thick and leafy. Leaves large, rigid, oblong-lanceolate, entire, up to 30cm long, 4-6cm broad, mostly clustered at the ends of the branches. Flowers large, 4-6cm across, fragrant, in terminal clusters, mostly waxy textured, whitish in colour with yellow centres. Fruit big bifollicled. Seeds small, many.

Habitat & Distribution

Cultivated in sandy-clay places, gardens, roadsides near sea beaches, tolerates salinity. Flowering in spring. Common in the UAE: Abu Dhabi, Al Ain, Dubai and Khor Fakkan.

Estimated Salinity Tolerance and Potential Uses

Moderate salinity tolerance and high drought tolerance. Ornamental plant with fragrant attractive blooms.

APOCYNACEAE
Rhazya stricta **Decne.**

HARMAL
حرمل

Smooth, yellowish-green shrub, up to 70cm high, with ascending branches from woody base. Leaves 3-10cm long, 0.7-2.0cm broad, yellowish-green, leathery, linear-oblong to elliptic, with a clear midrib and nerves, with short petiole or subsessile. Flowers in dense terminal cymes. Bracts small, subulate, persistent. Calyx lobes acute, small in size. Corolla tube 10-15mm long; limb white inside and bluish on back, shorter than the tube. Follicles erect, in pairs, slender, 3-6cm long. Seeds many, short winged.

Habitat & Distribution

In the desert on sandy or gravely soil, in rocky places and salty wadi beds. Flowering from February to June. Very common in the UAE: Found around Al Ain, near Abu Dhabi and Dubai.

Estimated Salinity Tolerance and Potential Uses

Moderately salt-tolerant, very popular in folk medicinal use.

APOCYNACEAE

Thevetia peruviana (Pers.) Schum.

HEBEN-ASFER

حبن – عصفر

Evergreen, compact shrub, 2-3 meters high. Stems leafy, with milky poisonous juice, densely branched above. Leaves yellowish-green, alternate or whorled, linear-lanceolate, tapering at base to short stalk, entire, 3-7cm long, 1-2cm broad. Flowers terminal, large, showy 3-7cm across, funnel or trumpet-shaped, golden-yellow. Fruit a drupe, apple-sized, with one seed.

Habitat & Distribution

Cultivated in sandy soil, tolerates salinity, flowering in spring. Common in the UAE: Dubai, Al Ain, and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderate in salinity and drought tolerance, mainly ornamental plant.

ARAUCARIACEAE
Araucaria excelsa (Lamb.) R.Br.

ARAUCARIA
أروكاريا

Large, evergreen, coniferous tree, up to 10 meters high, sharply distinct from the others, usually with massive, straight trunks that continue to apex of the tree, with a regular branching pattern, conical form. Leaves leathery, in-curved, needle-like, dark green. Male and female cones borne on same plants. Seed cones, round, bristly, develop right at top of the tree.

Habitat & Distribution

Cultivated in sandy coastal regions, gardens and parks. Propagated from seed in spring. Infrequent in the UAE. Found in Dubai and Umm al-Qaiwain.

Estimated Salinity Tolerance and Potential Uses

Highly salt-tolerant, ornamental tree.

ASCLEPIADACEAE
Calotropis procera **(Ait.) Ait.**

ASHKHAR or OSHUR
أشخر، أعشر

Bushy plant, grey in colour, stout, 1-3 meters high, with milky juice, many branched, tomentose. Stems with white corky bark. Leaves 8-20cm long, sessile, broadly ovate or obovate, fleshy, cottony. Flowers big, in umbel-like cymes. Corolla rotate, campanulate, 5-lobed, about 2cm in diameter, lobes ovate, acute, spreading, dark purple at tip; centre of corrolla whitish, outside greenish. Follicles 5-15cm in diameter, green, ovoid or ellipsoid, smooth. Seeds many, small, with long pappus.

Habitat & Distribution

Desert plant, poisonous, forming dominant element in sandy soil and salty wadi beds. Flowering from March to September. Very common in the UAE. Found around R'as al-Khaimah, Al Ain, Dubai and Shwayb.

Estimated Salinity Tolerance and Potential Uses

Moderately salt-tolerant, it has numerous medicinal uses that have been recognized for thousands of years.

ASCLEPIADACEAE

Leptadenia pyrotechnica (Forssk.) Decne.

MARKH

مرخ

Erect, bushy, yellowish-green, many-branched shrub, up to 3 meters, with drooping cylindrical whip-like stems and clear bitter juice. Leafless or with few linear leaves. Flowers yellow-green, subsessile, on lateral umbellate, pubescent cymes. Calyx small, pubescent; lobes ovate-deltoid, acute. Corolla 4-6mm long, rotate, lobes elliptical-triangular, acute. Corona with short lobes, alternating with petals. Follicles 6-12cm long, lanceolate, glabrous, comose.

Habitat & Distribution

A typical species found in sandy desert and salty depressions. Flowering from August to December and November to March. Very common in the UAE: R'as al-Khaimah, Madam, Dubai, Al Ain and Al-Waggan.

Estimated Salinity Tolerance and Potential Uses

Highly salt-tolerant, has many folk medicinal uses, common in sand dune stabilization.

ASCLEPIADACEAE
Pergularia tomentosa **L.**

GHALJA/ABU-GROON
غلجة/أبو قرون

Woolly-conescent, twining shrub with milky juice. Stem slender, tomentose. Leaves large, cordate or reniform, petioles 1-2cm long. Flowers greenish-yellow or white, on pedicels. Calyx small, divided to the base, lobes ovate. Corolla campanulate, lobes spreading, ovate-oblong. Corona double. Follicles 3-5cm long, lanceolate-ovoid, with long beak, echinate, tomentose. Seeds ovate, tiny, with white, fine pappus at apex.

Habitat & Distribution

Silty, salty regions, climbing on various plants. Flowering from February to May. Uncommon in the UAE: Masafi, Fujairah and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt-tolerant, it has a wide range of folk medicinal uses.

BALANITACEAE
Balanites aegyptiaca **(L.) Del.**

ZAQUOM
زقوم

Bushy, thorny shrub or small tree, 2-5 meters high, with many compact branches, mostly green or yellowish-green, minutely pubescent with thick rigid thorns. Leaves alternate, 2-leaflets, coriaceous, obovate-elliptical, entire, woolly. Flowers green, 5-merous in cymes of 3-5 flowers. Petals linear, glabrous, longer than sepals. Fruit a drupe, ovid-elliptical, of about plum size, green turning yellow.

Habitat & Distribution

Desert plant also cultivated in nurseries or in salty places. Flowering in spring. Infrequent in the UAE. Found in Dubai.

Estimated Salinity Tolerance and Potential Uses

Moderate salinity tolerance, ornamental uses, very useful plant for wood products, many medicinal uses.

BIGNONIACEAE

Tecoma stans **(L). Juss.**

TECOMA

تكوما

Large evergreen shrub, 1-3 meters high. Shoots herbaceous, leafy, with many branches. Leaves opposite, odd-pinnate, leaflets 5-11, oblong-lanceolate, serrate, acuminate, subsessile, 2-5cm long, 1-2cm wide. Flowers large, 2-4cm long, fragrant, in terminal panicles or racemes. Calyx campanulate, 5-toothed. Corolla funnel-shaped, yellow, the limb with wavy lobes. Stamens included, pubescent. Fruit consists of bunches of long, slender capsules.

Habitat & Distribution

Cultivated in sandy, salty soils, moderately tolerates salinity, grows well near coast. Flowering in spring. Common in the UAE. Found in Dubai, Abu Dhabi, Al Ain and Ajman.

Estimated Salinity Tolerance and Potential Uses

Moderate salinity tolerance, ornamental plant, easily propagated vegetatively.

BORAGINACEAE

Arnebia hispidissima **(Lehm.) DC.**

KWHIL

كحل، كحيلة، مليح

Low annual or biennial herb, 8-30cm high, hispid all over the plant. Roots dark-brown. Stems branched near the base. Lower leaves linear-oblanceolate, 2-5cm long, 4-9mm wide, acute; upper leaves smaller. Flowers small, yellowish, densely arranged in one-sided cymes; flowers nearly sessile. Calyx small, hispid, linear. Corollas yellow, hairy, with a tube 1-2cm long, twice as long as calyx; limb spreading. Stigma 2-flattened. Nutlets tiny, pyramidal, angled ventrally, glossy.

Habitat & Distribution

Desert plant found on sandy, salty soil. Flowering from December to April. Very common in the UAE: Dubai, Al Ain, Madam, Sila and Giathy.

Estimated Salinity Tolerance and Potential Uses

Low to moderate salinity tolerance, medicinal plant.

BORAGINACEAE
Cordia sebestena **L.**

AL-MUKHIAT
المخيط

Glabrous or somewhat scabrous tree, medium in size, up to 3 meters high, with round-headed crown, often with a crooked trunk and brown-ridged bark. Leaves large, long-petioled, orbicular-ovate, 4-12cm long. Flowers vivid scarlet, in clusters or cymes. Calyx-teeth short ovate. Corolla tube as long as calyx, lobes oblong-linear. Style 4-lobed. Stigma fan-shaped. Fruit a drupe, edible.

Habitat & Distribution

Cultivated in dry places, gardens, parks and in variety of salty regions. Flowering in spring. Common in the UAE. Found in Al Ain, Abu Dhabi and Dubai.

Estimated Salinity Tolerance and Potential Uses

Highly salt-tolerant. Ornamental plant.

BORAGINACEAE
Gastrocotyle hispida (Forssk.) Bunge

KAHIL-AGHBAR
خيل أغبر

Low, annual or biennial, hispid herb, 9-25cm across. Stems with ascending branches. Leaves linear-oblong, wavy margined, hispid, 1-8cm long, 6-15mm wide. Flowers solitary in the leafy axils, subtended by leafy bracts. Calyx small, deeply 5-lobed. Corolla slightly exceeding the calyx, blue or violet. Stamens 5, attached, corolla tube included. Ovary bicarpelled, 4-lobed. Nutlets 2 horizontal wrinkled or 4 angular wrinkled.

Habitat & Distribution

Sandy or salty limestone soil. Flowering from February to April. Frequent in the UAE. Found in Sharjah, Ajman, Jebel Ali, Madam and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Moderate salinity tolerance, ornamental plant.

BORAGINACEAE
Heliotropium curassavicum L.

RAHAB
رحاب

Perennial procumbent, 50-90cm long, glaucous and rather succulent herb, becoming blue-black when dry. Stem with many branches from a woody base. Leaves fleshy, small, spathulate to linear-oblong, obtuse, tapering at the base to a short petiole. Inflorescence terminal, short, spicate, scorpoid cymes. Flowers small, sessile. Calyx persistent, lobes tiny, ovate. Corolla white, longer than calyx. Stigma shortly conical. Nutlets 4, free, ventrally angled and often laterally grooved.

Habitat & Distribution

Sandy saline places near the sea. Flowering from November to January. Very rare in the UAE. Only seen around Sueyhan and Tarif.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, ornamental plant.

BORAGINACEAE
Heliotropium kotschyi (Bge.) Gurke

RAMRAM
رمرام

Rigid, dark-green shrub, many branched, with woody base, forming clumps, up to 80cm high. Stems and leaves densely bristly, hairy with bulbous-based hairs. Leaves 2-4cm long, alternate, subsessile, lanceolate, margin revolute. Flowers small, white, sessile, in one-sided cymes. Calyx 5-lobed. Corolla funnel-shaped with 5-lobes, white, longer than calyx. Stamens 5, included. Fruit small, of four triangular nutlets.

Habitat & Distribution

Sandy soil, salty regions and calcareous places. Flowering from October to April. Very common in all the UAE: R'as al-Khaimah to Umm al-Qaiwain Road.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, has many folk medicinal uses and is poisonous.

BORAGINACEAE

Moltkiopsis ciliata (Forssk.) I.M.Johnston.

EALAN
عيلان

Grey, small, stiff shrub, 10-40cm high, strigose, branching from woody base. Stems erect to ascending, branches often pinkish below. Leaves 1.5-3.5cm long, oblong-lanceolate, sessile, ciliate at margins with stiff bristles. Flowers bisexual, subsessile. Calyx deeply 5-lobed, hispid. Corolla blue to violet, small, 5-lobed, longer than calyx. Stamens 5, epipetalous, with unequal filaments. Stigma capitate, 2-lobed. Fruit 4 tiny nutlets, each ovate, triangular, tubercled, included in the persistent calyx.

Habitat & Distribution

Clumped distribution in sandy areas of the salty coastal lowlands. Flowering from February to May. Common in the UAE: R'as al-Khaimah, Ajman to Sharjah Road.

Estimated Salinity Tolerance and Potential Uses

Moderate in salinity and drought tolerance.

CANNACEAE
Canna indica **L.**

MOZ FAHAL
موز فحل

Herb-like perennial plant, usually dense, erect, with a creeping rootstock, 1-3 meter high. Leaves large, entire, lanceolate-ovate to narrowly elliptic, 30-50cm long and 10-20cm wide, light-green with purple tones. Inflorescence a raceme, flowers paired or solitary, large. Sepals 3, free, oblong-ovate variable in colour. Petals 3, connate at the base, red to yellow, linear, erect. Fertile stamen solitary, petaloid, basally adnate to the style. Ovary inferior. Fruit a capsule. Seeds numerous, tiny, globose, black.

Habitat & Distribution

Cultivated, is sun-loving and adapted to hot dry weather. Tolerates moderate salinity. Flowering in the spring. Common in the UAE: Abu Dhabi, Al Ain, Giathy and Sila.

Estimated Salinity Tolerance and Potential Uses

Low to medium salinity tolerance. Ornamental, some hybrids are cultivated.

CAPPARACEAE
Dipterygium glaucum **Decne.**

ALQA
علقة، صفراوي،صفيّر

Glabrous, perennial shrub, yellowish-green, erect, up to 90cm high. Stems slender, mostly branched from a woody base. Leaves alternate, often small, linear or oblong, obtuse, tapering towards base, sometimes deciduous. Flowers small, solitary or in axillary or terminal racemes. Pedicels short. Petals 4, (crucifer-like) yellow. Fruit tiny, obovate, nut-like, wrinkled, winged.

Habitat & Distribution

Desert plant, mostly on deep sands, also in saline places. Flowering from February to August. Common in the UAE: Sharjah-Dhaid road, and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Low to medium salinity tolerance. Medicinal uses.

CARICACEAE
Carica papaya **L.**

PAPAYA
بابايا

Large, attractive tree, 3-10 meters high, palm like. Trunk usually straight, rarely branched, with terminal crown of large leaves. Leaves large, palmately lobed, 30-120cm across, with long stalk. Flowers yellow, dioecious, many in clusters or racemes. Calyx tiny. Petals 5, larger than calyx. Stamens 10. Stigmas 5. Ovary many seeded. Fruit like melon in shape and size, yellow-orange, with many brown-black seeds.

Habitat & Distribution

Cultivated in dry places. It grows well in sandy and salty regions. Uncommon in the UAE: Found in Dubai, Al Ain and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Low to moderate salinity tolerance. Cultivated for fruits, industrial and medicinal uses.

CARYOPHYLLACEAE

Herniaria hemistemon **J. Gay**

HELIAKA
حليقة

Prostrate, perennial, pubescent-tomentose herb, 8-25cm across. Stems branched from the base. Leaves greyish-green, tiny, opposite, entire, elliptic-ovate, ciliate, subsessile. Stipules red-brown. Flowers minute, sessile, in axillary clusters. Calyx with short, hispid tube and 4, unequal, hispid-ciliate lobes. Stamens 2. Utricle membranous, included in calyx tubes. Seeds, ovoid, tiny, smooth.

Habitat & Distribution

Limestone and salty ground, thin sand or in wadis among rocks. Flowering from January to April. Uncommon in the UAE. Found in Abu Dhabi, Al Ain and R'as al-Khaimah

Estimated Salinity Tolerance and Potential Uses

Moderate salinity tolerance. Used in folk medicine.

CARYOPHYLLACEAE

Sphaerocoma aucheri **Boiss.**

TAR-TYR
طرطير

Subshrub, forming clumps, up to 85cm high, or in bush form with thick woody stem. Branches dense, knotted, blue-green. Leaves in fascicles on older stems, linear-terete, fleshy, small. Inflorescences capitate, 1cm across, on short peduncles. Bracts greenish-brown, with scarious margins, mucronate-aristate. Sepals tiny, similar to bracts. Petals white, slightly shorter than sepals. Stamens 5. Fruit 1-seeded, indehiscent.

Habitat & Distribution

Coastal salty sands. Flowering from February to June. Common in both coastal regions of the UAE: Fujairah and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant.

CASUARINACEAE
Casuarina equisetifolia **L.**

CASUARINA
كازوارينا

Large, erect, evergreen tree, resembling pine, 3-8 meters high. Branchlets many, slender, jointed, striate, bluish-green. Leaves drooping, filiform, scale-like, whorled, fall at intervals in the year. Flowers mostly unisexual, staminate in slender, terminal spikes, stamen one; pistillate, in short dense, axillary heads, pistil one. Fruit a cone, globular, about 1.5cm in diameter, valves hairy, not keeled.

Habitat & Distribution

Cultivated, it grows near beaches and exposed coastal headlands. Other plants will not grow easily underneath it. Tolerates dry and saline conditions. Flowering in spring. Common in the UAE: Al Ain, Dubai and Umm al-Qaiwain

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Ornamental and medicinal uses.

CHENOPODIACEAE

Arthrocnemum macrostachyum
(Moric.) Moris et Delponte

SHINAN
شنان

Succulent, jointed, richly-branched shrub, up to 80cm in height, with opposite connate leaves and a rudimentary lamina. Flowers bisexual, 2-3 together in the axils of the scales of sessile cone-like spikes. Bracts 2, connate, persistent. Perianth 3-fid at tip, obpyramidal, brownish. Stamens 1-2. Stigmas 2-3. Utricle ovate, included in the perianth. Seeds tiny, ovoid more or less compressed.

Habitat & Distribution

A halophytic plant found mostly on protected seacoast and inlets. It dominates in the littoral salt marshes of the UAE. Flowering in the autumn. Seen in Abu Dhabi, Dubai and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant (up to seawater salinity).

CHENOPODIACEAE

Atriplex leucoclada Boiss.

RUGHEL

رغل، قطف محلي

Shrub, prostrate to erect, up to 90cm high, mostly with woody base and mealy-canescent. Stems numerous, diffusely branched. Lower leaves vary in size, short-petioled, deltoid, sinuate-dentate, rarely entire, truncate at base, upper leaves smaller, sessile. Flowers in clusters, both axillary and terminal leafless spikes. Fruiting bracts broadest above, the middle smaller strongly indurated, deltoid-round. Seed small, vertical.

Habitat & Distribution

Sandy, salty and calcareous soil, as a forage plant. Flowering from April to October. Common in the UAE: R'as al-Khaimah - Sharjah Road

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. High-value forage shrub and energy source.

CHENOPODIACEAE

Bassia muricata (L.) Ascherson

LEHIAT AL-TAISS
لحية التيس

Greyish-green, annual, densely villous herb, 25-50cm high. Stems many, branched, erect or ascending, branching nearly from the base. Leaves 0.8-2cm long, linear-lanceolate, villous. Flowers 1-3, in clusters, sessile, axillary, loosely spiked, subtended by oblong bracts. Perianth of 5-segmants, connate below, armed on the back with spine. Seed tiny, discoid, grey.

Habitat & Distribution

Steppes and deserts, mainly on sandy and salty soil. Flowering from January to June. Common in the UAE: Al Ain, Abu Dhabi, Dubai and Jebel Ali.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Forage plant.

CHENOPODIACEAE
Chenopodium murale **L.**

WERIJ
وريج، لسان الطير

Glabrous, annual, green herb, 30-70cm high. Stems erect or ascending, branching nearly at the base. Leaves alternate, 2-6cm long and 0.5-4cm wide, petiolate, triangular or rhombic-ovate, acute, irregularly toothed. Inflorescencesleafy, axillary and terminal, paniculate, or cymose. Flowers hermaphrodite. Perianth 5-parts, green, keeled, enclosing the fruit. Seeds tiny, lens-shaped, not shining, black.

Habitat & Distribution

A weed in the gardens, orchards, waste salty places and roadsides. Flowering from February to May. Common in the UAE: Abu Dhabi, Dubai, Sharjah and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Low to moderate salinity tolerance. Forage herb grazed by animals.

CHENOPODIACEAE
Cornulaca monacantha **Del.**

THALEJ, SELY
ثلج، سلي

Rigid, grey-green, glabrous, prickly shrub, 30-60cm high. Stems much branched, glaucous. Leaves small, clasping at base, tapering into a rigid spine, short, woolly in the axils. Flowers 3-5, clustered in the axils, hidden by dense wool. Perianth 5 segments, small, linear-spathulate, 1 or 2 segments tapering into a clearly exserted spines in fruit.

Habitat & Distribution

Deep sandy soil and salty places. Flowering from October to December. Very common in the UAE. Seen in Abu Dhabi, Al Ain, Tarif and Sila.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Forage shrub grazed by camels. Medicinal plant.

CHENOPODIACEAE

Halocnemum strobilaceum (Pall.) M.Bieb.

Syn.:Salicornia strobilacea Pall.

HANTHAD

حنظد، سبت، حنظاوي

Low shrub, green to brown in colour, up to 80cm high. Stems erect or procumbent, much branched from the base, with short, thick, club-shaped joints, the top of each ending in an obtuse cupule of leaves. Leaves tiny, appearing as tubercles along the branches. Bracts reniform to orbicular. Spikes leafless, cylindrical, composed of articulated joints. Flowers minute, immersed in the nodes. Perianth with tiny lobes. Stamen 1, exerted. Seed minute, brown, nearly smooth.

Habitat & Distribution

Occurs in sandy-salty areas and salt marshes of both coastal regions. Flowering from October to December. Common in the UAE; Ajman to R'as al-Khaimah Road, Fujairah and Abu Dhabi

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant. Low grazing value.

CHENOPODIACEAE

Halopeplis perfoliata Bunge ex Schweinf. & Asch.

KHERAZ
خرز، خريزة

Fleshy, variable in colour, low shrublet or herb, up to 40cm high. Stems erect, woody based, glabrous, branched. Leaves small, succulent, globular-ovoid or pyriform, perfoliate, often becoming red in colour. Flowers minute, connate, sessile, in clusters of dense lateral and terminal spikes. Fruit a utricle included in the perianth. Seeds ovoid to ellipsoidal, papillate.

Habitat & Distribution

Saline places in both coastal regions. Flowering from July to December. Very common in the UAE. Found in R'as al-Khaimah, Abu Dhabi, Fujairah and Dubai.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Low forage value.

CHENOPODIACEAE

Halothamnus bottae Jaub. & Spach.

DEMRAN

دمران

Low shrublet, divaricately branched, mostly grayish, up to 70cm high. Stems erect or ascending, older branches pale-brown. Leaves alternate, sessile, mostly reduced, triangular, scale-like. Flowers solitary and axillary, arranged in spikes along upper parts of branches. Bract and bracteoles present. Perianth 5-lobed, indurated all over in fruit as membranous winged. Stamens 5. Style bifid. Fruit an utricle. Seeds tiny, horizontal.

Habitat & Distribution

Sandy gravel soil and salty limestone wadis. Flowering from September to January. It is infrequent in the UAE. Found in Al Ain and Giathy

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant.

CHENOPODIACEAE
Salsola rubescens **Franch.**

KHUM-KHAM
خمخام

Greyish, low shrub, up to 35cm high. Stems erect, much branched from woody base, with opposite leaves. Leaves thick, tomentose, clasping, in distinctive groups of 6-8 along twigs at 1-2cm intervals; flowering twigs often leafless. Flowers minute and distinct in red-yellow papery perianth. Wings remain on plant for a long period.

Habitat & Distribution

Gravelly plains and in clefts on limestone mountains, wadis and salty depressions. Flowering from September to December. Uncommon in the UAE. Mostly found in Al Ain and Hatta regions.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant.

CHENOPODIACEAE

Seidlitzia rosmarinus **Bge. ex Boiss.**

TERTIA

طرطيع، شنان

Low shrub, glabrous, up to 60cm high. Stems much branched from the woody base, lower internodes longer than upper. Branches opposite, whitish, glossy. Leaves 0.5-3cm long, opposite, succulent, linear, club-shaped, obtuse. Flowers clustered, 2-3, in fleecy leaf axils. Stamens 5, exerted. Style minute; stigmas 2. Fruiting perianth small in diameter including wings; wings unequal. Seed horizontal, black.

Habitat & Distribution

Saline places near seashores. Flowering from October to December. Common in the UAE. Found in Fujairah and R'as al-Khaimah to Ajman Road.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater level. Low forage value.

CHENOPODIACEAE

Suaeda aegyptiaca (Hasselq.) Zohary

Syn: Schanginia aegyptiaca (Hasselq.) Aellen

SUWEDA

سويدا، إخريط

Succulent, annual herb, glabrous, light-green, up to 50cm high. Stems procumbent to erect, branching, densely leafy. Leaves small, fleshy, terete or cylindrical, obtuse, incurved, longer than flowers. Flowers minute, sessile, clustered, arranged in long leafy spikes. Perianth lobes tiny, becoming spongy-baccate, gibbous-inflated in fruit. Seeds vertical, small, black.

Habitat & Distribution

Saline places or as a weed of wasteland. Flowering from October to December. Common in the UAE. Seen in Fujairah, Abu Dhabi, Dubai and Ajman.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater level.

CHENOPODIACEAE
Suaeda vermiculata **Forssk.**

SUWEDA, MELIAH
سويدا، مليحة

Large, dark-green, fleshy shrub, glabrous below but papillose-hirsute in upper younger parts, up to 100cm high. Stem non-jointed, divaricately branching from the base. Leaves about 1.5cm long and 0.5cm broad, subsessile, succulent, the lower obovate-oblong, the upper ovoid or globular, when dry becoming black. Flowers solitary, or 2-3 in a cluster, forming short leafy spikes. Flowers bisexual, shorter than bracts. Fruiting perianth small ovoid lobes, connivent. Stigmas 3. Seeds vertical, not beaked, shiny.

Habitat & Distribution

On both coastal regions, saline places - sabkhas. Flowering from October to December. Common in the UAE. Found in R'as al-Khaimah to Dubai, Jebal Ali, Jebal al-Dhana, Abu Dhabi, Al Ain and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity level. Ornamental use in coastal areas.

COMBRETACEAE

Conocarpus lancifolius Engl. & Diels

DAMAS

دامس

An upright, medium-sized, evergreen tree, up to 5 meters high, with many drooping branches. Leaves alternate, oblong-lanceolate, entire, 3-7cm long, 1-2cm wide. Petiole short, 1-2cm long. Inflorescence a raceme, with many small flowers. Calyx 4-5 lobed, valvate. Corolla 4-5 lobed, creamy white. Fruit small globular drupe.

Habitat & Distribution

Cultivated as an ornamental plant for gardens, roadsides and parks. Tolerates saline soil conditions. Flowering in the spring. Common in the UAE. Seen in Al Ain, Dubai and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity. Very valuable landscaping plant with high growth rate and lush foliage.

COMBRETACEAE
Terminalia catappa **L.**

LOZ-HINDI
لوز هندي

Large, bushy, green, semi-deciduous tree, up to 4 meters tall, with marked horizontal branches and round-headed crown. Leaves alternate, large, leathery, obovate, entire, 15-25cm long, mostly turn bright red before they fall. Flowers small, usually in loose spikes, creamy-yellow. Calyx small, 5-lobed, campanulate. Petals absent. Stamens 10, exserted, hairy. Style free, slender; stigma small. Fruit a nut, oval shaped, 2-3cm long, edible.

Habitat & Distribution

Cultivated. Grows in different soils, mostly close to sea or in gardens, roadsides and parks. Tolerates salinity. Flowering in the spring. Common in the UAE: Abu Dhabi, Dubai and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity level.

COMPOSITAE (Asteraceae)
Launaea nudicaulis (L.) Hook. f.

HAWA
حوة

Perennial up to 60cm high. Stem erect or decumbent, dichotomously and divaricately branching to loosely corymbose above. Leaves 3-17cm long, 2-3cm wide, rosetted, spathulate in outline, runcinate, deeply lobed into triangular or ovate, cartilaginous toothed lobes; upper leaves few, smaller. Heads lateral and terminal, yellow, on short peduncles. Involucral bracts herbaceous with wide margins. Achenes small of two types. Pappus of subequal white hairs persistent.

Habitat & Distribution

Coastal salty sands, rocky banks and sandy places. Flowering from February to May. Common in the UAE: Dubai, Al Ain, Abu Dhabi and Tarif.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity. Medicinal and culinary uses.

COMPOSITAE (Asteraceae)
Pentanema divaricatum **Jaub. & Spach**

UFAYNAH
عفينة

Low, annual herb, up to 30cm high, silky-hairy, dichotomously and divaricately branching from base into slender, purple stems. Leaves membranous, basal one oblong-spathulate, sessile, obtuse, entire, longer than upper leaves. Heads numerous, axillary and terminal, villous, globose. Flowers yellow, ray florets hardly longer than the disc florets. Achenes minute, shorter than pappus hairs.

Habitat & Distribution

Wadi beds, hillsides, and salty basins. Sabkhas. Flowering from February to June. Rare in the UAE. Seen beside R'as al-Khaimah to Ajman road.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity.

CONVOLVULACEAE
Cressa cretica **L.**

MELIAH
مليحة، نديوة

Grey, low, perennial herb, up to 30cm high, erect or diffuse, pubescent. Stems branched from above, leafy. Leaves closely condensed, salt-exuding, sessile, ovate-lanceolate, small. Flowers in short, dense spike-like racemes at the end of branchlets. Calyx hairy and tiny; lobes ovate, acute. Corolla 5-6mm long, white to cream or rose, pubescent at tips. Stamens and styles exserted. Stigma capitate. Capsule small, ovoid. Seed 1.

Habitat & Distribution

It grows around sabkhas or salt marshes and as a weed in cultivated areas. Flowering from March to May or September. Common in the UAE: Fujairah, Abu Dhabi, Tarif, Sila, Dubai and Umm al-Qaiwain.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity. Several known folk medicinal uses.

CONVOLVULACEAE
Ipomoea biloba **Forssk.**

QULB AL-ASHIQ
قلب العاشق

Green, prostrate or climbing, glabrous plant. Stems round, arising from thick woody base, long-trailing with many branches. Leaves large, cordate or orbicular with bilobed tip, 5-9cm across, entire, fleshy. Flowers 1-3 on long peduncle. Calyx 5-lobed. Corolla 5-lobed, trumpet-shaped, big, showy, pink in colour, 3-5cm long. Style solitary. Stigma globose, bilobed. Fruit a capsule.

Habitat & Distribution

Cultivated. Rapidly grows and covers large area in seaside locations. Plant mostly heat and salinity tolerant. Flowering in spring. Common in the UAE: Abu Dhabi and Dubai.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity. Potential medicinal and culinary uses.

CONVOLVULACEAE
Ipomoea palmata **Forssk.**

BINT AL-BASHA
بنت الباشا

Trailing vine or climbing to a great height over trees and walls. Stems round, many branched, covered with dense foliage. Leaves petioled, mostly palmate, deeply cleft into 5-7 lobes of various sizes. Peduncles 1-3, mauve flowers, longer than leaves. Calyx 5-lobed. Corolla broad, funnel-shaped, showy, 5-lobed. Style one; stigma capitate, 2-lobed. Fruit a capsule.

Habitat & Distribution

Cultivated. Easily grown in gardens and on roadsides, mostly tolerates a range of soils and salty conditions. Flowering in spring. Common in the UAE: Dubai, Al Ain, Ajman and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant. Potential medicinal and culinary uses.

CRUCIFERAE (Brassicaceae)
Anastatica hierochuntica **L.**

KAF MARIUM
كف مريم

A small, prostrate, annual or perennial herb, stellately hairy, up to 15cm high. Stem more or less woody, branching from the base, branches incurving in fruit to form globe-shape body. Leaves small, simple, entire or toothed, obovate. Flowers axillary, minute, white, subsessile. Fruit tiny, indehiscent, ovoid; valves extended at apex into spoon-like appendage.

Habitat & Distribution

Sandy salty soils in wadis or in desert depressions. Flowering from January to April. Common in the UAE. Seen in Al Ain, Shwayb, Hatta and Dhaid.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant. Several known folk medicinal uses.

CUCURBITACEAE

Luffa cylindrica (L.) Roem.

LIFA
ليفة

Annual herb, extensive climber. Leaves simple, ovate-cordate in outline, up to 20cm across, deeply palmately 5-lobed, scabrous. Petiole stout, 8-12cm long. Tendrils 4-fid. Flowers monoecious, yellow. Male racemes 10-20 flowered. Female flowers solitary, axillary. Calyx tube campanulate, 5-lobed. Petals 5, free, spreading, 2-4cm long. Stamens 3 or 5. Fruit cylindrical, terete, varying in length and diameter, spongy within when ripe. Seeds many, ovate, black.

Habitat & Distribution

Cultivated, sometimes wild, grows well in different dry and salty conditions. Flowers in spring. Uncommon in the UAE. Found in Al Ain, and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant. Domesticated in some parts in the world. Fruits are edible.

CYNOMORIACEAE (Balonphoraceae)
Cynomorium coccineum **L.**

TARTHUTH
طرثوث

Fleshy, leafless, blackish-red, erect herb, 15-30cm high. Stems cylindrical, stout, unbranched, ending in long flowering part, spadix-like, 3-12cm long and 2-4cm broad of numerous small densely-crowded flowers, covered with many red or purple protruding stamens. Staminate minute flowers pedicelate; perianth segments 5, linear-spathulate; stamen one. Pistillate and perfect flowers smaller than male flower, usually in cymes of 1-4 flowers. Fruit orbicular, 1 seeded, tiny.

Habitat & Distribution

Parasitic on the roots of other desert plants, e.g., Chenopodiaceae and Zygophyllaceae, mostly found in compacted sands and coastal salty regions. Flowering in spring. Very common in the UAE: Al Ain, Abu Dhabi, Dubai and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Several known medicinal uses.

CYPERACEAE
Cyperus alternifolius L.

SEID-ZENA
سعد الزينة

Perennial, grass-like in habit with short, thick rhizome. Stems clustered up to 150cm high, trigonous to subterete. Leaves long, narrow at the top, to the stalk in a whorl. Inflorescence large; bracts oblong-linear, numerous. Spikelets digitate, clustered, rhachilla wingless. Glumes ovate, acute. Stamens 3. Stigmas 3. Achene tiny, ellipsoid.

Habitat & Distribution

Cultivated, planted in clumps rather than singly, mostly in sandy-salty soil. Flowering in spring. Uncommon in the UAE. Found in Al Ain, Dubai and Abu Dhabi

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Naturalized and cultivated. Ornamental plant.

CYPERACEAE

Cyperus conglomeratus **Rottb.**

THENDA

ثندة، رشا

Bright green, variable in habit, perennial, glabrous herb, 20-70cm high; roots rigid, fibrous, woolly. Stem stout, terete, thickened below, trigonous above, leafy at base. Leaves as long as stem or shorter, terete, grooved, pungent. Bracts leaf-like, 10-30cm long. Spikelets linear, clustered on rays in an umbellate inflorescence, rather large, 6-16 flowered; glumes minutely mucronate, generally persistent. Stigmas 3. Achenes tiny, unequally trigonous.

Habitat & Distribution

Sandy places including seashores. Flowering from December-June. Very common in the UAE: R'as al-Khaimah, Dubai, Abu Dhabi, and Al Ain

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Forage plant with known several local medicinal uses.

EUPHORBIACEAE
Ricinus communis **L.**

KHRWIA
خروية

Broad, umbrella-shaped, evergreen, monoecious shrubs or small trees, 1-2 meters high. Stem hollow with many branches above. Leaves very large, palmately lobed. Green-reddish female flowers found above the male flowers in the erect spike. Fruit a capsule, globular, with prickles like small chestnut fruits. Seeds large in size, about 1cm long, ovate, mottled, contain oil.

Habitat & Distribution

Cultivated, grows quickly in gardens, courtyards and sea beaches. Tolerates salinity. Common in the UAE: Al Ain, Dubai and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant. Naturalized and cultivated, seeds are used for oil production. Several known folk medicinal uses.

FRANKENIACEAE
Frankenia pulverulenta **L.**

MELIAH
مليحة

Prostrate, annual, fleshy herb, grayish-green then turning to pink or reddish, glandular excreted salt crystals. Stems slender, divaricate, branching at the base, 6-20cm long. Leaves small, obovate to oblanceolate, glabrous, entire, apex rounded or retuse. Petioles very short. Flowers solitary or in loose cymes. Calyx tubular 4-5 fid, persistent. Petals 5 lobed, pink. Fruit a capsule, 3 valved, enclosed in calyx.

Habitat & Distribution

Salty places and coastal regions. Flowering in spring. Uncommon in the UAE: found in R'as al-Khaimah, Jebel al-Dhana and Sila.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant.

GRAMINEAE (Poaceae)
Aeluropus lagopoides (L.) Trin.

IKRISH - ECHRISH
إشرش

Prostrate, perennial grass, with long stolons or rhizomes and densely tufted culms, with erect flowering peduncles, up to 20cm long. Stems woody, widely spread, later covered with hairy overlapping scales. Leaf blade flat, lanceolate, usually pungent, 2-3cm long; ligules absent. Inflorescence a dense globular or oblong head, 1-1.5cm long, of hairy spikes. Lemmas often mucronate. Fruit a caryopsis.

Habitat & Distribution

In sandy and salty marshes or moist ground. Flowering from March to May. Common in the UAE: Dubai, Abu Dhabi and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity. Grazable.

GRAMINEAE (Poaceae)
Cenchrus ciliaris **L.**

SABAT
سبط، ليبد، مخاضير

Perennial, with tufted clums, erect, much-branched grass, up to 90cm in height. Culms slender, upright, tufted at base. Leaf-blade flat, up to 18cm long. Ligule a line of hairs. Inflorescence dark or purplish, a cylindrical spicate panicle consisting of burr-like, soft sessile involucres, inner bristles united as cup-like structure, outer bristles reduced or short, but one of the bristles longer and more rigid than the rest. Glumes veined, distinct.

Habitat & Distribution

Sandy or salty places and sandstone hillsides. Flowering from February to May. Very common in the UAE: Al Ain, Dubai, R'as al-Khaimah

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant. Very valuable forage. Naturalized and cultivated.

GRAMINEAE (Poaceae)
Chloris gayana Kunth

RHODES
رودس

Erect, tufted, perennial grass, up to 90cm high. Culms glabrous, stout, naked above, carrying an umbel-like or digitate head, 6-15 fingered, each 5-9cm long. Leaf-blades narrowly linear, flat; sheath smooth; ligule a narrow membrane. Spikelets 2-awned; awns as long as the lemma.

Habitat & Distribution

As pasture on cultivated farms and saline places. Flowering from February to May - November. Common in the UAE: Al Ain, Al Waggan and Liwa.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant. High value forage, widely cultivated.

GRAMINEAE (Poaceae)

Cymbopogon commutatus (Steud.) Stapf

Syn: C. parkeri Stapf

SAKHBAR

صخبر، إصخبر

Perennial, compact grass, strongly aromatic, densely tufted with culms up to 70cm high, with woolly or sparsely hairy basal sheaths. Leaf-blades linear or filiform, somewhat curled. Ligules scarious. Panicle erect, terminal, spatheate; racemes two, short, divaricate. Lowest joint of the sessile raceme prominent, swollen and hardened. Awn kneed with a spirally twisted column, exserted, nearly as long as the spikelet.

Habitat & Distribution

Desert plant, gravel and compact sandy salty places. Flowering from February - May. Common in the UAE: seen in Dubai, Al Ain, Sharjah, Ajman and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable plant. Grazed by animals. Several known uses in folk medicine.

GRAMINEAE (Poaceae)
Lolium rigidum **Gaud.**

HAYBAN
هيبان

Smooth, glabrous, annual grasses. Culms erect or decumbent, branched at base, up to 60cm high, usually with 2-4 nodes. Ligule rounded to truncate. Leaf-blades 5-20cm long, linear-acuminate, flat, glabrous. Spike up to 25cm long, stiff with spikelets appressed-ascending. Spikelets flattened, awnless. Glume ½ to ¾ as long as the spikelet. Lemmas not turgid at maturity.

Habitat & Distribution

Damp places on salty ground, clay or sandy-gravel hills or as a weed. Flowering March to May. Common in the UAE: Al Ain, Dubai and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, good quality forage.

GRAMINEAE (Poaceae)
Panicum turgidum Forssk.

THUMAN
ثمام

Shrubby, desert grass, growing in dense bushes, up to 1 meter high. Culms woody, densely branched with clusters of brown empty leaf-sheaths at the swollen nodes. Leaves usually flat, linear-lanceolate, acute, glabrous. Panicle spreading, lax, pale, few-flowered. Spikelets glabrous, ovoid, minute. Stigma densely plumose.

Habitat & Distribution

Abundant in sandy and stony deserts, along the Gulf it often covers the whole salty coastal plain. Common in the UAE: Al Ain, Dubai, Jebel Ali, Fujairah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, common forage, naturalized and cultivated. Used in folk medicine.

GRAMINEAE (Poaceae)

Phragmites australis (Cav.) Trin. ex Steudel

Syn: P. communis Trin.

BOSS, QASAB

بوص، قصب

Glabrous, tall, rhizomatous, perennial reed, 2-4 meter high. Stem simple, rigid, erect, from a creeping root stock, leafy up to the panicle. Leaves flat, linear to lanceolate, tip subulate, 20-50cm long, 1-3cm wide. Ligule a rim of hairs. Panicle large, lax, one-sided, usually brownish purple. Spikelets 2-6 flowered; glume unequal, glabrous, lemma narrowly lanceolate, long pointed lowest lemma twice as long as upper glume. Hairs on rachilla.

Habitat & Distribution

Lakes, swamps, canal banks. Flowering all year around. Common in the UAE: Al Ain, Abu Dhabi, R'as al-Khaimah and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant, up to seawater salinity. Grazable, used in folk medicine.

GRAMINEAE (Poaceae)
Sporobolus spicatus (Vahl) Kunth

HALFA
حلفا، صخام، وفرة

Light-green, stiff, perennial grass, with creeping rhizomes, up to 40cm in height, often forming tufts of leaves and culms at the rooting nodes. Ligule a short rim of hairs. Leaf-blades very narrow, linear, 4-8cm long, rigid, involute, with spinous tips. Inflorescence narrow, long, cylindrical, pointed spike, 4-8cm long. Spiklets very small, single-flowered. Glumes unequal, awnless.

Habitat & Distribution

In marshes, fallow fields and salty soil. Flowering from October to May. Common in the UAE: Al Ain, Abu Dhabi, Sila, Tarif, Dubai, and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, grazable forage.

JUNCACEAE
Juncus rigidus **Desf.**

ASAL, SELY
أسل، سلّي

Marsh perennial rush, dark green, stout, tufted, glabrous with creeping rhizome and erect, parallel, rigid, pointed stems, up to 1.5 meters high. Leaves terete, hollow, nodeless, often with sharp points. Flowers green, small, in an open lateral cyme, the stem is continued above the inflorescence. Tepals lanceolate, acute, equal or the outer 3 longer; inner 3 obtuse. Anthers yellow to red, 3-5 times longer than the filaments. Capsule tiny, trigonous-ovoid with a tapering, pyramidal top, exceeding the tepals. Seed many, short tailed at each end, brownish.

Habitat & Distribution

Salty marshes, streams in wadis and permanent pools. Flowering from March to July. Common in the UAE, in the coastal regions and salt marshes.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant, up seawater salinity. Grazed by camels, used in folk medicine and industrial uses.

LABIATAE (Lamiaceae)
Salvia aegyptiaca **L.**

KHIZAM
خزام، شجرة الغزال، نعيم

Grey, much branched, dwarf, woody based shrublet, up to 30cm high. Branches rigid, divaricate, hairy. Leaves rigid, 1-3cm long, 4-12mm broad, subsessile, lanceolate, acute, wrinkled, rugose, hairy, nerves and veins prominent, gland-dotted below. Flowers in rather distant verticillasters toward end of the branches. Calyx growing in fruit, glandular, hairy with acuminate, purplish, unequal teeth. Corolla pale-mauve, spotted, about 1.5 times as long as the calyx, with lower lip longer than the upper. Fruit tiny nutlets, oblong-ellipsoid smooth, bluish-black.

Habitat & Distribution

Sandy, salty and rocky places. Flowering from February to May. Fairly common in the UAE: Dubai, Hatta, Dhaid, Sharjah and Masafi.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, several known folk medicinal uses.

LEGUMINOSAE
Acacia ehrenbergiana **Hayne**

SALAM
سلّم

A large desert shrub, up to 2 meters, glabrescent. Branches many from the base. Spines usually straight, whitish, 2-4cm long. Leaves mostly with 1-2 pairs of pinnae; leaflets 6-9 pairs. Flowers yellow, fragrant, appearing before the leaves, solitary or clustered in the axils. Legume glabrous 4-8cm long, falcate, constricted between the seeds.

Habitat & Distribution

Sandy soils and banks of salty wadis. Flowering from April to May. Common in the UAE: Al Ain and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, highly grazable, fuel and ornamental tree, has many folk medicinal uses.

LEGUMINOSAE
Acacia farnesiana (L.) Willd.

AMBAR
عنبر، فتنة

Small tree, 1.5-3 meters high. Branches slightly zigzag, glabrous, cortex brownish to purplish. Stipules spinescent, divergent, in pairs. Pinnae 2-8 pairs; leaflets in 10-20 pairs, oblong, acute, sessile. Flowers fragrant, yellow, in globular heads on axillary peduncles, 15-25cm long. Calyx tubular-campanulate, 5-dentate. Corolla and filaments yellow. Pod 3-6cm long, 1-1.5cm broad, slightly curved, turgid, glabrous, dark brown. Seeds oblong-ovate.

Habitat & Distribution

Cultivated in garden or sometimes escaped, in salty places. Flowering from March to May. Very common in the UAE: Al Ain, Dubai, Giathy and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, highly grazable, fuel and ornamental tree, has medicinal use.

LEGUMINOSAE

Acacia nilotica (L.) Willd. ex Del.

Syn: Mimosa nilotica L. Willd

SANT, KUROT

قرط، سنط

Tree, 2-10 meters high with variable shape of twigs. Bark on trunk rough, grey or brown. Stpules spinescent, 1-6cm long, divergent. Leaf often pinnae in 2-11 pairs, leaflets numerous, 7-30 pairs. Flowers in globular heads. Calyx tubular-campanulate, 5-dentate. Corolla bright yellow. Pod very variable in form, indehiscent, glabrous or downy, up to 15cm long and 1-2cm broad, constricted between the seeds. Seeds suborbicular, small, blackish-brown.

Habitat & Distribution

Alluvial and salty places and cultivated for ornament. Flowering from September to December. Common in the UAE: Al Ain, Dubai, Abu Dhabi and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, highly grazable, fuel and ornamental tree, has medicinal use.

LEGUMINOSAE

Acacia tortilis (Forssk.) Hayne

Syn: Mimosa tortilis Forssk.

SAMAR

سمر

Umbrella-shaped tree or big shrub, 2-4 meters high, branching from base, young branches reddish-brown, usually pubescent. Spines partly long, white, straight and partly small, recurved, dark-tipped. Pinnae 2-10 pairs, leaflets 6-18 pairs. Flowers in globular heads, 4-7mm across, white to pale-yellow. Pod 3-9cm long and about 0.5cm wide, contorted or spirally twisted in 1-3 coils, pubescent.

Habitat & Distribution

In wadis, salty depressions and oases. Flowering from March to April. Very common in the north of UAE: Al Ain, Masafi, Sharjah and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, highly grazable, fuel and ornamental tree, has medicinal use.

LEGUMINOSAE

Albizia lebbeck (L.) Benth.

LBAKH

لبخ

Unarmed large deciduous tree, 2-5 meters high. Stems many branched, leafy. Leaves bi-pinnate, pinnae with 3-10 pairs of leaflets, each leaflet oblong, entire, rounded at the apex, glabrous or sparsely pilose, 2-5cm long, e-3cm wide. Inflorescences on long peducles, round capitula, spike or raceme. Calyx hairy, minute 5-teeth. Corolla tubular, 5-lobed, hairy, 6-10mm long. Stamens numerous, united below. Pod oblong to broadly linear, compressed, not septate. Seeds oval, compressed, brown, up to 1cm long.

Habitat & Distribution

Cultivated, fast-growing plant gives excellent shade in streets, gardens and parks. Tolerates salinity. Common in the UAE: Al Ain, Dubai, Ajman and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, highly grazable, fuel and ornamental tree, has medicinal use.

LEGUMINOSAE
Bauhinia purpurea **L.**

KHUF AL-JEMEL
خف الجمل

Shrub or small tree, 2-5 meters high, with many branches, glabrescent, cortex reddish-brown to yellowish. Leaves large, bilobed, broadly ovate, 4-8cm across, entire, leathery, cleft about one third at the apex. Flowers fragrant, reddish-purple, axillary or terminal. Calyx 5-toothed. Corolla 5-lobed, free, imbricate, large, 2-4cm long. Fertile stamens 3. Style slender. Stigma small. Pod oblong to linear, not septate, 15-25cm long. Seeds orbicular, compressed, 1-1.5cm long.

Habitat & Distribution

Cultivated in desert region, gardens, streets and parks. Tolerates salinity. Common in the UAE: Al Ain, Dubai, R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, fuel and ornamental tree with fast growth rates.

LEGUMINOSAE

Caesalpinia gilliesii (Hook.) Dietr.

SESELPINIA

سيسيلبينا

Unarmed, semi-deciduous to evergreen shrub or small tree, up to 3 meters high. Twigs greenish, glabrous, many below the inflorescence. Leaves long, the slender rhachis 8-30cm; pinnae in 6-15 pairs of leaflets. Inflorescence terminal, racemose, the axis and pedicels densely hairy; flowers many each 2-3cm long. Calyx 5-toothed. Petals large, pale-yellow, much exceeded by the long exserted purple filaments. Style long, purple. Stigma small, truncate. Pod compressed, 5-10cm long, seeds brown, small, ovate.

Habitat & Distribution

Cultivated in gardens, roadsides and parks Grows in dry and salty conditions. Common in the UAE: Al Ain, Dubai and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, fuel and ornamental tree.

LEGUMINOSAE

Cassia italica (Mill.) F.W.Andr.

ESHREJ

عشرج، عشرق، سينامكي

Erect or prostrate and spreading herb, 40-60cm high. Stems branching from woody base. Leaves paripinnate; leaflets obovate, obtuse, short-mucronate, in 3-7 pairs, midrib and venation prominent, 1.5-3cm long, 1-2cm wide, unequal at base on short petiolules. Inflorescence raceme, axillary, single, many flowered, erect, rather loose. Bracts caducus nearly ovate. Flowers 1-2cm across. Calyx 7-12mm long. Corolla 5, free, unequal petals, yellow striped with violet veins. Pod 2-4cm long, 1-1.5cm wide, flat, thin, papery, obovate, curved, crested above the seeds. Seeds compressed, obovate.

Habitat & Distribution

Sandy gravel, wadis, oases, roadsides and waste salty places. Flowering from February to May and in August. Common in the UAE: Al Ain, Dubai, R'as al-Khaimah and Abu Dhabi.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, highly grazable, widely used in folk medicine.

LEGUMINOSAE

Crotalaria aegyptiaca **Benth.**

NIZAA
نزاع

Grey-green, erect or spreading shrub, up to 60cm high. Stems many branched, stiffly ascending or short and pointed, nearly glabrous. Leaves reduced or absent below. Flowers in terminal racemes, showy. Calyx-tube short, teeth linear, subequal. Corolla equaling or exceeding calyx, varies from yellow to light mauve, usually with reddish veins. Pod ovoid, glabrous, twice or more as long as calyx.

Habitat & Distribution

Gravelly desert and sandy or salty places. Flowering from February to April. Common in the UAE: Al Ain, Shwayb, Giathy, Jebel al-Dhana and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable particularly by camels, used in folk medicine.

LEGUMINOSAE
Dalbergia sissoo **Roxb.**

SISAM
سيسام

Unarmed, large tree, with many grey-downy branches and densely tomentose twigs. Stipules subulate, caducus. Leaves imparipinnate; petioles 1-3cm long; leaflets 3-5 alternate, roundish 1.5-5cm long, 1-4cm broad, acuminate above. Flowers small, yellowish-white, numerous, in short axillary panicles with racemose-corymbose branches, pedicels short. Bracts small, caducus. Calyx tubular, teeth small, ciliate, unequal. Corolla often twice as long as the calyx. Stamens 9. Stigma capitate. Fruit 2-5cm long, 0.5-1.5cm broad, strap-shaped or samaroid, 1-4 seeded. Seed reniform, brown.

Habitat & Distribution

Very widely planted in the salty plains along the roadsides and fields and in forest plantations. Flowering from February to May. Common in the UAE: Al Ain, Dubai and Umm al-Qaiwain.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, ornamental and timber plant, grazable, used in folk medicine.

LEGUMINOSAE
Indigofera intricata **Boiss.**

NEELA
نيلة، بيشة

Silvery-grey, prostate to procumbent, low spreading shrublet, 10-35cm high. Stem woody with many branches, lateral branches spinescent. Leaflets 3-7, opposite to subopposite, small, ovate, obtuse or mucronate, with strong appressed silvery hairs on both surfaces. Stipules present. Raceme short, 2-5cm long with few flowers on a stout axis, spinescent. Flowers red, 4-6mm long. Calyx tiny with linear acute lobes, densely pubescent. Standard 4-6cm long, externally pubescent. Pods subsessile, cylindrical, mucronate, pubescent, 3-5 seeded, 7-14mm long.

Habitat & Distribution

It occurs along roadsides in sandy and salty places. Flowering from February to May. Common in the UAE: Al Ain, Faqa, Dubai, Sharjah and Dhaid.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, highly grazable, used in folk medicine.

LEGUMINOSAE

Leucaena leucocephala **(Lam.) De Wit**

LEUCAENA

لوسيانا

Unarmed tree, up to 9 meters high, with light brownish twigs. Leaves with 2-5 pairs of pinnae, leaflets pubescent in 5-18 pairs, oblong-lanceolate, acute, 8-15mm long. Petiole 2-3cm long. Inflorescence of round capitula, pedunculate, axillary and solitary. Peduncle 2-3cm long, hairy. Flowers hermaphrodite, 5-merous, yellowish-green. Calyx tubular-capamulate. Petals 5, free. Stamens 10, free, exserted. Pod linear-oblong, compressed, brown, glossy, 5-15cm long, 1-2cm broad. Seed obovate, small.

Habitat & Distribution

Culitvated and grows in the warmer places, naturalized and common in the UAE: Al Ain, Dubai, Abu Dhabi and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental and timber plant, highly grazable.

LEGUMINOSAE
Parkinsonia aculeate **L.**

SHAUK AL-BAHR
شوك البحر

Glabrous, evergreen or sometimes semi-deciduous spiny tree, 2-6 meters high, with light foliage and long pendulous branches. Leaves bipinnate, elongated, 10-40cm long, with numerous obovate, small leaflets. Flowers yellow, in axillary racemes. Calyx with short tube, 5-lobed. Petals 5, somewhat unequal. Stamens 10, free. Stigma small. Pod linear, scarcely compressed, 1-5 seeded, torulose but not septate, 3-10cm long. Seeds small, brownish.

Habitat & Distribution

Cultivated in gardens, parks and road sides. Tolerates salinity and survives in harsh locations. Flowering in the spring. Common in the UAE: Al Ain, Dubai, Abu Dhabi and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental plant.

LEGUMINOSAE

Pithecellobium dulce (Roxb.) Benth.

GHAF AL-BAHR

غاف البحر

Large dense, round-headed, prickly tree, 3-8 meters high. Twigs somewhat flexuose, cortex grayish with bipinnate leaves. Leaflets opposite, in 1-3 pairs, each lanceolate-oblong. Stipules spinous. Inflorescence of axillary racemes or terminal. Flowers small, white, in globular heads. Calyx tubular or campanulate, 4-5 toothed. Corolla tubular-campanulate, 4-5 lobed. Stamens very numerous, fused below; filaments long, exserted. Style short. Pod spirally twisted and contorted, 5-12cm long, brownish. Seeds small, flat, shiny black.

Habitat & Distribution

Cultivated as a hedge in date gardens, parks and streets. Tolerates salinity conditions. Flowering in February. Common in the UAE: Al Ain, Dubai, Sharjah and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, ornamental tree with several folk medicinal uses.

LEGUMINOSAE

Prosopis cineraria (L.) Druce

GHAF
غاف

Erect, grey, dense tree, up to 10 meters, with slender, tough branches and scattered prickles. Leaves 2-pinnate; pinnae of 2-4 pairs; leaflets in 6-15 pairs, oblong, 8-18mm long, 3-5mm wide. Flowers 4-6mm long, sessile, in axillary spikes, 4-10cm long, and terminal panicles, often interrupted at abase, solitary or twin. Calyx truncate, not ciliated. Corolla yellow, tiny. Pod 5-15cm long, 0.4-0.8mm wide, linear, curved, torulose, glabrous, reddish-brown. Seeds many, oblong, brown.

Habitat & Distribution

Sandy places. Tolerates dry and saline conditions. Flowering from December to March. Very common in the UAE: Al Ain, Dubai, Abu Dhabi and Ajman.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental and forage tree with several known folk medicinal use.

LEGUMINOSAE
Propopis juliflora (Sw.) DC.

GHAWIAF
غويف

Evergreen, spreading, small tree, 2-6 meters high, generally armed with stipular spines and glabrous foliage. Leaves bipinnate with 1-3 pinnae pairs; rachis 1-8cm long; leaflets opposite, 10-22 pairs, 6-16mm long, 2-3mm wide, entire, oblong, obtuse. Stipules spiny, 3-10cm long. Inflorescence a dense spike, 5-10cm in length, 1cm broad. Flowers greenish-yellow, 4-5mm long. Calyx tiny, cup shaped, 5 toothed, slightly ciliate. Petals 5, free, hairy. Stamens 10, free, exserted. Pod straw-coloured, 6-20cm long and 6-10mm wide, straight or curved, somewhat torulose, with many seeds.

Habitat & Distribution

Cultivated as windbreak and ornamental but frequently escaped around salty areas. Flowering from March-May. Very common in the UAE: Al Ain, Dubai, Abu Dhabi and Sila.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental and forage tree with several known folk medicinal use.

LEGUMINOSAE

Rhynchosia schimperi Hockst. ex Boiss.

FELIS
فليس

Gray, perennial subshrub, velutinous up to 60cm high. Stems erect, much branched. Leaves trifoliate, on short stalks; lateral leaflets ovate, entire, terminal cuneate-obovate, retuse, 1-1.5cm in diameter. Flowers small, one to few, axillary or solitary on short pedicel. Calyx teeth unequal. Corolla yellow; standard 5-7mm long, externally pilose; wing and keel smaller. Pod 1.5-2.5cm long, woolly, obovate-oblong, 2-seeded. Seeds globular, black.

Habitat & Distribution

Occurs in sandy depressions, salty wadis and roadsides. Flowering from March to July. Uncommon in the UAE: found in Al Ain, Shwayb, Dubai and Umm al-Qaiwain.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable forage tree, used in folk medicine.

LEGUMINOSAE
Tamarindus indica **L.**

TAMR HINDI
تمر هندي

Unarmed, glabrous, evergreen tree, 2-10 meters high. Twigs with rough grayish cortex. Leaves paripinnate; leaflets numerous, in pairs. Petiole 1-2cm long, rhachis 3-8cm long. Inflorescence racemose, terminal and lateral on branches, mostly with few flowers. Flowers rather small, about 1cm long. Calyx 4-5 lobes. Corolla 5-lobes, yellow with red veins. Perfect stamens, 3 with long visible filaments. Style slender; stigma truncate-capitate. Pods 5-12cm long and 1-3cm wide, thick, linear-oblong, curved, septate. Seeds ovate, flattened, dark-brown, 1-1.5cm long.

Habitat & Distribution

Cultivated in gardens, parks, roadsides near sea beaches, tolerates saline conditions. Flowering in spring. Common in the UAE: Al Ain, Dubai and Bani Yas.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, ornamental tree with edible fruits.

LEGUMINOSAE

Tephrosia apollinea (Del.) DC.

DHAFRA
ظفرة

Green-silvery coloured, low shrub, densely leafy, erect, up to 90cm in height. Stems woody below, much branched, stout, and hairy. Leaves grey, hairy, alternate, odd-pinnate or compound with 3-5 pairs of short petiolate, oblong to obovate or spathulate, mucronate; leaflets 2-4cm long, each leaflet with conspicuous midrib and parallel veins. Stipule more or less spiny. Inflorescence raceme, long, terminal, 3-6 flowers. Flowers about 1cm long, purple or red. Calyx 5-toothed. Corola papillionate, twice as long as calyx. Fruit a pod, 2-4cm long, flattened, falcate, dark brown, with many elliptical seeds.

Habitat & Distribution

Rocky and sandy or salty places. Flowering from October to April. Very common in the UAE: R'as al-Khaimah, Al Ain, Masafi, Fujairah and Madam.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable shrub with many known uses in folk medicine.

LEGUMINOSAE

Tephrosia nubica (Boiss.) Baker

ESMAT

عصمت

Erect, stiff, perennial herb, with woody root stock, 30-50cm high. Stems and petioles densely hairy. Stipulate. Leaves 2-4 pairs of leaflets, usually lanceolate-oblong, obtuse, entire, leaflets 1-5cm long and 1cm wide. Flowers many, pale-pink, in leaf-opposed or long terminal racemes. Bracts minute, present. Calyx small, 5-lobed, villous, standard pubescent outside; keel obtuse. Pod ovoid, 1cm long, obliquely mucronate-beaked, densely hairy, 1-seeded. Red.

Habitat & Distribution

Desert plant mostly in salty wadi-beds or among rocks. Flowering from February to July. Uncommon in the UAE: found in Al Ain, Hatta and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable herb with many known uses in folk medicine.

MALVACEAE
Althaea rosea **L.**

WARD AL-KHATEMA
ورد الخطمة، الختمية

Perennial, stout, erect plant, up to 80cm high, covered in soft hairs, grayish in colour. Stems branched below. Leaves large and decrease in size up stem, usually round or cordate, 3-5 lobed, undivided, with long petioles. Flowers large, 3-6cm across, white to purple, mostly racemose in the upper part of the stem and branches. Epicalyx of 5-9 bracteoles, connate at the base. Calyx campanulate, 5-lobed. Petals broadly obovate. Stamenal tube divided into numerous filaments above. Fruit a dry schizocarp. Seeds many, reniform, wrinkled.

Habitat & Distribution

Cultivated. There are a number of varieties, of this quick-growing plant, usually in gardens or in small scale landscapes. Tolerates dry, hot and saline conditions. Flowering in the spring. Very common in the UAE: Al Ain, Dubai, Abu Dhabi, and Ajman.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, ornamental plant.

MALVACEAE

Hibiscus rosa-sinensis **L.**

WARED AL-JAMAL

ورد الجمل

Erect shrub or small tree, 1-3 meters high, usually open-textured, evergreen plant, with long shoots. Leaves broadly ovate, 3-10cm long, entire below, serrate above with acuminate tip. Petioles 1-3cm long. Flowers large and showy, red or yellow, usually solitary and axillary, often in terminal racemes. Epicalyx 6-8 lanceolate bracteoles. Calyx 5-partite. Petals 5, free. Staminal column long with numerous filaments above. Stylar column 5-branched above. Stigma capitate. Capsule oblong-ovoid, glabrous. Seeds tiny, reniform, blackish, hairy.

Habitat & Distribution

Cultivated, grown in gardens, parks, roadsides in desert regions. Tolerates salinity. Flowering in spring. Common in the UAE: Al Ain, Dubai, and Abu Dhabi.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, ornamental plant.

MALVACEAE
Malva parviflora **L.**

KHUBAYZAH
خبيزة

Annual herb with stellate hairs, variable in size. Stems simple, erect or with decumbent branches from the base. Leaves orbicular, 3-7cm in diameter, margins with 4-6 rounded, serrate lobes, hairy. Petioles variable in length, up to 10cm. Stipules small, oblong. Flowers 2-3, in axillary clusters, pink or purple. Bracteoles shorter than calyx. Epicalyx 3-linear to lanceolae. Calyx 5-lobed, triangular in outline. Petals 5, obovate, to oblong, notched at apex, longer than calyx. Stamens many, monadelphous. Fruit of many carpels. Seeds reniform, wrinkled, brown in colour.

Habitat & Distribution

A weed of cultivated areas, roadsides and waste salty places. Flowering February to May. Very common in the UAE: R'as al-Khaimah, Masafi, Al Ain, Dubai and Abu Dhabi.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable herb.

MALVACEAE
Thespesia populnea **Soland.**

AL-SHAMSIA
الشمسية

Evergreen, medium leafy tree, 3-6 meter high, with rounded head and many branches. Leaves large, 5-10cm long, alternate, cordate, entire with long acuminate or tapering off at the tip. Flowers large, bell-shaped, 3-6cm long, yellowish with purple centres, mostly racemose in the upper part of the branches. Epicalyx connate. Petals showy, yellow, longer than calyx, short-lived. Fruit large globular capsule, apple-sized and shaped.

Habitat & Distribution

Cultivated near buildings, in courtyards gardens, roadsides near sea beaches. Tolerates salinity and dry conditions. Flowering in spring. Common in the UAE: Abu Dhabi, Dubai, Sharjah and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental plant.

MELIACEAE

Azadirachta indica **A. Juss.**

NEEM

نيم

Deciduous tree with hard wood, 3-8 meters high. Branches leafy, form a dense crown, rounded shape. Leaves large, 1-3 pinnate, 20-90cm long, leaflets 3-12, opposite to alternate, ovate-lanceolate, 2-5cm long, serrate, hairy. Flowers in branching axillary panicles. Calyx small, 5-6 lobed. Petals 5-6, free, oblong or obovate, whitish to purple colour. Stamens many, united into a cylindrical tube. Style slender, as long as staminal tube. Stigma capitate, 3-6 lobed. Fruit a small globose drupe.

Habitat & Distribution

Cultivated. Widely grown in dry, hot and saline conditions. Flowering in April to May. Very common in the UAE: Al Ain, Abu Dhabi and Dubai.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental tree with some medicinal use.

MOLLUGINACEAE
Gisekia pharnaciodes **L.**

DEDMAN
ديدمان

Low, bluish-green, glabrous annual herb, 10-20cm across. Stem diffuse, procumbent, much branching, slender. Leaves opposite, 1-4cm long, linear-lanceolate to spathulate, entire, tapering at base. Many small flowers in cymes or subsessile in axils of bracts shorter than leaves. Sepals 5-lobed, ovate, small, persistent, margin white. Stamens 5. Carpels 5, free. Fruit achene ovoid, purplish, star-shaped. Seed one, tiny, red.

Habitat & Distribution

This plant grows in sandy soil, on the slope of sand dunes and along salty coastlines. Tolerates salinity. Flowering from January to April. It is infrequent in the UAE: found in Al Ain, Dubai, Fujairah and Sila.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant.

MORACEAE
Ficus benghalensis **L.**

TIN BANGALY
تين بنغالي

Grey bark with milky sap, rounded-head, evergreen tree, 3-10 meters high, produces aerial roots from its branches, which become secondary trunks. Leaves large, leathery, ovate or elliptic, 10-20cm long, dark green with yellow-green veins. Male flowers smaller in size than the female ones. Fruits small, globular, stalkless pairs, red, cherry-like.

Habitat & Distribution

Cultivated, it is ideal for parks, gardens roadsides and large courtyards near sea. Grows well in full sun and has a very long life. Tolerates salinity. Flowering in the spring. Common in the UAE: Al Ain, Abu Dhabi, Dubai and Fujairah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, widely spread ornamental plant.

MORACEAE
Ficus religiosa **L.**

LESAN AL-ASFOR
لسان العصفور

Large, evergreen tree, 4-8 meters high, with a broad, rounded crown, much-branched from a short, heavily fissured trunk. Leaves large, simple, deltoid-ovate, 5-15cm long and 4-10cm wide, cordate at the base and ending in a long narrow tip; upper surface shining, lower dull. Petioles slender, 3-8cm long. Stipules yellowish-brown, shortly ciliate, about 1cm long. Receptacle spherical. Inflorescence monoecious. Male flowers tiny, very few. Perianth segments 3, ovate. Female flower larger, perianth segments 5, lanceolate. Fruit small, globous, dark-purple, 1-1.5cm in diameter.

Habitat & Distribution

Cultivated in the desert regions, gardens, parks and roadsides near the sea. Flowering in spring. Common in the UAE: Al Ain, Abu Dhabi and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, widely spread ornamental plant.

MORNIGACEAE
Moringa peregrina (Forssk.) Fiori

SHEYOA
الشوع

Attractive, grey tree, 2-4 meters high, with numerous leafless slender branches with whip-like appearance. Leaves few, those when present consisting of 3 pairs, rush-like, oblong, obtuse, leaflets. Flowers pedicelled, 1cm in diameter, usually appear on the tree before leafing. Calyx cup-shaped, 5-lobes, reflexed, unequal, petaloid 0.4-0.8cm long. Petals 5, unequal, white, heavily tinged with purple near centre, 0.6-1.0cm long. Pod 15-25cm long, pendulous, with 3, rounded angles and 6-grooves. Seeds angled, nutlike, white and rich in oil (ben-oil).

Habitat & Distribution

In mountains, steppic regions and salty wadis. Flowering from February to April. Rare in the UAE: Sham, Dibba to Fujaira Road, Ajman and Al Ain.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, ornamental plant with several known medicinal uses in the region.

MUSACEAE
Musa paradisiaca **L.**

MOZ
موز

Perennial, rhizomatus food plant, treelike herb, up to 9 meters high, with spirally arranged leathery green leaves with obvious midrib, forming a slender trunk by their sheathing bases. Flowers yellow; bracts violet, mostly once-blooming plants. Sepals and petals 3. Stamens 6. Ovary inferior, 3-celled. Fruit is the well known banana. The unripe fruit is rich in starch, which on ripening turns into sugar.

Habitat & Distribution

Cultivated in warm and humid regions, with many hybrid cultivars, that tolerate salinity and adverse soil conditions. Flowering in spring. Banana plant uncommon in the UAE: found in Dubai, R'as al-Khaimah, Dibba and Fujiairah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant fruit tree.

MYRTACEAE
Callistemon citrinus **Stapf.**

FERSHET AL-ZEJAJ
فرشة الزجاج

Evergreen, woody shrub or small tree, 2-4 meters high, bears pendulous magnificent long-stamened, mostly red flowers in dense cylindrical spikes. Tips of flower spike continue to grow as leafy shoots, leaving long-lasting, woody seed capsules that become half embedded in the thickening branch. Leaves linear, oblong, pointed, entire, arranged alternately, glossy, 2-5cm long. Calyx-tube adherent to ovary, cleft in small lobes. Stamens numerous, free, showy, red.

Habitat & Distribution

Cultivated, grows well in coastal tough conditions where soil is saline, poor and dry. Flowering in the spring. Common in the UAE: Al Ain, Abu Dhabi, Dubai, and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, very common ornamental plant.

MYRTACEAE

Eucalyptus camaldulensis **Dehnh.**

KINA

كينا

Evergreen, large tree, 5-18 meters high. Quick-growing, bark smooth, whitish and deciduous. Branches many, spread with leaves contain aromatic oil. Leaves mostly large, alternate and vertical, rigid, pinnate-veined, linear-oblong, grayish-green, entire, 3-10cm long. Flower usually 3 or more together in umbels or heads. Receptacle adnate to the ovary at the base. Petals united with calyx lobes to form a lid or cap which opens transversely, lid mostly pointed or beaked. Stamens many. Ovary 3-6 celled. Fruit a small globular capsule usually partly enclosed in the calyx tube.

Habitat & Distribution

Cultivated and suited to dry climates. Tolerates drought and salinity. Flowering March - May. Common in the UAE: Al Ain, Abu Dhabi, Dubai, Dhaid and Ajman.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, ornamental plant with known folk medicinal use.

MYRTACEAE
Myrtus communis **L.**

MERSIN, YASS
مرسين، ياس

Dense evergreen, aromatic shrub, 1.5-3 meters high. Twins many, tetragonal. Leaves opposite, coriaceous, short-petioled, ovate-lanceolate, acuminate, pellucid-dotted 1-3cm long. Flowers white, regular, hermaphrodite. Peduncles solitary, axillary, shorter than leaves. Calyx tube globular, limb 5-parted. Petals 5, spreading. Stamens numerous in several rows. Berry blackish-blue, edible, about 1cm in diameter.

Habitat & Distribution

Cultivated with several cultivars. Grows in gardens, parks and roadsides. Needs full sun and tolerates salinity and dry conditions. Flowering in the spring. Common in the UAE: Dubai, Al Ain, Abu Dhabi, and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, ornamental plant.

NYCTAGINACEAE
Bougainvillea glabra **Choisy**

JAHANMIYA
جهنمية

Woody climber, weakly spiny shrub with a very tangled, twiggy branch structure. Leaves alternate, petiolate, ovate to elliptic, 1-4cm long, entire, acuminate at the apex. Inflorescences axillary or terminal, pedunculate, solitary in cymose groups, each mostly of 3 large coloured bracts, 2-4cm long and 1-3cm broad, usually purple or white or variously coloured, each bearing a flower in the ventral surface near the base. Calyx petaloid of 5-sepals, united below into a long cylindrical tube.

Habitat & Distribution

Cultivated as garden climber and found growing near buildings. Needs full sun and tolerates salinity. Flowering for a long period. Very common in the UAE: Al Ain, Abu Dhabi, Jebal al-Dhana and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, very common and successful ornamental plant.

OROBANCHACEAE

Cistanche tubulosa (Schrenk) Wight

Syn: C. lutea Wight

THANON

ذانون

Parasitic, fleshy herb, yellowish-brown, 20-60cm high. Stem erect, simple, thick. Leaves present, alternate, scale-like, 2-4.5cm long, 1-2cm wide. Floral part ¼-½ of the height of the erect palnt; inflorescences racemes. Flowers 2-4cm long, compact, in dense spike. Bract ovate-lanceolate, 1-2cm long. Calyx 5-lobed, united below, obtuse, lobes 1-2cm long about 1cm wide. Corolla oblique campanulate or funnel-shaped, usually yellowish with purplish lobes, 2-4cm long, 1.5-2cm broad at the mouth. Stamens 4 didynamous. Stigma 2-lobed not deeply divided. Capsule 1.5-2cm long, ovoid-oblong, beaked, many seeded.

Habitat & Distribution

Along coastlines and roadsides. Flowering from January to March. Very common in the UAE: Al Ain, Abu Dhabi, Liwa, Dubai and Ajman.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, weed plant with several known folk medicinal uses.

OXALIDACEAE
Oxalis corniculata **L.**

HAMIDAH
حميضة

Annual or perennial, creeping herb, up to 20cm high. Stems many, procumbent, spreading mat-like, pubescent, rooting at the nodes. Leaves on long petioles, 3-foliolate, digitate; leaflets obcordate, 8-20mm long, deeply emarginated, tomentose on the lower surface. Stipules auricluate. Flowers 1-6, in umbel-like cymes on axillary peduncles. Flower yellow, about 1cm long. Sepals minute, lanceolate, acute. Petals 8-10mm long, with rounded apex. Stamens 10. Capsule cylindrical, 1-2cm long, 5-furrowed. Seed tiny, ovate, compressed.

Habitat & Distribution

A weed in gardens and orchards and along roadsides, waste and salty places. Common in the UAE: Al Ain, Abu Dhabi, Dubai, Sharjah and Umm al-Qaiwain.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant weed without a known significant use.

PALMAE (Arecaceae)
Cocos nucifera **L.**

JOZ NARJIL, JOZ AL-HIND
جوز نرجل، جوز الهند

Coconut palm widely spread into all tropical humid regions, especially along the sea shore. It is a tall unbranched, erect tree, 10-18 meters high, with a somewhat thickened base and tipped by majestic crowns of glossy leathery pinnate or feathery leaves, each 3-5 meters long. Inflorescence usually aggregated in a terminal mass, often complex, branching of many spicate. Flowers small, an oblong sheath protects the flowers. Calyx and corolla mostly similar, trimerous. Stamens free or united, 3 or more. Fruit edible nuts, inside a large yellow-brown husk, 10-15cm across.

Habitat & Distribution

Cultivated, tolerates dry, saline and hot conditions. It is an ideal plant for avenues, gardens and streets near the sea. Flowering in the spring. Common in the UAE: Abu Dhabi, Dubai and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity. Ornamental and fruit tree.

PALMAE (Arecaceae)
Phoenix dactylifera **L.**

NAKHIL AL-TAMER
نخيل التمر

Dioecious tree 6-18 meters high, with single slender unbranched stem. Leaves pinnatisect, 2-3 meters long, glaucescent, oblong-lanceolate in outline, feather like, with a thick rachis; leaf segments linear-lanceolate, acuminate. Inflorescence much branched spadix, enveloped in a simple spathe before flowering. Male and female flower perianth similar of 3-free valvate segments. Fruit a 1-seeded ovoid berry, date edible. Seed with a longitudinal furrow.

Habitat & Distribution

Cultivated or wild and probably indigenous in salty marshes in the deserts. Tolerates dry, hot and saline conditions. It grows well in orchards, avenues and streets. Flowering from April to May. Very common in the UAE: Al Ain, Abu Dhabi and Dubai.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity. Very valuable ornamental and fruit tree.

PLANTAGINACEAE

Plantago boissieri **Hausskn. & Bornm.**

RIBEL

ريل، لسان الحمل

Low annual, stemless herb, 6-20cm high. Leaves and scapes villous with fine silky hairs. Leaves rosulate, linear-lanceolate, entire, acute, 6-12cm long. Spikes long-cylindrical, 3-8cm long, densely villous with minute flowers. Bracts obovate, scarious margins. Sepals elliptic, scarious margined, villous at margins and apex. Corolla lobes ovate-oblong, acute. Stamens many, exeserted at maturity with filaments. Capsule ellipsoid, 2-seeded. Seed oblong, boat-shaped, tiny, brown.

Habitat & Distribution

Desert plant, sandy soil and salty places. Flowering from February to May. Common in the UAE: Al Ain, Dubai, Shwayb, Madam and Dhaid.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable herb with several known uses in folk medicine.

PLUMBAGINACEAE

Limonium axillare (Forssk.) O. Kuntze

SHELIALAH

شليلة، قطف

Dwarf shrublet, forming clumps 30-70cm high, usually with woody rootstock and many erect branches, older branches without leaves. Leaves grayish-green, fleshy, fascicled, oblanceolate-spathulate, 1.5-4cm long and 0.4-0.8cm broad, with a short petiole or sessile, mostly punctate or with glands secreting salts. Flowers many, small bracteates, in dense spikelets in a naked terminal panicle. Calyx tiny, nearly plicate, hairy below, with white limb. Corolla purple, longer than calyx, deciduous. Fruit circumscissile.

Habitat & Distribution

The plant grows in saline areas along both coasts and at sabkha edges around Al Ain, Liwa and Sueyhan. Flowering from January to June. Common in the UAE: Al Ain, Abu Dhabi, Dubai, and north part of UAE.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity.

POLYGONACEAE
Calligonum comosum **L'Hér**

ARTA
الأرطى

Woody, deciduous shrub, 50-150cm high, much branched, glabrous, with whitish older branches, swollen and knotty at the nodes and younger slender green branchlets. Leaves if present minute, filiform, adnate to the ochrea. Pedicels equal or longer than perianth. Perianth lobes small, white-pinkish, oblong, obtuse. Achenes red or greenish, 1-1.5cm long, 0.5-1cm broad, ovate, covered with rough branching bristles arising from 4-pairs, jointed short longitudinal wings.

Habitat & Distribution

Sands and sand dunes and salty places Flowering from February to April. Common in the UAE: Sharjah, Dhaid, Al Ain, Giathy and Liwa.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, grazed by animal, used for fuel and as an ornamental plant. One of the old well-known plants in folk medicinal use.

POLYGONACEAE
Calligonum crinitum **Boiss.**

ABEL
أبل

Large shrub, 50-180cm high, with stout, coiled, grey-whitish stems and branches. Young shoots, slender, flexible, green, swollen and knotty at the nodes. Leaves mostly absent; ochrea entire, cup-like. Flowers solitary or 2-3 at the nodes. Perianth tiny lobes, oblong, obtuse, white-pink, with darker median vein. Achenes oblong, yellowish-green, 1-1.5cm long, covered with simple, long, soft, branched spreading bristles.

Habitat & Distribution

Sand and sand dunes and salty places. Flowering from January to March. Uncommon in the UAE. Also cultivated along the roadsides in Sharjah, Dubai, Abu Dhabi, Jebel al-Dhana and Sila.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity, grazed by animal, used for fuel and as an ornamental plant. One of the old well-known plants in folk medicinal use.

PORTULACACEAE
Portulaca oleracea **L.**

BARBIR - FREFRO
بربير، فريفرو، رجلة

Prostrate, annual, fleshy herb, about 40cm across. Stem glabrous, cylindrical, much branched, greenish-red, swollen at nodes. Leaves fleshy, subsessile, alternate or subopposite, obovate or spathulate, rounded at apex. Stipules absent. Inflorescence in terminal heads. Flowers yellow, small, sessile, in clusters on tips of branches, opening on sunny mornings. Calyx 2 sepals, unequal, obtuse. Petals 5, yellow, 0.4-1cm long, united at base, obovate-oblong. Stamens 7-12. Ovary ovoid; style short with 3-6 branches. Capsule 0.5-1.3cm long, obovoid, circumscissile. Seeds many, small, reniform, black, tubercled.

Habitat & Distribution

Grows in irrigated fields and orchards as a weed. Also found on the sea coast. Flowering from November to June. Common in the towns of the UAE: Al Ain, Dubai, Abu Dhabi, and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, edible and gazable herb, used for greening of water-front areas, widely used in folk medicine.

PORTULACACEAE
Portulaca quadrifida **L.**

REJELA
رجلة

A low, annual, succulent herb with adventitious roots from the lower nodes. Stem diffuse or prostrate, up to 20cm across, jointed, swollen at nodes. Leaves small, opposite, glabrous, ovate to lanceolate, acute. Flowers small, solitary, terminal, surrounded by 4 leaves, with short pedicel. Sepals 2, oblong, acute. Petals 4, yellow, minute, obovate, united with sepals at base. Stamens 8-12; filaments filiform, unequal. Stigmas 4. Capsule small, acute at apex, circumscissile; seeds small, reniform.

Habitat & Distribution

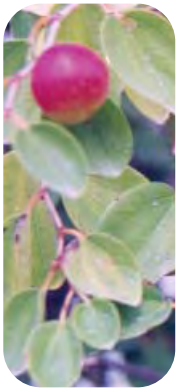
It grows in plantations, fields and also in salty places. Flowering from November to June. Uncommon in the UAE: found in Al Ain, Dubai, Abu Dhabi and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, gazable herb, used for greening of waterfront areas, also used in folk medicine

RHAMNACEAE
Ziziphus spina-christi (L.) Willd.

SIDR, NABEJ
سدر، نبق (نبج)



Evergreen shrub or tree, 2-6 meters high, with main trunk, branches spiny, elongate, spreading, somewhat divariacate, glabrous or thinly hairy. Stipular spines 2, one straight and the other curved. Leaves ovate-oblong to elliptic, rounded at the base, 2-4cm long, 1.5-3cm wide, entire or with crenulate margins, 3-nerved at base. Pedicels short, tomentellous. Flowers minute, in groups of 3-8 together in axillary cymes, yellowish-green. Calyx tomentose on the outer surface, lobes acute. Petals small, shorter than sepals, nearly spathulate, concave. Fruit drupe, ovoid-globular, orange-yellow to brown, glabrous, 8-10mm in diameter, edible.

Habitat & Distribution

In the desert regions, wadi beds, coastal foothills, also cultivated on the alluvial plain. Flowering from September to April, also in other seasons. Very common in the UAE: Al Ain, Dubai, Abu Dhabi, Sharjah and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, fruits are edible and extremely rich in vitamin C, used as an ornamental and for sand movement control.

RHIZOPHORACEAE

Rhizophora mucronata **Lam.**

GURM AHMER

قرم أحمر

These remarkable trees grow on stilt roots in shallow tidal coastal waters and gradually reclaim land from the sea. The tree, 2-6 meters high, with densely branches. Leaves opposite, simple, elliptic, entire, coriaceous, broadly pointed at apex, 5-12cm long and 2-5cm broad. Flowers few, axillary with 4 oblong, leathery sepals. Petals entire, hairy inside. Ovary inferior. The seeds ovate to globular, large, germinate before falling from the tree.

Habitat & Distribution

Cultivated on muddy shores, found in few coastal regions in the UAE, Flowering in April to June. Tolerate salinity. Uncommon in the UAE: found in Abu Dhabi, Dubai and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater level. Important in environmental rehabilitation of coastal areas, and as a source of wood in some parts of the world.

RUBIACEAE
Gaillonia aucheri (Guill.) Jaub. & Spach.

KHURMAN
خرمان

Low, white-silver, woody shrub, up to 1.5 meters, with unpleasant smell, much branched from above, with thick woody base; ends of braches sharp pointed or spinescent. Leaves opposite or in threes, dark-grey, small, cylindrical, linear or needle-like, 0.5-1.5cm long. Flowers small, axillary and terminal, with white petals. Calyx 2-5 toothed with long white hairs. Corolla funnel-shaped, 5-lobed. Fruit tiny, surrounded by long feather-like hairs.

Habitat & Distribution

In the salty wadis, hillsides, sandy-gravelly soil. Flowering in the spring. Uncommon in the UAE: found in Al Ain, Masafi and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, used in folk medicine.

SALVADORACEAE
Salvadora persica **L.**

MUSWAK, ARAK
مسواك، آراك

Glabrous, large, evergreen, straggling shrub with opposite, whitish branches, 2-4 meters high. Leaves a pale green, coriaceous, 2.6cm long, and 0.8-2cm wide, elliptic-ovate, entire, acute, tapering at base on petiole 1-1.5cm long. Racemes spike-like, forming a leafy panicle. Flowers greenish-yellow, small. Calyx 4-5 lobed, bell-shaped, minute. Corolla 4-lobed, twice as long as calyx. Stamens 4, shorter than the corolla lobes. Fruit a drupe, 2-6mm in diameter, globose, smooth, red or orange, edible.

Habitat & Distribution

Frequently cultivated in many salty regions of all the UAE, especially in western dunes, also in wadis and coastal areas as windbreak along the roadsides and also found as a wild escapee. Flowering in spring. Very common in the UAE: Al Ain, Dubai, Abu Dhabi, Sharjah and Giathy.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity, lightly grazed by camels and goats, fruits are edible, used in landscaping. The plant has many known medicinal uses.

SAPINDACEAE

Dodonaea viscosa **(L.) Jacq.**

MESHRASS

مشراس، شَحْص

Compact evergreen, much-branched, viscid shrub, up to 2 meter high with smooth, angular branches. Leaves simple, glabrous, glossy, viscid, oblong or elliptic, entire, obtuse, with clear midrib and veins, 2-10cm long and 0.5-2cm broad. Flowers greenish-yellow, in terminal and axillary clusters. Sepals 4, ovate, united at the base. Stamens 6-10, free. Fruit 2-4 valved, capsule, 1-2cm long, flat, orbicular to obcordate, deeply emarginate, with 3 broad membranous wings. Seeds sub-globose, small black.

Habitat & Distribution

Cultivated as an ornamental plant mostly in salty places. Flowering from February to April. Uncommon in the UAE: found in Al Ain, Abu Dhabi, Dubai and Sharjah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, widely used in landscaping and reclamation of salty soils, wood is used in many handcrafts. The plant has many folk medicine uses.

SOLANACEAE
Lycium shawii **Roem. & Schult.**

AWSAJ, SERIM
عوسج، صريم

Rigid, erect, spinous shrub, 1-3 metes high. Stems much branched and varying in spine size, 1-2cm long, mostly pubescent. Leaves elliptical-oblanceolate to spathulate, obtuse or acute, tapering at the base to a short petiole, 1-3cm long, 0.3-1cm wide. Flowers solitary or in clusters, 1-3 flowered. Peduncles 1-9mm long. Calyx narrowly tubular, minute, with 5 equal teeth. Corolla 10-16mm long, tubular, with the obtuse lobes of the limb 1-3mm, variable in colour, white, pink to purple. Stamens unequal, exceed petals. Berries red, of pea-size, edible.

Habitat & Distribution

Desert plant. Flowering most of the year around. Common in the UAE, cultivated in nurseries or in salty regions. Found in Al Ain, Dubai, Ajman, Dhaid, Shwayb, Tarif and Giathy.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, grazed by camels, used in landscaping and fencing. Many folk medicinal uses are cited for this plant.

TAMARICACEAE
Tamarix arabica **Bunge**

TARFA
طرفة، أثل

A bush or small tree, variable in size. Branches slender, with brown or red-brown colour. Leaves partially encircling stem with at least a short triangular blade. Racemes loose, 1.5-4cm long. Pedicels shorter than calyx. Bracts longer than pedicels. Petals minute, obovate-oblong, pink to white. Stamens, 5-free, filaments inserted into the deeper notches of the disk. Fruit small, pyramidal, reddish-brown, tapering to apex with 3 stigmas. Seeds many, with terminal tuft of hairs.

Habitat & Distribution

Sandy places, along roadsides and camp edges mostly in saline regions. Flowering from February to May. Common in the UAE: Al Ain, Dubai, Al Waggan, Sharjah and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant up to seawater salinity. Ornamental plant, historically known in folk medicine uses.

TAMARICACEAE

Tamarix aucheriana (Decne ex Walp.) Baum

ATHEL
أثل

Large shrub or bush, up to 3.5 meters high, with deep purple to blackish-purple bark. Leaves small, alternate, sessile, fleshy, scale-like, strongly clasping stem. Racemes 2-6cm long. Flowers many, small in size. Petals 5, tiny, pink, obovate-elliptic, imbricate. Stamens 10-13, free, inserted on a glandular, crenate, 10-lobed, fleshy disk. Style very short; stigmas 3. Fruit pink, pyramidal, 3-valved capsule, 4-9mm long. Seeds many, with terminal tufts of hairs.

Habitat & Distribution

Saline regions (sabkhas) and roadsides. Flowering from April-October. Common in the UAE: Al Ain, Dubai, Sharjah, Dhaid, Jebel al-Dhana and Umm al-Qaiwain.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant, Ornamental plant, historically known in folk medicine uses.

VERBENACEAE
Avicennia marina (Forssk) Vierh.

GURM
قرم، شورة

Despite the harsh hot-dry environment of the Arabian Gulf region, mangrove stands can be found scattered along the Gulf. This is considered the maximum northern distribution of the mangrove forest. *Avicennia marina* is the only species of mangrove present in the region. The stands of *A. marina* are poorly developed. Generally, trees only grow to 3-4m in unprotected areas due to by heavy grazing of camels. Even the tallest trees are less than 8m high due to the high salinity of the seawater.

Although mangroves are stunted in the region, Arabian people well understand the important role of mangroves. In the past, mangrove poles were commonly used as building materials for local houses and masts for ships. Today, fishermen know that the mangrove ecosystem is also important for the preservation of fishing grounds.

In general, *A. marina* is found below the high water mark along the shores of the oceans and seas from East Africa to New Zealand. The species has adapted to life in extreme habitats in a number of ways; one of the most characteristic being the presence of erect outgrowths of the roots called pneumatophores or breathing roots. These stick out above the water and absorb air, which is then transported to the roots in the poorly aerated mud beneath.

Description

Seashore trees, 1.5 to 5m tall, mealy-tomentose. Pneumatophores 10-20cm. Leaves opposite, oblong, elliptic or obovate, entire, acute, 3-7cm long, 1-3cm broad, tapering at base to a short petiole, coriaceous, green on upper face, greenish-white on the lower, turning somewhat blackish when dried. Flowers small, sessile, in dense heads at the apex of short-peduncled cymes. Bract and two bracteoles concave, ovate. Calyx lobes ovate, obtuse, tomentose on the back. corolla about 5mm long, yellow, with four subequal spreading lobes. Capsule almond-shape, 1.5 to 2cm long, pale green or grayish, tomentose.

Habitat & Distribution

Mangrove grows in 17 documented localities in the UAE, of which 16 are along the Gulf coast and one on the eastern coast on the Gulf of Oman near Khor Kalba. Mangrove stands are associated with tidal flats that developed along the shores of lagoons or islets within the lagoon (Embabi 1993). They are usually found in areas sheltered from strong wind and wave action. Dense stands of mangroves are common in some tidal lagoons between Jebel al-Dhana and north of Abu Dhabi Island, near Dubai, Rams, Ra's al-Khaimah and Khor Kalba. Flowering from April to July; fruit remains on tree until October or November.

Mangrove stands are under increasing pressure from environmental and development constraints. The main environmental factors limiting mangrove growth at UAE are threefold.

1. *Water characteristics*. Salinity and temperature of water are particularly important for mangroves. Very high salinity, over 50,000 ppm, of the Arabian Gulf may limit the growth and distribution. Strong water currents

are also detrimental to mangroves. Some evidence suggests that fresh water influx to mangrove stands is necessary for healthy growth.

2. *Climatic conditions*. Temperatures above 45°C in summer and below 8°C in winter limit mangrove growth. High atmospheric humidity and frequent fog and dew may play an important role in enhancing mangrove growth in the Arabian Gulf.
3. *Geomorphological aspects*. Highly alkaline soils (pH 8-9) with little organic matter restrict mangrove growth. Lagoons, the most common habitats for mangroves in the UAE, provide shelter from drastic environmental changes. Alteration and destruction of such habitats is detrimental to their well being.

Human activities can influence mangroves in either a positive or a negative manner. Establishment of nurseries and expansion of mangrove stands are two positive influences. Negative influences are related to short- and long-term activities such as:

- Dredging (ongoing in many areas)
- Pollution from various sources, including oil refineries, land-based desalination plants and petrochemical factories
- Dumping of sewage
- Dumping of earth materials into shallow mangrove habitats

Estimated Salinity Tolerance and Potential Uses

Extremely salt-tolerant to seawater salinity. Important plant in coastal environment rehabilitation. Used for wood production and as forage, particularly for camels. Also used in folk medicine.

VERBENACEAE
Lantana camara **L.**

MEINA
مينا

An evergreen shrub, 1-3 meters high, with numerous branches, mostly with rough, prickly feeling leaves. Leaves opposite, ovate 3-6cm long, short-petioled, crenate-dentate, thickish, wrinkled-scabrous above, hairy beneath. Flowers in dense heads, flat-topped on rigid axillary peduncles. Calyx minute, truncate. Corolla limb colour ranges from yellow to pink, spreading, oblique, nearly 2-lipped, with 4-5 broad obtuse lobes. Fruit small, drupe-like, with 2-nutlets, purple-blackberry.

Habitat & Distribution

Cultivated as an excellent border plant or as decorative plant in full sun or shade. Flowering in May to June. Tolerates salinity and dry conditions. Common in the UAE: Al Ain, Abu Dhabi, Dubai and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant up to half seawater salinity. Ornamental plant.

VERBENACEAE

Lippia nodiflora (L.) Michx.

Syn: Phyla nodiflora (L.) Greene

BERBIN AL-JEDIE

بربين الجدي

Perennial herb, mat-shaped, prostrate, trailing, rooting at nodes, hairy, up to 40cm across. Stems angular, much branched, hairy. Leaves opposite, simple, short-petioled, spathulate, acutely serrated above, with clear nerves. Peduncles long, solitary, axillary. Spikes dense, many flowered, ovoid to cylindrical. Flowers, small, bracteate. Calyx bilobed, membranous. Corolla 4-lobed, funnel-shaped, pinkish. Stamens 4, didynamous. Stigma capitate. Fruit a drupe, rounded, yellowish.

Habitat & Distribution

Weed of wet, salty areas, in fields and gardens. Flowering from September to March. Common in the UAE: Al Ain, Dubai, Abu Dhabi, Sharjah and Ajman.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant plant, used in folk medicine.

ZYGOHPYLLACEAE
Seetzenia lanata (Willd.) Bullock

ABU-SHOUKA
أبو شوكة

Perennial, prostrate, glabrous or pappillate, glaucous herb, usually woody at base, up to 30cm across. Stem and branches terete, articulate, somewhat swollen and lanate at nodes. Leaves opposite, trifoliate; median leaflet larger, obovate, cuneate, apiculate; lateral leaflets oblique, smaller, subsessile. Stipules interpetiolar, triangular, ciliate. Flowers solitary, axillary 4-5mm long, on short pedicels. Sepals tiny, oblong. Petals absent. Disk 5-lobed. Stamens 5. Fruit an ellipsoid-ovoid capsule, 6-9mm long, 4-6mm wide, obtuse, pentagonal, pendulous. Seeds elliptical, small, brown to black, flat.

Habitat & Distribution

Desert plant, mostly in rocky or salty wadi beds. Flowering from March to May-November. Uncommon in the UAE.

Estimated Salinity Tolerance and Potential Uses

Moderately salt tolerant, grazable herb.

ZYGOHPYLLACEAE
Tribulus terrestris L.

KUTOB, HISEK
قطب، حسك

Low, annual, grey-green, pilose herb. Stems prostrate, with spreading branches, up to 40cm across. Leaves opposite, 4-8cm long, unequal; leaflets 3-8 pairs, 3-7mm long, oblong, mucronate, hairy beneath, less above, rounded-oblique at the base. Peduncles, 6-12mm long. Flowers solitary, axillary or leaf-opposed. Sepals minute, lanceolate, acute, hairy. Petals yellow, 4-8mm long obovate. Stamens 10; stigma subsessile, mostly pyramidal. Fruit globose in outline, 6-8mm in diameter, somewhat keeled and crested at back, with 2-4 straight, terete, strong, long, prickles.

Habitat & Distribution

A weed in fields, orchards, salty wadis and desert roadsides. Flowering from February to April and September to November. Very common in the UAE: Al Ain, Abu Dhabi, Dubai, Hatta, Khor Kalba, Ajman and R'as al-Khaimah.

Estimated Salinity Tolerance and Potential Uses

Highly salt tolerant, grazable plant with many known uses in folk medicine.

ZYGOPHYLLACEAE

Zygophyllum hamiense **Schweinf.**

HARM

هرم

Pale-green, glabrous, woody based shrublet, up to 70cm high. Stems erect, much branched, with internodes slightly swollen at joint. Leaves 1-foliolate or sometimes 2-foliolate in younger plants; leaflets fleshy, terete, or cylindrical, 1-2cm long, on fleshy stalk, light or dark green or sometimes yellow, glossy. Stipules triangular, membranous. Flowers small, solitary at each node, peduncle short cylindrical. Sepals small, ovate. Petals 5, white, spathulate, 3-5mm long. Stamens protruding, exceeding the petals. Capsules soft, tubular, leaf-like, cylindrical, angled, 8-18mm long.

Habitat & Distribution

Shallow sand and overlying saline regions. Flowering time variable mostly from September to March. Very common all over the UAE: abundant along the Arabian Gulf coast, throughout western dunes and saline plains, and across the central desert.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant, grazed by camels, very common in folk medicine.

ZYGOPHYLLACEAE
Zygophyllum simplex **L.**

QARMAL
قرمل، هريم

Low, succulent, annual herb. Stems forming prostrate mat, circular in outline, up to 25cm across, dichotomously branched: branches many, slender, reddish or green. Leaves 1-foliate, small, succulent, ovoid-cylindrical, obtuse. Stipules, membranous. Peduncles short. Flowers axillary, solitary or in pairs, yellow, 3-5mm long. Sepals 5, caducous, obovate, with scarious margins. Petals, spathulate, long-clawed. Disk fleshy, angled. Stamens 8-10. Stigma persistent. Capsules small, deeply 5-lobed, obovoid. Seeds minute, fusiform, smooth.

Habitat & Distribution

In salty regions and on shallow sand. Flowering from March to June. Very common in the UAE.

Estimated Salinity Tolerance and Potential Uses

Extremely salt tolerant, grazed by camels, very common in folk medicine.

APPENDIXES

Glossary

Achene	1-seeded dry indehiscent fruit
acuminate	Long-pointed, with point narrow
acute	Pointed
adnate	Attached the whole length
alternate	With 1 leaf at each stem node and pointing in different directions
anther	The male part of a flower, containing pollen
aristate	With a bristle-like projection
awn	Bristle-like projection, as in the flowering parts of grasses
berry	Fleshy, single- to many-seeded fruit
bifid	Split deeply in two
bract	Scale or leaf-like upper leaf surrounding a flower or inflorescence
bracteole	Small scale-like, often membranous bract, occurring on flower stalks
bulb	Underground organ composed of densely packed fleshy scale leaves
calyx	The sepals as a whole; either composed of spreading or reflexed free sepals, usually green in colour, or else combined into a calyx tube
campanulate	Bell-shaped
capitate	Shaped like a head, head-like
capsule	Dry fruit, consisting of several carpels, opening by pores or slits
cone	The 'fruit' of coniferous trees, consisting of numerous overlapping woody scales
connate	Joined together at the base
cordate	Heart-shaped, with the point at the tip
corolla	The petals as a whole, free or combined
crenate	With a notched or scalloped margin
culm	Flowering stem of grasses

cyme	Inflorescence with growing points terminated by flowers, and having a terminal flower
dentate	Toothed
dichotomous	Branching into two
dioecious	Male and female flowers on different plants
drupe	Fruit with a fleshy exterior and inner stone-like wall to the seed
emarginated	Notched
epicalyx	Calyx-like structure of several bracts close under the calyx
filament	The stalk below the anther in a stamen
follicle	Fruit consisting of 1 carpel which opens only along 1 side
glabrous	Without hairs of any sort
glandular hairs	Have a small gland at the tip
glume	Tough, membranous leaf-like part of the flowers of grasses, often with an awn
halophyte	Plant of salty soil
head or capitulum	Flowers are densely packed into a compact head
imbricate	Overlapping
inflorescence	A flower branch, or the part of the stem that carries the flowers
involucre	A collection of bracts
keel	The lower petal and the wings are the two side petals (eg, *Leguminosae*)
lanceolate	Spear-shaped
leaf axil	Angle between leaf and stem
leaf blade	The broadened lower part of a leaf, usually flat
leaf sheath	The broadened lower part of a leaf which encloses the stem in a tube or pouch
leaflet	Part of a compound leaf
lemma	A bract in the grass family
ligule	A small extension at the junction of leaf sheath and blade (eg, in grasses)

limb	The broader part of a petal
lobed	Divided, but not into separate parts; some leaves have an enlarged terminal lobe
mericarp	1-seeded section of a dry fruit
monoecious	Flowers occur on the same plant, male and female
nectary	Nectar-secreting glands that occur in various parts of the flower and attract insects
obcordate	Heart-shaped, with the stalk in the notch, opposite to cordate
obovate	Egg-shaped but upside down, with the broadest part above
opposite	With 1 leaf on either side of the same stem node
ovate	Egg-shaped
palmate or digitate	Branched or lobed like the fingers of a hand
panicle	Branched inflorescence with stalked flowers
pappus	Hairs or bristles on the fruit of many compositae, taking the place of the calyx
paripinnate	Pinnate without a terminal leaflet (ie, the number of leaflets is even)
pedicel	Stalk of a flower in an inflorescence
peduncle	Stalk of a flower or inflorescence
petal	An inner perianth segment; petals are usually brightly colored and surround a flower's reproductive organs
petiole	Stalk of the leaf blade
pinnate	In two opposite rows along a common axis (eg, of compound leaves)
pinnatisect	Pinnately divided almost to the midrib, but not into separate leaflets
pod	Dry fruit consisting of one carpel, opening by a seam around both sides
prickles	Hard, prickly outgrowths of the outer surface of leaf and stem
procumbent	Growing along the ground

raceme	An elongated inflorescence with stalked flowers, usually with a terminal flower
reniform	Kidney-shaped
reticulate-veined	With veins in a network
rhizome	Rootstock, a creeping underground stem
rosette	An arrangement of leaves, usually at the base of the stem
sagittate	Arrow-head shaped
scarious	Thin, dry and not green
schizocarp	A dry fruit that falls into several-seeded sections (mericarps) with ripe
sepal	An outer perianth segment; known as calyx
serrate	Saw-edged with sharp teeth
sessile	Without a leaf stalk
siliqua	Fruit of the Cruciferae - more than three times long as wide
spadix	A fleshy spike, often with a club-shaped appendage at the tip
spathe	A sheath enclosing an inflorescence
spathulate	Spoon-shaped
spike	Elongated inflorescence with sessile flowers
stamen	The pollen-bearing male organ of a flower, consisting of a filament and an anther
staminode	A modified stamen which does not contain pollen
stigma	Tip of the style which receives pollen
stipule	Scale-or leaf-like appendage at the base of the petiole, usually paired
style	The stalk that connects the ovary and stigma in the female flower; styles lie in the centre of the flower
tendril	Fragile structure, often spirally twisted, for attachment, developed out of a leaf or leaflet-
terete	Circular in cross-section
throat	Limb or mouth of corolla

trifoliate	Having 3 leaflets
tuber	Fleshy thickened part of root or stem
Tubercle	A small swelling
Umbel	Umbrella-shaped inflorescence, with flower stalks all rising from the same point
Unisexual	A flower either with stamens (male flowers) or with ovaries (female flowers) only
Villous	Long, woolly, hairy, shaggy
Viscide	Sticky
whorled or verticillate	Describes an arrangement with more than 2 leaves or flowers at each node
Xerophyte	A plant of dry and habitat (eg, desert)
Zygomorphic	Corollas divided into equal halves by one plane only, upper and lower parts are different

List of Arabic and Scientific Names

ABEL	*Calligonum crinitum*
ABU-GROON	*Pergularia tomentosa*
ABU-SHOUKA	*Seetzenia lanata*
AL-MUKHIAT	*Cordia sebestena*
ALQA	*Dipterygium glaucum*
AL-SHAMSIA	*Thespesia populnea*
AMBAR	*Acacia farnesiana*
ARA	*Aerva javanica*
ARAK	*Salvadora persica*
ARAUCARIA	*Araucaria excelsa*
ARTA	*Calligonum comosum*
ASAL	*Juncus rigidus*
ASHKHAR	*Calotropis procera*
ATHEL	*Tamarix aucheriana*
AWSAJ	*Lycium shawii*
BERBIN AL-JEDI	*Lippia nodiflora*
BINT AL-BASHA	*Ipomoea palmata*
BOSS	*Phragmites australis*
CASUARINA	*Casuarina equisetifolia*
CHEHIL	*Arnebia hispidissima*
DAMAS	*Conocarpus lancifolius*
DEDMAN	*Gisekia pharnacioides*
DEMRAN	*Halothamnus bottae*
DHAFRA	*Tephrosia apollinea*
DHEFLA	*Nerium oleander*
EALAN	*Moltkiopsis ciliata*
ECHRISH	*Aeluropus lagopoides*
ERF AL-DEEK	*Amaranthus viridis*
ESHREJ	*Cassia italica*

ESMAT	*Tephrosia nubica*
FELIS	*Rhynchosia schimperi*
FERSHET AL-ZEJAJ	*Callistemon citrinus*
FILFIL AREED	*Schinus terebinthifolius*
FITNA	*Plumeria alba*
FREFRO	*Portulaca oleracea*
GHAF	*Prosopis cineraria*
GHAF AL-BAHR	*Pithecellobium dulce*
GHAWIAF	*Prosopis juliflora*
GURM	*Avicennia marina*
GURM AHMER	*Rhizophora mucronata*
HALFA	*Sporobolus spicatus*
HAMIDAH	*Oxalis corniculata*
HANTHAD	*Halocnemum strobilaceum*
HARM	*Zygophyllum hamiense*
HARMAL	*Rhazya stricta*
HAWA	*Launaea nudicaulis*
HAYBAN	*Lolium rigidum*
HEBEN	*Nerium oleander*
HEBEN-ASFER	*Thevetia peruviana*
HELIAKA	*Herniaria hemistemon*
HELMAH	*Aizoon canariense*
HISEK	*Tribulus terrestris*
JAHANAMIYA	*Boungainvillea glabra*
JOZ AL-HIND	*Cocos nucifera*
JOZ NARJIL	*Cocos nucifera*
KAF MARIUM	*Anastatica hierochuntica*
KAHIL-AGHBAR	*Gastrocotyle hispida*
KHERAZ	*Halopeplis perfoliata*
KHIZAM	*Salvia aegyptiaca*

KHRWIA	*Ricinus communis*
KHUBAYZAH	*Malva parviflora*
KHUF AL-JEMEL	*Bauhinia purpurea*
KHUM-KHAM	*Salsola rubescens*
KHURMAN	*Gaillonia aucheri*
KINA	*Eucalyptus camaldulensis*
KUROT	*Acacia nilotica*
KUTOB	*Tribulus terrestris*
LBAKH	*Albizzia lebbeck*
LEHIAT AL-TAISS	*Bassia muricata*
LESAN AL-ASFOR	*Ficus religiosa*
LEUCAENA	*Leucaena leucocephala*
LIFA	*Luffa cylindrica*
LITHEB	*Ficus salicifolia*
LOZ-HINDI	*Terminalia catappa*
MARKH	*Leptadenia pyrotechnica*
MEINA	*Lantana camara*
MELIAH	*Cressa cretica*
MELIAH	*Frankenia pulverulenta*
MELIAH	*Suaeda vermiculata*
MERSIN	*Myrtus communis*
MESHRASS	*Dodonaea viscosa*
MOZ FAHAL	*Canna indica*
MOZ	*Musa paradisiaca*
MUSWAK	*Salvadora persica*
NABEJ	*Ziziphus spina-christi*
NAKHIL AL-TAMER	*Phoenix dactylifera*
NEELA	*Indigofera intricata*
NEEM	*Azadirachta indica*
NIZAA	*Crotalaria aegyptiaca*

OSHUR	*Calotropis procera*
PAPAYA	*Carica papaya*
QARMAL	*Zygophyllum simplex*
QASAB	*Phragmites australis*
QULB AL-ASHIQ	*Ipomoea biloba*
RAHAB	*Heliotropium curassavicum*
RAMRAM	*Heliotropium kotschyi*
REJELA	*Portulaca quadrifida*
RHODES	*Chloris gayana*
RIBEL	*Plantago boissieri*
RUGHEL	*Atriplex leucoclada*
SABAH AL-KHAIR	*Sesuvium verrucosum*
SABAT	*Cenchrus ciliaris*
SAKHBAR	*Cymbopogon parkeri*
SAMAR	*Acacia tortilis*
SEID-Zena	*Cyperus alternifolius*
SELEM	*Acacia nilotica*
SELY	*Cornulaca monacantha*
SELY	*Juncus rigidus*
SERIM	*Lycium shawii*
SESELPINIA	*Caesalpinia gilliesii*
SHAUK AL-BAHR	*Parkinsonia aculeata*
SHELIALAH	*Limonium axillare*
SHEYOA	*Moringa peregrina*
SHINAN	*Arthrocnemum macrostachyum*
SIDR	*Ziziphus spina-christi*
SINDAR	*Amaranthus graecizans*
SISAM	*Dalbergia sissoo*
SUBBAR	*Aloe vera*
SUWEDA	*Suaeda aegyptiaca*

SUWEDA	*Suaeda vermiculata*
TALH	*Acacia ehrenbergiana*
TAMR HINDI	*Tamarindus indica*
TARFA	*Tamarix arabica*
TARTHUTH	*Cynomorium coccineum*
TAR-TYR	*Sphaerocoma aucheri*
TECOMA	*Tecoma stans*
TERTIA	*Seidlitzia rosmarinus*
THALEJ	*Cornulaca monacantha*
THANON	*Cistanche tubulosa*
THENDA	*Cyperus conglomeratus*
THUMAM	*Panicum turgidum*
TIN	*Ficus carica*
TIN BANGALY	*Ficus benghalensis*
UFAYNAH	*Pentanema divaricatum*
WARD AL-JAMAL	*Hibiscus rosa-sinensis*
WARD AL-KHATEMA	*Althaea rosea*
WERIJ	*Chenopodium murale*
WINKA	*Catharanthus roseus*
YASMIN-HINDI	*Plumeria acutifolia*
YASS	*Myrtus communis*
ZAQUOM	*Balanites aegyptiaca*

Index of Scientific Names

List of Plant Family Names

Aizoaceae
Aloeaceae
Aranthaceae
Aacardiaceae
Aocynaceae
Aaucariaceae
Aclepiadaceae

Balanitaceae
Bignoniaceae
Boraginaceae

Cannaceae
Capparaceae
Caricaceae
Caryophyllaceae
Casuarinaceae
Chenopodiaceae
Combretaceae
Compositae
Convolvulaceae
Cruciferae
Cucurbitaceae
Cynomoriaceae
Cyperaceae

Euphorbiaceae

Frankeniaceae

Gramineae

Juncaceae

Labiatae
Leguminosae

Malvaceae
Meliaceae
Molluginaceae
Moraceae
Moringaceae

Nyctaginaceae

Orobanchaceae
Oxalidaceae

Palmae
Plantaginaceae
Plumbaginaceae
Polygonaceae
Portulacaceae

Rhamnaceae
Rhizophoraceae
Rubiaceae

Salvadoraceae
Sapindaceae
Solanaceae

Tamaricaceae

Verbenaceae

Zygophyllac

Check List of Salt-tolerant Plants in the UAE

A. Wild plants

Angiospermae
Monocotyledonae

Cyperaceae

Cyperus arenarius
Cyperus conglomeratus
Cyperus laevigatus
Cyperus rotundus

Hydrocharitaceae

Hslophila ovalis
Halophila stipulacea

Juncaceae

Juncus rigidus
Juncus socotranus

Liliaceae

Aloe vera
Asphodelus tenuifolius
Dipcadi serotinum

Poaceae (Gramineae)

Aeluropus lagopoides - (Amassauensis)
Aristida abnormis
Cenchrus ciliaris
Coelachyrum piercii
Cymbopogon parkeri
Cynodon dactylon
Dactyloctenium aegyptium
Desmostachya bipinnata
Echinochloa crus-galli
Halopyrum mucronatum
Lolium rigidum
Panicum antidotale
Panicum turgidum
Pennisetum divisum
Phragmites australis
Sorghum halepense
Sporobolus arabicus
Sporobolus spicatus

Aizoaceae
Aizoon canariense
Mesembryanthemum nodiflorum
Sesuvium sesuvioides
Sesuvium verrucosum
Zaleya pentandra

Amaranthaceae
Aerva javanica
Amaranthus graecizans
Amaranthus spinosus
Amaranthus viridis

Apocynaceae
Nerium oleander
Rhazya stricta

Asclepiadaceae
Calotropis procera
Leptadenia pyrotechnica
Pergularia tomentosa

Asteraceae (Compositae)
Launaea nudicaulis
Pentanema divaricatum
Pluchea ovalis

Balanitaceae
Balanites aegyptiaca

Boraginaceae
Arnebia hispidissima
Echiochilon kotschyi
Echiochilon persicum
Gastrocotyle hispida
Heliotropium curassavicum
Heliotripium kotschyi
Moltkiopsis ciliata

Capparaceae
Dipterygium glaucum

Caryophyllaceae
Herniaria hemistemon
Herniaria hirsuta
Sphaerocoma aucheri

Chenopodiaceae
Agriophyllum minus
Anabasis setifera
Arthrocnemum macrostachyum
Atriplex canescens
Atriplex leucoclada
Bassia eriophora
Bassia muricata
Beta vulgaris
Bienertia cycloptera
Chenopodium murale
Cornulaca aucheri
Cornulaca monacantha
Halocnemum strobilaceum
Halopeplis perfoliata
Halothamnus bottae
Haloxylon elegans
Salsola drummondii
Salsola baryosma
Salsola tetrandra
Seidlitzia rosmarinus
Suaeda aegyptiaca
Suaeda vermiculata

Cistaceae
Helianthemum lippii

Convolvulaceae
Cressa cretica

Cruciferae (Brassicaceae)
Anastatica hierochuntica
Eruca sativa

Cynomoriaceae
Cynomorium coccineum

Euphorbiaceae
Ricinus communis

Frankeniaceae
Frankenia pulverulenta

Geraniaceae
Monsonia nivea

Labiatae (Lamiaceae)
Salvia aegyptiaca

Leguminosae (Caesalpiniaceae)
Cassia italica
Cassia senna

Leguminosae (Mimosaceae)
Acacia ehrenbergiana
Acacia farnesiana
Acacia raddiana
Acacia tortilis
Prosopis cineraria
Prosopis farcta
Prospis juliflora

Leguminosae (Papilionaceae)
Alhagi maurorum
Astragalus eremophilus
Astragalus hauarensis
Astragalus vogelii
Crotalaria aegyptiaca
Dalbergia sissoo
Indigofera intricata
Lotus garcinii
Lotus glinoides
Lotus halophilus
Rhynchosia schimperi
Taverniera spartea
Tephrosia apollinea
Tephrosia nubica

Malvaceae
Abutilon pannosum
Malva parviflora

Molluginaceae
Gisekia pharnaceoides

Moraceae
Ficus salicifolia

Moringaceae
Moringa peregrina

Orobanchaceae
Cistanche tubulosa

Oxalidaceae
Oxalis corniculata

Plantaginaceae
Plantago boissieri

Plumbaginaceae
Limonium axillare
Limonium carnosum

Polygonaceae
Calligonum comosum
Calligonum crinitum
Emex spinosa

Portulacaceae
Portulaca oleracea
Portulaca quadrifida

Rhamnaceae
Ziziphus spina-christi

Rhizophoraceae
Rhizophora mucronata

Rubiaceae
Gaillonia aucheri

Salvadoraceae
Salvadora persica

Solanaceae
Lycium shawii

Tamaricaceae
Tamarix aphylla
Tamarix arabica
Tamarix aucherana

Verbenaceae
Avicennia marina
Lippia nodiflora

Zygophyllaceae
Seetzenia lanata
Tribulus terrestris
Zygophyllum hamiense
Zygophyllum mandavillei
Zygophyllum qatarense
Zygophyllum simplex

B. Cultivated plants

Sesuvium portulacastrum	Aizoaceae
Agave americana	Amaryllidaceae
Mangifera indica	Anacardiaceae
Schinus molle	Anacardiaceae
Schinus terebinthifolius	Anacardiaceae
Plumeria alba	Apocynaceae
Nerium oleander	Apocynaceae
Thevetia peruviana	Apocynaceae
Catharanthus roseus (Venca)	Apocynaceae
Araucaria excelsa (Aheterophylla)	Araucariaceae
Eupatorium spp.	Asteraceae (Compositae)
Jacaranda mimosaefolia	Bignoniaceae
Tecomaria capensis	Bignoniaceae
Tecoma stans	Bignoniaceae
Cordia sebestena	Boraginaceae
Brassica oleracea	Brassicaceae
Eruca sativa	Brassicaceae
Bauhinia purpurea	Caesalpiniaceae
Caesalpinia gilliesii	Caesalpiniaceae
Parkinsonia aculeata	Caesalpiniaceae
Tamarindus indica	Caesalpiniaceae
Canna indica	Cannaceae
Carica papaya	Caricaceae
Atriplex dimorphostegia	Chenopodiaceae
Atriplex halimus	Chenopodiaceae
Atriplex lentiformis	Chenopodiaceae
Atriplex nummularia	Chenopodiaceae
Conocarpus lancifolius	Combretaceae
Conocarpus erectus	Combretaceae
Terminalia arjuna	Combretaceae
Terminalia catappa	Combretaceae
Ipomoea biloba	Convolvulaceae
Ipomoea palmate	Convolvulaceae
Luffa cylindrica	Cucurbitaceae
Cupressus sempervirens	Cupressaceae
Cyperus alternifolus	Cyperaceae
Casuarina equisetifolia	Casuarinaceae
Excoecaria agallocha	Euphorbiaceae
Ricinus communis	Euphorbiaceae
Yuca spp.	Liliaceae

Lagerstromia indica	Lythraceae
Lawsonia inerme	Lythraceae
Althaea rosea	Malvaceae
Hibiscus rosa-sinensis	Malvaceae
Malvaviscus arboreus	Malvaceae
Thespesia populnea	Malvaceae
Melia azedarach	Meliaceae
Acacia nilotica	Mimosaceae
Acacia decurrens	Mimosaceae
Acacia farnesiana	Mimosaceae
Acacia melanoxylon	Mimosaceae
Acacia saligna	Mimosaceae
Acacia tortilis	Mimosaceae
Acacia victoriae	Mimosaceae
Albizzia lebbek	Mimosaceae
Leucaena leucocephala	Mimosaceae
Pithecellobium dulce	Mimosaceae
Prosopis cineraria	Mimosaceae
Prosopis faracta	Mimosaceae
Prosopis juliflora	Mimosaceae
Prosopis tamarugo	Mimosaceae
Ficus benghalensis	Moraceae
Ficus retusa (*F. nitida*)	Moraceae
Ficus religiosa	Moraceae
Ficus carica	Moraceae
Moringa oleifera	Moringaceae
Musa paradisiaca	Musaceae
Callistemon citrinus	Myrtaceae
Eucalyptus camaldulensis	Myrtaceae
Myrtus communis	Myrtaceae
Psidium guajava	Myrtaceae
Bougainvillea spp.	Nyctaginaceae
Cocos nucifera	Palmae (Arecaceae)
Phoenix dactylifera	Palmae (Arecaceae)
Phoenix canarensis	Palmae (Arecaceae)
Washingtonia filifera	Palmae (Arecaceae)
Medicago sativa	Papilionaceae
Trifolium alexandrinum	Papilionaceae
Sesbania aegyptica	Papilionaceae
Plumbago auriwlata	Plumbaginaceae
Chloris gayana	Poaceae (Gramineae)
Hordeum vulgare	Poaceae

Spartina alterniflora	Poaceae
Spartina patens	Poaceae
Punica granatum	Punicaceae
Zizyphus jujuba	Rhamnaceae
Zizyphus spina-cristi	Rhamnaceae
Salvadora persica	Salvadoraceae
Dodonaea viscosa	Sapindaceae
Tamarix articulala (Taphylla)	Tamaricaceae
Avicennia marina	Verbenaceae
Lantana camara	Verbenaceae
Vitex angus-castus	Verbenaceae
Vitex negundo	Verbenaceae
Guaiacum officinale	Zygophyllaceae

REFERENCES

Ali MAA and **Hasbini BA**. 1999. Salinity Issues in the United Arab Emirates. Biosaline Agriculture Center, Dubai, UAE.

Al Hadrami GA, Ibrahim AS, Karim F, Ali YF and **Dadou A.** 2000. Forage Plants in the United Arab Emirates: Description and Chemical Analysis. UAE University Press. Al Ain, UAE.

Chapman VJ. 1974. Salt Marshes and Salt Deserts of the World. Verlag Von J Cramer. Lehre, Germany.

El-Ghonemy AA. 1993. Encyclopedia of Medicinal Plants of the United Arab Emirates. UAE University Publications. Al Ain, UAE.

Ellison D. 1995. Cultivated Plants of the World. New Holland Publishers (UK) Ltd.

Embaby NS. 1993. Environmetal aspects of geographical distribution of mangrove in the United Arab Emirates in Towards the rational use of high salinity tolerant plants, Vol 1 (Leith M and Al Masoom A, eds). Kluwer Academic Publishers.

Epstein E. 1983. Crops tolerant of salinity and other stresses, pp 61-82 in Better Crops for Food. Pitman Books. London, UK.

Glennie KW. 1996. Geology of Abu Dhabi, pp16-35 in Desert Ecology of Abu Dhabi (Osborne PE, ed.), Pisces Publications. Newbury, UK.

Hayward, HE. 1954. Plant Growth Under Saline Conditions: Reviews of research on problems of utilisation of saline water, pp 37-72. UNESCO. Paris.

Karim FM. 1995. Weeds in the United Arab Emirates. Desert and Marine Environment Reseach Centre, UAE University. Al Ain, UAE.

Karim FM. 2002. Wild Flowering Plants of the United Arab Emirates. Environmental Research and Wildlife Development Agency. Abu Dhabi, UAE.

Karim FM. Flora of the United Arab Emirates (two volumes, unpublished).

Levitt J. 1980. Responses of Plants to Environmental Stress. Vol II: Water, Radiation, Salt and other Stresses. Academic Press. New York.

Poljakoff-Mayber A and **Lerner HR.** 1999. Plants in Saline Environments in Handbook of Plant and Crop Stress, 2nd Edition (Pessarakli M, ed). Marcel Dekker Inc. New York.

Roshier DA, Boer BB and **Osborne PE.** 1996. Vegetation of Abu Dhabi and a Preliminary Classification of its Plant Associations, pp 50-65 in Desert Ecology of Abu Dhabi (Osborne PE, ed.), Pisces Publications. Newbury, UK.

Satchell JE. 1978. Ecology and Environment in the United Arab Emirates. Arid Environment Journal, Vol 40 No 3, pp 210-226

Shoji T. 1997. Report on Introduction of Salt and Drought Tolerant Plants in the United Arab Emirates. Faculty of Agricultural Sciences and JICA Company. United Arab Emirates University. Al Ain, UAE.

Sigmond AAJ. 1927. The classification of alkali and salty soils. International Congress of Soil Scientists: 1, pp 330-344.

Western AR. 1989. Flora of the United Arab Emirates: An Introduction. Al-Bain. Dubai, UAE.

Zohary M. 1973. Geobotanical Foundations of the Middle East (Vols 1&2). Gustav Fischer Verlag. Stuttgart, Germany.

The Authors

Fawzi M Karim, a New Zealand citizen of Iraqi origin, spent over 15 years studying the flora and fauna of the UAE. After working at United Arab Emirates University at Al Ain as a Wildlife Consultant from 1989 to 1998, he worked for both the Environmental Research and Wildlife Development Agency (now Environment Agency-Abu Dhabi) and the Dubai-based International Center for Biosaline Agriculture (ICBA), the publisher of this book. Dr Karim's studies on the biodiversity of the UAE, the most extensive on this subject ever undertaken, have previously been collected in four books:

- Weeds in the United Arab Emirates (1995)
- Wild Flowering Plants of the United Arab Emirates (2000)
- The Vegetation of Abu Al Abyad Island, UAE (2002)
- Flora of the United Arab Emirates (two volumes, unpublished)

Salt-tolerant Plants of the United Arab Emirates, the fifth book to emerge from Dr Karim's research, provides typical characteristics and growth habits of over 700 indigenous species of trees, shrubs and herbs. Like his previous books, it provides both the Latin binomials and common names of each plant.

The photographs in this book, most of which were taken by Dr Karim during field trips throughout the country, are a colorful guide to unique flora that have developed tolerance for salinity.

Abdullah J Dakheel, a Syrian national, has an extensive background in agricultural ecology and physiology of crop and natural plants. Dr Dakheel began his career as a lecturer at Aleppo University in Syria. He later worked as a consultant in ecology and physiology of cereal crops at the International Center for Agricultural Research in the Dry Areas (ICARDA), and subsequently as Associate Professor of arid land ecology at UAE University where he also held the position of Research Farm Director. It was at the university that his professional partnership with Dr Karim began. He joined ICBA as Field and Forage Crops Scientist in 2001.

Dr Dakheel's numerous publications in peer-reviewed journals and his voluminous correspondence with the scientific community have made him a world-renowned authority on the subject of biosalinity and the ecology of arid lands.

Dr Dakheel holds a PhD in Ecology from the University of California Davis, USA.

International Center for Biosaline Agricultrue

The International Center for Biosaline Agriculture (ICBA) is a non-profit international agricultural applied research and development center.

Established in Dubai, United Arab Emirates in 1999, the Center's founding sponsors are the Islamic Development Bank, the OPEC Fund, and the Arab Fund for Economic and Social Development. The Government of the United Arab Emirates also provided additional support to launch the Center.

ICBA's core expertise lies in the management of saline water, saline soils and salt-tolerant plants in irrigated agricultural production systems to arrest or reverse environmental degradation. In addition to extensive first-hand knowledge and experience of the farming systems of the Middle East, North Africa and West Asia, ICBA has expertise in irrigation and drainage system design and management, improved crop management practices, and selection of appropriate species of food, forage and industrial crops for saline areas.

PO Box 14660
Dubai, United Arab Emirates
Tel +971 4 336 1100
Fax +971 4 336 1155
Email icba@biosaline.org.ae
www.biosaline.org