CONSERVATION AND SUSTAINABLE USE OF MEDICINAL PLANTS IN EGYPT

NATIONAL SURVEYS VOLUME 4

NORTH EASTERN DESERT AND RED SEA COAST AREA

Implementing Agency: Faculty of Science, Cairo University
Principle Investigator: Prof. Dr. Ahmad Kamel Hegazy
Co-Principle Investigator: Prof. Dr. Tahany M. Abdel Rahman

Cairo, Egypt
2016
Front cover photograph by Prof. Dr. Khaled Shams (Eastern Desert):

*Hyoscyamus muticus* L.

Published by the Egyptian Encyclopedia of the Wild Medicinal Plants Project

Funded by the Academy of Scientific Research and Technology

Copyright © 2016

ASRT & EEAA

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the copyright owner.

Dar El-Kutub No. 23194-2016

Printed in Egypt at the Printshop of Al Ahram, on behalf of ASRT & EEAA
Dedicated with respect and gratitude to the memory of the late Professor Dr. Kamal El-Din Hassan El-Batanouny, National advisor of the project (1936 – 2011)
This work represents the final report of the project: Conservation and Sustainable Use of Medicinal Plants, in Arid and Semiarid Ecosystems (National Surveys). Funded by UNDP, GEF and EEAA.
Editor-in-Chief
Prof. Dr. Rizk, Abdel-Fattah

Executive Editor
Prof. Dr. Omer, El-Sayed Abou Elfotoh

Scientific Advisor
Prof. Dr. Hammouda, Faiza Mohammed

Editorial Board
Prof. Dr. Abdel-Azim, Nahla Sayed
Prof. Dr. Fayed, Abdel-Aziz Ali
Prof. Dr. Shaltout, Kamal Hussien
Prof. Dr. Shams, Khaled Ahmed
RESEARCH TEAM

Ahmad K. Hegazy, Prof., Principal investigator of the project, Professor of Ecology, Botany Department, Faculty of Science, Cairo University.

Tahany M. Abdel Rahman, Prof., Coprincipal investigator, Professor of Microbiology, Botany Department, Faculty of Science, and Deputy Dean for Graduate Studies, Faculty of Science, Cairo University.

Ahmed A. El Khatib, Prof., Professor of Plant Ecology, Botany Department, Faculty of Science, Sohag University.

Ahmed Abdallah Zayed, Mr., Demonstrator, Geography Department, Faculty of Literature, Assiut University.

Ahmed Abdallah Zayed, Prof., Professor of Sociology, Dean of Faculty of Literature, Cairo University.

Ahmed Farghally Hassan, Prof., Biodiversity Economics Consultant, Dean of the Faculty of Commerce, Cairo University.

Ahmed Mohammad Youssef, Prof., Geology Department, Faculty of Science, Sohag University.

Dina M. W. Abou Hussein, Dr., Lecturer, Pharmacognosy Department, Faculty of Pharmacy, Cairo University.

Feebi F. Nashed, Mrs., Biochemist, Agricultural Museum Herberium. Agriculture Research center, Cairo.

Hamdy Hassanein, Prof., Dean of Faculty of Science, Cairo University.

Hanan F. Kabiel, Dr., Lecturer of Plant Ecology, Botany Department, Faculty of Science, Cairo University.

Hasnaa A. Hosni, Prof., Professor of Plant Taxonomy, Botany Department, Faculty of Science, Cairo University.

Hesham Ibrahim El-Askary, Ass. Prof., Pharmacognosy Department, Faculty of Pharmacy, Cairo University.

Ismail M. Kamel Ismail, Prof., Professor of Microbiology, Botany Department, Faculty of Science, Cairo University.

Manal Zakaria, Mrs., Ass. Lecturer, Psychology Department, Faculty of Literature, Cairo University.
Marwa M. Soliman, Ms., Agricultural Research center, Giza.

Mohamed Soliman, Prof., Chairman of Botany and Microbiology Department, Faculty of Science, Helwan University.

Nasr Hassan Gomaa, Mr., Ass. Lecturer, Botany Department, Faculty of Science (BeniSuief), Cairo University.

Safwat Azer, Mr., Ass. Researcher, Plant Taxonomy.

Samia K. Wanis, Ass. Prof., Sociology Department, Faculty of Literature, Ain Shams University.

Tarek Kapiel, Dr., Lecturer, Botany Department, Faculty of Science, Cairo University.

Youssry Saleh, Prof., Professor of Microbiology and Head of Botany Department, Faculty of Science, Cairo University.
### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Subject</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Executive summary</td>
<td>3</td>
</tr>
<tr>
<td>Environmental setting as related to medicinal plants</td>
<td>7</td>
</tr>
<tr>
<td>a- Geographical location</td>
<td>7</td>
</tr>
<tr>
<td>b- Geological aspects</td>
<td>8</td>
</tr>
<tr>
<td>c- Topographical aspects and geomorphology</td>
<td>10</td>
</tr>
<tr>
<td>d- Climate</td>
<td>15</td>
</tr>
<tr>
<td>e- Water resources</td>
<td>20</td>
</tr>
<tr>
<td>f- Vegetation and medicinal plant life</td>
<td>26</td>
</tr>
<tr>
<td>g- Human population</td>
<td>31</td>
</tr>
<tr>
<td>h- Human impact</td>
<td>34</td>
</tr>
<tr>
<td>i- Traditional knowledge</td>
<td>37</td>
</tr>
<tr>
<td>j- Recipes</td>
<td>42</td>
</tr>
<tr>
<td>k- Cultivation</td>
<td>46</td>
</tr>
<tr>
<td>l- Socio-economic assessment</td>
<td>49</td>
</tr>
<tr>
<td>List of medicinal plants</td>
<td>53</td>
</tr>
<tr>
<td>Categories of medicinal plants</td>
<td>54</td>
</tr>
<tr>
<td>Acacia tortilis (Forssk.)</td>
<td>56</td>
</tr>
<tr>
<td>Achillea fragrantissima (Forssk.)</td>
<td>56</td>
</tr>
<tr>
<td>Aerva javanica (Burm. f.)</td>
<td>57</td>
</tr>
<tr>
<td>Anastatica hierochuntica L.</td>
<td>57</td>
</tr>
<tr>
<td>Artemisia judaica L.</td>
<td>58</td>
</tr>
<tr>
<td>Avicennia marina (Forssk.)</td>
<td>58</td>
</tr>
<tr>
<td>Balanites aegyptiaca (L.)</td>
<td>59</td>
</tr>
<tr>
<td>Calligonum polygonoides L.</td>
<td>60</td>
</tr>
<tr>
<td>Calotropis procera (Aiton)</td>
<td>60</td>
</tr>
<tr>
<td>Capparis spinosa L.</td>
<td>60</td>
</tr>
<tr>
<td>Cistanche phelypaea (L.)</td>
<td>61</td>
</tr>
<tr>
<td>Citrullus colocynthis (L.)</td>
<td>61</td>
</tr>
<tr>
<td>Cleome amblyocarpa Barratte&amp;Murb.</td>
<td>62</td>
</tr>
<tr>
<td>Cleome droserifolia (Forssk.)</td>
<td>62</td>
</tr>
<tr>
<td>Cocculus pendulus (J. R. &amp; G. Forst.) Delile</td>
<td>63</td>
</tr>
<tr>
<td>Cotula cinerea Delile</td>
<td>63</td>
</tr>
<tr>
<td>Crotalaria aegyptiacaBenth</td>
<td>64</td>
</tr>
<tr>
<td>Ephedra aphylla Forssk.</td>
<td>64</td>
</tr>
<tr>
<td>Fagonia bruguieri DC.</td>
<td>64</td>
</tr>
<tr>
<td>Fagonia glutinosaDelile</td>
<td>65</td>
</tr>
<tr>
<td>Ficus palmata Forssk.</td>
<td>65</td>
</tr>
<tr>
<td>Hyoscyamus muticus L.</td>
<td>65</td>
</tr>
</tbody>
</table>
Juncus rigidus Desf. 66
Leptadenia pyrotechnica (Forssk.) 66
Moringa peregrina (Forssk.) 67
Nitraria retusa (Forssk.) 67
Peganum harmala L. 67
Pergularia tomentosa L. 68
Plantago ovata Forssk. 68
Pulicaria crispa (Forssk.) 69
Pulicaria incisa (Lam.) 70
Retama raetam (Forssk.) 70
Rumex vesicarius L. 70
Salvadora persica L. 71
Salvia aegyptiaca L. 72
Senna alexandrina Mill. 72
Solenostemma arghel (Delile) Hayne 72
Stachys aegyptiaca Pers. 73
Teucrium polium L. 73
Trigonella stellata Forssk. 74
Ziziphus spina-christi (L.) 74
Zygophyllum album L. 75
Zygophyllum coccineum L. 75
Zygophyllum decumbens Delile 75
Zygophyllum simplex L. 76
General recommendations 77
Appendices 78
Appendix Tables 79
Appendix Photos 88
References 154
Arabic Summary 164
FOREWORD

The Academy of Scientific Research and Technology (ASRT) is the house of the Egyptian experience in the fields of science and technology. The terms of reference of the Academy include planning and promotion of programs and research projects of national and interdisciplinary characters and provide the necessary financial and material resources to implement them. In this regard, the Academy of Scientific Research and Technology adopted a national project on medicinal plants aimed to documenting scientific information on wild medicinal plants concerning their habitat, botanical characters, geographical distribution, their status; as well as their chemical constituents, folk medicine, pharmacological activities, cultivation efforts and also documentation of their genetic inheritance. This project is one of several academic initiatives for the advancement of the national economy and to prepare a scientific base for these plants.

The Academy of Scientific Research and Technology, on 16.01.2015, announced by national newspapers and websites and official correspondences, interest in adopting the national project for Egypt's wealth (Wealth of Egypt). The Academy received stating about the scattered research group efforts in this regard. Among these efforts was the Project “Egypt- Conservation and Sustainable Use of Medicinal Plants in Arid and Semi-Arid Ecosystems” supported by United Nations Development Program (UNDP), Global Environmental Facility (GEF) and implemented by Egyptian Environmental Affairs Agency (EEAA) during the period 2002 - 2010. The main objective of the project was to remove the root causes of biodiversity loss and the specific threats to the conservation and sustainable use of globally significant medicinal plants and their habitats in the different Phytogeographic regions of Egypt. It focused on protecting endangered medicinal plant species, introducing small-scale community-based cultivation, harvesting, processing and medicinal plant marketing and protecting intellectual property rights of traditional medicine. This project addressed important studies on medicinal plants in five regions in Egypt: North Western Coastal Region; North Eastern Desert and Red Sea; Halaib Triangle Area; Western Desert and Oases; and North Sinai. Aware of the importance of management of data generated from such studies and allow its valuable information
available to researchers and all those interested in medicinal plants, as well as to prevent the recurrence of such research, the Academy is pleased to finance the publication of the five volumes.

As the use of medicinal plants in Egypt has always been a part of culture that has been passed down from generation to generation, the importance of documenting the indigenous traditional knowledge on medicinal plants will be a vehicle for; (i) preserving cultural heritage, (ii) ethno pharmacological bases of drug research and (ii) preserving of biological diversity. In this regard, ASRT is currently funding projects with the National Research Centre, Misr University for Science and Technology and Agricultural Research Center in this area.

Finally, I would like to express my gratitude by thanking the people who helped and encouraged in the process of editing and publishing these volumes especially the editorial board.

Prof. Dr. Mahmoud Mohamed Sakr
President, Academy of Scientific Research and Technology
Introduction

The North Eastern Desert and the Red Sea Coast of Egypt are planned for multidisciplinary developmental activities. Currently, the region is under intensive and extensive development programs to provide marine and landscape recreation activities. The development activities in the areas are creating large scale and rapid negative impacts on the surrounding natural ecosystems. Sustainable development and tourism in the two regions require healthy natural areas to support the regional resource development activities and ensure the protection of its natural characteristics. There is an urgent need for an integrated approach to multipurpose land use in the region, aiming at reconciliation between the need for conserving the productivity of the natural ecosystems and the socioeconomic needs of the local people and national economy. This will ensure the highest overall benefits and will be flexible enough to leave options for environmentally sound landscape development considerations within the context of sustainable development.

Medicinal plants in this region are threatened due to various human impacts on plants and their ecosystems including: uncontrolled tourism, overgrazing, collection, over-exploitation, mining and quarrying. Inclusion of medicinal plant conservation into development plans and policies will reduce human impact and ensure their sustainable use. The knowledge of potential medicinal value of the plants will meet national priorities and achieve global benefits.

The inhabitants of the region belong to Ma`aza and Amariin tribes. Assessment of the medicinal and conservation value of the flora in this region suggests its designation to support the industrial and agricultural development of medicinal plants. This judgment is based on: Strategic location, large area, position in meeting point of ecological-biogeographical units, rich biological diversity, naturalness, typicalness and representativeness of ideal desert ecosystems, potential importance for economic output, scientific and educational values, prosperous ecotourism, local and government support, cultural and archeological values, threats and urgency for conservation plan (Hegazy et al., 2003 and 2000). The region is rich in its flora and habitat types, an important asset for this study are to explore the medicinal value of plants, design and implement the appropriate conservation plans.

Assessment of the medicinal and conservation value of the medicinal flora in this region suggests its designation to support the industrial and agricultural development of medicinal plants. This judgment
is based on: Strategic location, large area, and position in meeting point of ecological/biogeographical units, rich biological diversity, naturalness, typicalness and representativeness of ideal desert ecosystems, potential importance for economic output, scientific, educational and cultural values.

Due to the nature of this project where activities cover various disciplines, and following the activities and mean of its verification, a combined literature and field survey, laboratory tests on some selected medicinal plants, and interview data analysis in the study area were undertaken. The findings of the project studies were presented in three quarterly reports. All project findings were analysed, synthesized and compiled in this final report.

The abiotic and biotic environment in the study region, viz. North Eastern Desert and Red Sea Coast, the monographs of 44 medicinal plant species covering ecology, taxonomy, phytochemistry, pharmacology, traditional knowledge and cultivation were presented.
Summary

The North Eastern Desert lies in the eastern side of the Nile Valley which is situated between Nile Valley from the west, Red Sea and Suez Gulf from east, Qift-Qusier Road from south, and Cairo-Suez Road from north. Geologically, it is composed of both sedimentary and crystalline rocks. The major habitat types which dominate the region include the coastal habitats, coastal plains, inland plains, wadis, mountain escarpment and rocky plateaus.

The potential flora known to be found in the region is about 280 taxa belonging to several families (about 60), genera and life forms. Many of these taxa are known in folk medicine in the surveyed area. Based on the life form category, herbs and undershrubs dominated the other categories of life forms growing in the study area. Floristically, the study area found to support growth of about 280 taxa of different botanical families, of which, around 45 medicinal plant species were recorded as dominant/co-dominant or as associate species in the surveyed plant communities. The total of 16 recipes is recognized by the healers and local dwellers for treatment of many diseases. Local plants are used and sometimes mixed with plant materials brought from outside the region.

Medicinal plants in the North Eastern Desert region are threatened due to various human impacts on plants and their ecosystems including: uncontrolled tourism, overgrazing and collection, over-exploitation, mining and quarrying. Inclusion of medicinal plant conservation into development plans and policies will reduce human impact and ensure their sustainable use. The knowledge of potential medicinal value of the plants will meet national priorities and achieve their conservation plans.

Assessment of the current status with regard to medicinal plants information and knowledge included:
- Review of published and data obtained on medicinal plants in the study region.
- Documentation of local traditional knowledge and use of medicinal plants.
- Field survey of desert and coastal areas in the study region. The potential medicinal plants and their community types are identified in all visited sites.
- Medicinal plant habitat types include coastal, desert plains, wadis, mountain escarpment and rocky plateaus. Vegetation varies according to the variation of habitat type.
The geomorphology is closely related to the geologic structures and regional geologic setting and is divided into three main units; the watershed, the water collectors and the coastal plain. Climate in the northern Eastern Desert belongs to two climatic provinces; the hyperarid with a mild winter and hot summer which is represented by the inland part, while the arid province includes the coastal mountains with winter rainfall. The water resources are usually scarce and come from different sources including conventional and orographic rainfall, wells and ephemeral rocky holes. The arid climate and scarce water resources and increased salinity of permanent water sources (wells) represent major challenge for medicinal plant agriculture in the region.

The Bedouins of the Ma’aza tribe constitute the main population who live between the River Nile and the Red Sea as local dwellers of the region. Pastoral nomadism style of life is threatened due to introduction of tourism business in the region where most of the populations are now giving up the nomadic life. The local dwellers still partially depend upon the natural vegetation as a source of fuel and medicine as well as its grazing value for raising livestock during rainy seasons.

The human population plays a limited role as for the direct medicinal use of plants in the study area. This is primarily due to the nature of the physical environment in the region and the rarity of the plants, which makes the population move to other activities that generate more income, especially in the field of tourism, with the related service activities practiced by Bedouins. Dependence of local people on medicinal plants as a therapy is contracting as pharmaceutical medicine became available to them through tourism activities.

Socio-economic valuation methods are needed to decide which plant species is more valuable than the others. At the present time, the socioeconomic valuation of medicinal plants is not accurate due to absence of statistics and fixed market of the commonly used and collected plants. Application of the appropriate methods for valuation of quality and quantity will support their sustainable use and conservation purposes. The commonly used valuation methods include: market price method; cost price method; travel coast method; contingent method; production factor method; and integrated socioeconomic method. Selection of the appropriate method is species and market dependent as based on cost-benefit analysis of different alternatives.

The prolonged periods of drought, scarcity of water resources and in appropriate quality of permanent water resources (wells) are major
challenges for agricultural development of medicinal plants in the region. Valuable species can be propagated and agriculturally developed in areas having adequate and permanent water resources, such as areas associated with the Nile valley.

The obstacles that limit the production of cultivated medicinal plants include:

- Lack of seeds and propagules, and when they are available their source is unknown.
- High costs, which led to the monopolizing the products by traders who control prices.
- Absence of equilibrium between production and consumption because of ignorance of the needs of the market.
- Affliction with plant disease, and the producers being unaware of and not complying with guidelines and technical directives; and
- Neglecting the safety measures of handling by the producers in the production stages as harvesting, drying, sieving and storage as well as being mixed with botanic and animal wastes, which affects their quality and their exportability.

Most of the medicinal plants in the Northern Eastern Desert and the Red Sea coast are rare, threatened and characterized by absence of regeneration due to the heavy human impacts and frequent environmental stresses such as drought. Many of these plants showed difficulties in the traditional way of propagation. Application of the biotechnological methods such as tissue culture contributes to improvement and conservation of rare, threatened or overused taxa. Tissue culture technology makes it possible to produce a large number of disease free and uniform plants of medicinally important species. Such methods can be used for the extraction of medicinally important compounds, or for pharmacological studies. Such methods can also help in germplasm conservation, and can be reintroduced into protected habitats and national parks. Pathogen free plants maintained under \textit{in vitro} conditions can also be used for the safe exchange of germplasm across national borders.

Chemical constituents and pharmacological activities of the target medicinal plants in the region demonstrated the high diversity of the chemical constituents, activities and uses. Further laboratory work is needed for isolation and identification of the active chemical constituents in the investigated species. The chemical constituent and pharmacological activities for the target taxa showed that some taxa have no data or the available data do not support their official use as herbal drugs for treatment of several diseases. The surveyed taxa contain constituents from different
chemical classes as the main constituents including, volatile oils, alkaloids, saponins, glucosinolates, terpenoidal compounds and flavonoids. Many taxa showed different pharmacological activities including hypoglycemic, anti-inflammatory, analgesic, anti-pyretic, hypolipidemic effect, immunostimulant, hepatoprotective, molluscicidal activities as well as antimicrobial and cytotoxic activities.
Environmental Settings as Related to Medicinal Plants

A. Geographical Location

The study area lies in the eastern side of the Nile Valley which is situated between Nile Valley from the West, Red Sea and Suez Gulf from East, Qift-Quiser Road from South, and Cairo – Suez Road from North. The area has a latitudes 25° 52’ 00” to 30° 11’ 00”N and longitudes 30° 46’ 48” to 34° 17’ 57” E and a total area of ~ 93700 km² (Fig. 1).

Fig.1: Geographical Location of the Study Region
B. Geological Aspects

Geologically, the Eastern Desert is composed of both sedimentary and crystalline rocks (Fig. 2). The oldest exposed crystalline rocks belong to the Pre-Cambrian age and are overlain by the Nubian sequence and post-Nubian deposits. The crystalline rocks of the Pre-Cambrian basement complex form massive formations extending parallel to the Red Sea graben and consisting mainly of metamorphic rocks, as well as acidic and basic igneous rocks (Said 1990 and 1962, El-Ramly 1972). The coastal mountains of Pre-Cambrean age include Gebel Abu Dukhan (1705 m), Gebel Qattar (1963 m), Gebel Shayeb el Banat (highest peak in the Eastern Desert: 2187 m) and Gebel Umm Ėnab (1982 m).

To the north, extensive limestone plateau extend along the Gulf of Suez. They comprise South Galala (1464 m), North Galala (1273 m) and Gebel Ataqa (871 m), which are separated from each other by broad wadis. The formations of this limestone plateau are mainly Upper Eocene (Bartonian) and Middle Eocene (Lutetian). The Upper Eocene formations include a series of sands, marls, clays and marly limestones which are softer and contain larger amounts of gypsiferous and ochreous materials. The Middle Eocene formations include various types of limestone which are more solid and contain a number of hard dolomitic bands (Kassas and Girgis 1964). They form the main bulk of the northern limestone plateau of the Eastern Desert. This Eocene desert adjoins on its north border sand and gravel formations of the Oligocene (Cairo-Suez desert, Kassas and Imam 1959).

The Nubian sandstone, which belongs to the Lower Cretaceous, consists of alternating beds of sandstones, shale and clay. The sand grains range from fine to course and the degree of cementation varies from friable to well consolidated (Issawi 1983, Issawi and McCauly 1993). The Nubian sandstone directly overlies the basement complex and is itself overlain by the impervious shaley strata of the Upper Cretaceous forming a continuous belt of outcrops across the Eastern Desert as shown in (Fig. 2).

The Post-Nubian deposits are represented by three main groups: the Carbonate group, the Neogeone sediments and the alluvial deposits. The Carbonate group consists of a limestone succession belonging to the Upper Cretaceous (150-700 m thick), Paleogene (200-500 m thick), and the Neogene (50-150 m thick). The carbonate rocks are nonporous but contain fissures, fractures and joints which function as groundwater conduits. The Neogene sediments are exposed in the Red Sea coastal belt represented by the Miocene succession that consists of evaporates intercalated with clay and sand in the upper part of the succession. The lower part consists of
sandstone interbedded with clay. The thickness of this formation varies from place to place, reaching a thickness of 2,000 m at some localities (El-Belasy 1994). The alluvial deposits belong to the Pleistocene and the recent ages. They are widely distributed in the Eastern Desert covering most of the Wadi floors, alluvial fans, and structural depressions. The alluvial deposits may be subdivided into two groups. The first are the Wadi fillings distributed in various depressions, over alluvial fans and along alluvial courses. These deposits are extremely variable in thickness and overlie both sedimentary and crystalline basement rocks. The second group consists of coral reefs and beach deposits (Map 2). Tectonically, the Eastern Desert represents one of the four major segments (parallel crustal plates) of Egypt, which are separated by NNW-SSE fault trends (El-Shazly 1977). It is comprised of three main features; faults, folds and volcanic formations. In some areas, faults and joints function as water conduits.

Fig. 2: Geological Map of the Eastern Desert, Egypt
C. Topographical Aspects and Geomorphology

The geomorphology of the north eastern desert is closely related to its geologic structures and regional geologic setting and is divided into three main units; the watershed, the water collectors and the coastal plain.

The watershed areas are represented by the uplands and they are subdivided into four main units; the Red Sea mountain terrain (Pre-Cambrian), the high limestone plateaus (Miocene and Eocene), the hilly areas (coastal and inland) and the ridges, that are built of isolated basement rocks separated from their mother rocks. The water collectors are represented by the morphotectonic depressions and the drainage lines that receive heavy occasional storms. The depressions reflect the different types of structures and/or erosional features. The third morphometric unit is the coastal plain of the Red Sea and the Gulf of Suez that consists mainly of gravel and sand which form alluvial terraces and raised beaches. Between the high lands foothills and the shoreline, the coastal plain slopes gently. It varies in width, and may be practically non-existent as in certain parts of the Gulf of Suez. It is generally divided into a littoral salt marsh with sandy hillocks and flats of calcareous silt, and an inland desert plain. Near the hills, the desert plain is often covered with coarse boulders, but further away the surface sediments become less coarse. The shoreline comprises in some areas a number of bays and lagoons.

The exposed rocks of the Eastern Desert are dissected by a number of wadis trending in different directions. The Wadis in the Eastern Desert are divided into two main groups. The first group includes all the drainage basins that drain toward the Red Sea Coast (the Red Sea Basin Group) and the second group includes the drainage basins that drain toward the Nile basin (the Nile Basin Group). The catchment area of the Nile Basin Group covers about 105,580 km² representing 10.56% of the total surface area of Egypt (about ten times the total area of the Nile Valley), while the basin area of the Red Sea Basin Group covers about 42,240 km². The large catchment area of the Nile Basin Group can be attributed mainly to the existence of the water divide (boundary of the watershed) which runs mostly through the basement complex hills, closer to the Red Sea than to the Nile Valley, giving rise to the occurrence of the large basin areas of the wadis that drain toward the Nile. The Red Sea Basin Group almost cuts through the basement complex, while some of Nile Basin Group, actually does cut through (at least in the eastern part) the basement rocks. In south part of the study area, most of the wadis cut through the sedimentary succession ranging in age between the Eocene and the Quaternary (e.g. Wadi Qasab, Wadi El-Asyuti and Wadi Tarfa).
Consequent upon the previous discussed geological events, the north Eastern desert is characterized by different habitat types (Fig. 3). These major habitats are:

1- **Coastal Habitats:**

These habitats represent a more or less narrow strip (El-Ain Sokhna southward to El-Quiser) along the Red Sea coast and are subjected to periodic inundation by tides and salt spray. Mangroves and salt marshes are the two main habitats recognized along the coast. Halophytes form the plant cover of these habitats. In addition to the coastal salt marshes, the northern part of the Eastern Desert contains inland marshes which are common in the delta of many wadis such as Wadi Sannur and Wadi El-Malaha.

2- **Coastal Plains:**

The plains extend between the littoral salt marsh belt on the seaward side and the coastal range of hills and mountains on the inland side. The plant growth of this coastal desert is confined to the drainage systems, which collect run-off water and alluvia. It shows a mosaic pattern and distinct seasonal aspects, mainly due to the rich growth of ephemerals in response to occasions of rain.

3- **Inland Plains:**

These plains include gravel and sandy plains. The former is best represented on both sides of the Cairo - Suez desert road and is common all over the northern part of the Eastern Desert. The ground surface is covered with gravels made of pebbles. The mature gravel desert is nearly a sterile habitat except for some desert lichens which grow on the lower surfaces of the few white translucent types of gravel. In certain localities, the development of the gravel cover is incomplete (Premature gravel desert). In these locations ephemeral species may appear during the rainy season. The surface of gravel desert may be dissected by runnels which collect run-off water. These runnels may support the growth of some plant communities. Sandy plains habitats are not well represented in the study area and their vegetation is very open and the plants are mainly sand dwellers.

4- **Wadis:**

Wadis are well represented habitats and denote the main ecosystems in the study area. Different microhabitats were recorded in the wadi-bed ecosystem according to the soil thickness and plant covers.
5- **Mountain Escarpment:**

The Red sea coastal land is bounded on the inland side by a range of mountains and hills (Galala Bahria, Galala Quiblia, Shayeb El-banant group,…etc). The presence of this coastal range has influenced the climate and the water resources of the Eastern Desert. Plant life in these mountains is affected by water resources which depends on a combination of factors such as: 1) expanse of water body traversed by wind before reaching the coast, 2) distance from the shore line to the mountains, 3) altitude and 4) Exposure (Kassas and Zahran 1971). The vegetation is more rich on the intermediate elevations (Hegazy and Amer 2002). Within the coastal hills of the Gulf of Suez, the vegetation is confined to the upstream parts of the drainage systems and to the slopes of hills.

6- **Rocky Plateaus:**

The rocky substratum provides little possibility for plant growth. Water and soil may accumulate in notches or depressions located on the rocky surface and this may support the growth of ephemerals. In certain localities, the rock fragments support the growth of various species of lichens. The run-off water may produce furrows in the surface of rocks. These furrows are lined with fine rock fragments, which allow the growth of ephemeral. The shallow furrows may lead into shallow trenches, in which some perennials may be found. In the wet season, certain ephemerals may appear in these trenches.
Mangrove Habitat in Safaga with *Avicennia marina*

Gravel Coastal Desert Plain

Mountain Escarpment - Rocky Wadi with *Moringa peregrina*
Mountain Escarpment- Sandy Wadi Supporting Open Vegetation

Desert Wadi around Qusier with Almost Dead Vegetation Due to Severe Drought

Fig.3: Landforms and Habitat Types in the Study Area
D. Climate

According to Ayyad and Ghabbour (1986), the northern Eastern Desert belongs to two climatic provinces; the hyperarid with a mild winter and a hot summer which is represented by the inland part, and the arid province which includes the coastal mountains along the Gulf of with winter rainfall. The climatic data (CNARE 1979, CLAC 2004) obtained from nine stations bordering the study region in the North Eastern Desert (Figs. 4-7 and Appendix Tables 1-4) denote two important climatic gradients; precipitation decreases southwards while temperature increases southwards.

The temperature regime in the northern Eastern Deserts is affected mainly by the latitudinal location and the maritime effect of the Red Sea. The altitudinal effect is limited to the highlands. Summer is generally hot (mean monthly air temperature ranges from 24.3° in Helwan to 32.4°C in Qena). Winter is either warm or mild (mean monthly air temperature ranges from 11.8° in Minya to 25.6°C in Qena (Fig. 4).

Rainfall is scarce, infrequent and occurs between October and May and mainly between December and January (Fig. 5). In Helwan and Suez (the northern stations), the annual rainfall is 23.3 mm and 19.6mm, respectively. In remaining stations, the annual rainfall varies between 0.7 mm in Assuit to 7.8 mm at Beni- Suef. The highest mean annual water evaporation was recorded in Assuit (14.2 mm/day), while the lowest value was recorded at Sohag (7.2 mm/day), (Fig. 6).

The relative humidity is affected mainly by the proximity to the Red Sea. The lowest records of relative humidity are generally those of later spring, whereas the highest records are those of late autumn and early winter (Fig. 7).
Fig. 4: Monthly Mean Air Temperature
Mean Annual Temperature is Shown between Brackets
Fig. 5: Monthly Mean Rainfall
Total Annual Rainfall is shown between Brackets
Fig. 6: Monthly Mean Water Evaporation
Mean Annual Water Evaporation is shown between Brackets.
Fig. 7: Monthly Mean Relative Humidity
Mean Annual Relative Humidity is shown between Brackets
E. Water Resources

1- Rainfall and Surface Water Resources

Although rainfall is sporadic, rare and variable, it represents the most important water resource in the north Eastern Desert. Heavy sporadic floods may occur. Floods in Saharan wadi systems are scarce; their frequency may be spaced from once every few months to once every decade (Dubief 1953). A flashflood is capable of disturbing the ecosystem. Such disturbance is followed by successive stages of regeneration (Van der Maarell 1988). The partial or complete destruction of wadi bed vegetation due to torrential floods creates gaps favourable for establishment of new plants (Fossati 1999). Floods are collected in the wadi beds and some water may percolates into crevices between rocks. Despite the destructive effects of floods on the urban centers and roads, they increase the water content of desert regions which consequently supports the wild life in deserts.

In the northern Eastern Desert, flooding occurs approximately every seven years (Labib 1981). Table 1 shows the amount of the total rainfall and the calculated net torrential run off water in some representative wadis of the study area, which frequently receive floods (Zayed 2005).

During the field study, some parts of the northern Eastern Desert were reclaimed for purposes of cultivation and new irrigation canals were constructed, that transported water from the old valley canals to the reclaimed area as in Wadi Qasab, near to Sohag area.

Table 1: Total Rainfall and The Estimated Consequent Net Torrential Run off Water in Some Representative Wadis of the Study Area Which Frequently Receive Floods (Source: Zayed 2005, and the List of Arabic References):

<table>
<thead>
<tr>
<th>Name of the Wadi</th>
<th>Total rainfall (m³)</th>
<th>Net torrential run off (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faleq El Waar</td>
<td>2840400</td>
<td>2123187</td>
</tr>
<tr>
<td>Faleq El Sahl</td>
<td>2866800</td>
<td>2158258</td>
</tr>
<tr>
<td>El Baroud</td>
<td>9488000</td>
<td>9079423</td>
</tr>
<tr>
<td>Safaga</td>
<td>13361600</td>
<td>11084783</td>
</tr>
<tr>
<td>Gasos</td>
<td>1948800</td>
<td>1673684</td>
</tr>
<tr>
<td>Hamrawin</td>
<td>1898000</td>
<td>1743744</td>
</tr>
<tr>
<td>Quseir</td>
<td>1074000</td>
<td>990225</td>
</tr>
<tr>
<td>Ambagi</td>
<td>34900000</td>
<td>32079691</td>
</tr>
</tbody>
</table>
2- Groundwater Resources

Groundwater resources in the Eastern Desert are very limited, compared to the other geomorphological provinces of Egypt (the Nile Valley and its Delta, the Western Desert and the Sinai). This is mostly due to the fact that the area is covered in most parts by crystalline rocks (mostly igneous and metamorphic), in addition to the limited sources for recharge.

Groundwater in the Eastern Desert may be found in both shallow and deep formations. Shallow groundwater occurs in the alluvial deposits and shallow carbonate rocks and is discharged either naturally through springs, or through drilled wells of shallow depth. The deeper water-bearing formations, however, are more extensive and generally provide larger and more reliable well yields (Can and Khafagi 1981).

Generally, the aquifers in the Eastern Desert are represented by four main geologic units: the fractured crystalline Pre-Cambrian aquifer, the Nubian sandstone aquifer, the fractured limestone and sandstone aquifers, and the Quaternary aquifer.

i- Fractured Crystalline Pre-Cambrian Aquifer

The Pre-Cambrian rocks are primarily exposed in the mountains of the Eastern Desert. These rocks include gabbroid to granite, intrusive serpentines, various volcanic and geosynclinal metasediments, and metavolcanics. The crystalline fractured aquifer is represented by the fractured basement rock, that outcrops or is, located at a very shallow depth on some wadis especially at the eastern part of the Eastern Desert (adjacent to the Red Sea coast).

This part of the desert is cut by a number of wadis (The Red Sea Group, almost 28 wadis). In the Nile Basin Group, the fractured crystalline aquifer is located at a very shallow depth, at the eastern part of the wadis (i.e. upstream of the wadis). The scarce rainfall over the catchment area of the basins recharges the aquifer, through the cracks and fractures in these massif rocks. Part of the recharge, through the fractures or fault plane, also feeds the numerous springs found in some wadis.

The aquifer supplies several hand-dug wells that are used by desert nomads. The groundwater quality of the Pre-Cambrian aquifer is greatly affected by the geochemistry of the host rock and the local climate. The water quality is variable, ranging from fresh to brackish in the northern part of the Eastern Desert. The TDS values range from 600 to 3,500 ppm. The potential supply of groundwater, from the fractured basement aquifer, is considered to be very limited and can not be relied upon as a sustainable source of water for human needs in the Eastern Desert.
ii- Paleozoic - Mesozoic Clastic Aquifer (Nubian Aquifer)

The Nubian aquifer of the Central Eastern Desert has a very high exploitation potential. The aquifer is composed of sands and sandstone, with intercalated of clay and shale. The thickness of the Nubian aquifer varies from one place to another and generally ranges between 10 and 120 m (the maximum thickness is located in wadi Qena), while the depth to water ranges between 4 and 40 m. In the northern wadis (north of Qena), the Nubian sandstone aquifer may occur at a deeper level.

The depth to the Nubian aquifer increases westward towards the entrance of these wadis. The ground water in the Nubian aquifer occurs under confined to semi-confined conditions in most localities, where the upper layers of the Nubian Formation consist mainly of confining layers of shale and clay. Recharge of the Nubian sandstone aquifer is mainly through the occasional infiltration of rain in the Eastern Desert, in addition to the water that was stored during pluvial times.

The quality of water extracted from the Nubian aquifer differs from one place to another. In most areas, the water is normally brackish with Total dissolved salts (TDS) ranging between 1,800 and 2,500 ppm. The water quality in the lower deep-seated layer is better. An evaluation of the groundwater extracted from the Paleozoic -Mesozoic aquifer in the Eastern Desert (Sallouma 1996, Khafagi and Sabir 1981) demonstrates that the groundwater in some areas is suitable for human use, e.g. Wadi El-Mathula, Wadi Araba, Wadi Bali, and Hurgada area.

iii- Fractured Limestone and Sandstone Aquifers

The fractured limestone and sandstone aquifers are mainly represented by the thick extensive multi-horizon succession of carbonate- rock facies, sandstones, shale and clay, located in the northwestern part of the Eastern Desert. The horizons include the Miocene sandstone and limestone aquifers, the Oligocene sandstone aquifer, and the Upper Cretaceous limestone and sandstone aquifers, which vary in thickness in different localities in the Eastern Desert. Groundwater may occur in these karstified rocks as local pockets, or perched at contacts with the impervious clay layers. It should be noted that at some localities (especially in the Red Sea Basin Group), the Miocene sandstone strata are considered to be a promising source of water.

These strata are distributed in the coastal plain forming a portion of the low hilly region (e.g. east of El-Quseir). The analysis of pumping test data indicated that the hydraulic conductivity, the storativity and the transmissivity of the Middle Miocene aquifers are 4.31 m/ d, 1.2x 10^{-3}, and 70 M^2 /d, respectively (El-Ghazawi and Abdel Baki 1991).
The aquifer may receive some recharge from the underlying aquifers through the deep fractures and fissures (Gomaa and Aggour 1999).

In different localities, water discharges from the aquifer as springs, such as El-Ain spring at 11 km east of Sohag, and Helwan spring 20 km east of Cairo. Generally, the quantity of discharge is very limited and the rate of spring discharge is variable depending, in most cases, on the seasonal rainfall. The quality of water extracted from the limestone and sandstone aquifers varies from fresh to brackish. The TDS of the carbonate-rock aquifer ranges between 1,000 and 9,000 ppm.

iv- Quaternary Aquifer

The Quaternary alluvial deposits cover the courses of the main wadis and their tributaries, forming terraces either in the Red Sea Basin Group or the Nile Basin Group. These deposits are dominated by sands and gravels. The Quaternary deposits represent the most important shallow groundwater supplies in the Eastern Desert. In the Red Sea group, their thickness is very limited, ranging between 2 and 20 m and generally increasing towards the Red Sea Coast. Generally, the deposits comprising the Quaternary aquifer in the Red Sea Basin Group occur in thin layers at depths varying from 1 m to about 15 m. The Quaternary aquifer is characterized by a high storage capacity containing water of generally good quality, but the aquifer is not extensive and its reliability can vary seasonally and geographically. In the central part of the Eastern Desert, the Quaternary aquifer does not represent a significant source of water, except for small communities and for limited domestic purposes. In most of the drainage basins (Nile Basin Group), the Quaternary deposits comprise the main aquifer which is mostly located adjacent to the flood plain of the Nile. It also extends beneath the cultivated lands of the Nile Valley forming the main sources of potable water in valley.

In the drainage basins under consideration, the Quaternary aquifer is composed of sands and gravels of Pleistocene Age, with intercalated lenses of clay. In the southern wadis (W. El-Mathula and W. Qena), the Quaternary deposits overlie, in most places, the Nubian sandstones while in the northern wadis (W. Qassab W. El-Assuti, and W. Tarfa) they rest directly over Pliocene clays which form the base of the aquifer. Recharge to the Quaternary aquifer occurs mainly by the very intermittent infiltration of the rainwater in the drainage basins of the wadis. Upward leakage from the underlying deep aquifer is considered as another source of recharge. It is important to mention that there is a hydraulic connection between the Quaternary aquifer in the main wadis of the Nile Basin Group and that under the Nile flood plain. Therefore, water exchange between the two aquifer segments is influencing the recharge-discharge relationship as well as the water quality. The TDS of the samples collected from these wadis ranges
between 500 and 2,000 ppm. Along the Red Sea coast, seawater intrusion to the Quaternary aquifer could be considered as the main source of the highly saline water in the underlying aquifer.

The above aquifers supplied the wells (Bir) that distributed in study areas, which may be shallow (< 30 m) or deep. Most wells are located in the mountain and hill escarpment, which receives high amounts of rains. Few wells are present in the Red Sea coastal area, but their water is almost brackish. Generally, the water of wells contains relatively high salt content and the percentage of salinity differs according to the location of the well (Zayed 2005). The quality of water of wells that located in the silicic rocks is higher compared to those present in the rocks that contain high amounts of Ca and Mg. The distribution of wells (according to the recent maps of Egyptian General Authority for Civil Survey 1991 and General Authority for Military Survey 1995- cited in arabic) in the north Eastern Desert is shown in (Table 2, Fig. 8).

The region has some other wells including: (1) Bir Abo Shaar: A natural well located at the edge of Gebel Abo Shaar facing the Red Sea. Its water is saline and contains high percentage of sulphates, which make it unsuitable for human use. The well is surrounded by Tamarix and palms; (2) Bir Dukhan: It is located in the area of Gebel Dukhan. Its water contains small amounts of salts; (3) Bir Um Dalfa: This well is located at the foot of Gebel Um Dalfa. The low amounts of soluble salts make the water suitable for human use. Lichens grow around this well; and (4) Bir Malaha: It is a saline natural well similar to the wells of oases of the Western Desert. The well supports heavy growth of Tamarix, phragmites and palms.

In addition to the natural wells, many man-made wells were established since ancient times. In the Romanian period, some wells were established in the region of Wadi Abo Kharif (historically called Mons Kladinos), which located at 7 Km west of Hurghada (Hegazy et al., 2003). Also some wells are present in the sites of oil excavations along the eastern coast of the Gulf of Suez, but most of them have saline water.

During the field survey, it was noticed that the study area contains what is called ephemeral rocky holes. These holes are present in almost all rocky surfaces of narrow wadis, dissecting the high mountains. Rocky holes are abundant in the igneous rocks. They become filled with water after rainfall and may last from few weeks to few months (native settlements). The amount of water in these holes depends on several factors, such as the amounts of rain, drainage system in the region and the size of the holes.
Table 2: List of the Known Wells (*Bir* = Well) In the North Eastern Desert:

<table>
<thead>
<tr>
<th>Well number</th>
<th>Well name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bir El Deep</td>
</tr>
<tr>
<td>2</td>
<td>Bir Ain Sukhna</td>
</tr>
<tr>
<td>3</td>
<td>Bir Zafarana</td>
</tr>
<tr>
<td>4</td>
<td>Bir Gharib</td>
</tr>
<tr>
<td>5</td>
<td>Bir El Ghardaqa</td>
</tr>
<tr>
<td>6</td>
<td>Bir Safaga</td>
</tr>
<tr>
<td>7</td>
<td>Bir Sialalah</td>
</tr>
<tr>
<td>8</td>
<td>Bir Abu Marawan</td>
</tr>
<tr>
<td>9</td>
<td>Bir El Gedami</td>
</tr>
<tr>
<td>10</td>
<td>Bir El Kobaneiah</td>
</tr>
<tr>
<td>11</td>
<td>Bir El Faookhir</td>
</tr>
<tr>
<td>12</td>
<td>Bir El Laqitta</td>
</tr>
<tr>
<td>13</td>
<td>Bir Earss</td>
</tr>
<tr>
<td>14</td>
<td>Bir Um Lassifa</td>
</tr>
<tr>
<td>15</td>
<td>Bir Shitoon</td>
</tr>
<tr>
<td>16</td>
<td>Bir Um Dood</td>
</tr>
<tr>
<td>17</td>
<td>Bir Um Ummiad</td>
</tr>
<tr>
<td>18</td>
<td>Bir Boiraat</td>
</tr>
<tr>
<td>19</td>
<td>Bir Awiddah</td>
</tr>
<tr>
<td>20</td>
<td>Bir Reshrash</td>
</tr>
<tr>
<td>21</td>
<td>Bir Qena</td>
</tr>
<tr>
<td>22</td>
<td>Bir El Agamiah</td>
</tr>
<tr>
<td>23</td>
<td>Bir Gendali</td>
</tr>
</tbody>
</table>

Fig.8: The Wells Distribution in Part of the Study Area
F. Vegetation and Medicinal Plant Life

The present survey of medicinal plants showed that many of the medicinal plant species dominate the communities, in which they occur, but the majority present as associated species with other dominant non-medicinal species.

In Qena-Safaga -Qusier area, plant communities of Acacia tortilis occur in habitat types of soft ingredients of alluvial soil deposits. The most common associated species include Zilla spinosa, Zygophyllum coccineum, Leptadenia pyrotechnica and Pulicaria undulata subsp. Undulate.

A community dominated by Salvadora persica forms patches of growth that show the influence of repeated cutting. When plants preserved from cutting, they may attain a tree growth with upright trunks (Zahran and Willis 1992). The associated species include Zygophyllum coccineum and Zilla spinosa. As for Pulicaria crispa, the species dominates few communities with Zilla spinosa as major associated species.

The downstream of Wadi Ambagi supports heavy growth of Juncus rigidus. The common associated species are Tamarix nilotica, Phragmites australis and Zygophyllum coccineum.

Mangrove vegetation is a notable feature of the littoral landscape. Avicennia marina forms a pure stand, in a site located at 17 Km south of Safaga.

Zygophyllum coccineum dominates community types with Zygophyllum simplex, at the downstream of Wadi Qena. This community includes some medicinal plants as Cistanche phelypaea, Citrullus colocynthis, Fagonia bruguieri and Rumex vesicarius. Also, Zygophyllum simplex shares the dominance with Cistanche phelypaea and Haloxylon salicornicum in a community recorded at the downstream of Wadi Qena.

Among the medicinal plants associated with this community, are Rumex vesicarius, Cotula cinerea, Citrullus colocynthis and Fagonia bruguieri. Calotropis procera co-dominates with Ochradenus baccatus and Leptadenia pyrotechnica some community types. Some medicinal species as Rumex vesicarius and Cotula cinerea are present as common associates.

Few trees of Moringa peregrina were recorded along the Qena- Safaga road within the region of the Red Sea coastal mountains. The trees were
associated with *Zilla spinosa*, *Zygophyllum coccineum* and *Cleome drosertifolia*.

One of the notable features of Wadi Qena is the preponderance of *Tamarix* sp. communities. Although *Tamarix* sp. are not included in our study as medicinal species, their communities are of special importance, when dealing with the ecology of the medicinal species of Qena region, as they include some important medicinal species including *Aerva javanica*, *Acacia tortilis*, *Pulicaria undulata subsp. undulata* and *Artemisia judaica*. These communities are dominated by *Tamarix nilotica* and *Tamarix aphylla*. The former species is usually associated with soils that are more saline than those of *Tamarix aphylla* (Kassas and Girgis 1972, Kassas and Zahran 1965). Some regions of Wadi Qena are characterized by fossil Tamarix hillocks which indicate former dense growth of *Tamarix* forest (Zahran and Willis 1992).

El-Minya and Assiut desert wadis have vegetation type dominated by characteristic medicinal plants which include *Calligonum polygonoides*, *Artemisia judaica*, *Acacia tortilis*, *Pulicaria undulata subsp. undulata*, *Zygophyllum coccineum*, *Cotula cinerea*, *Hyoscyamus muticus*, *Achillea fragrantissima*, *Leptadenia pyrotechnica*, *Ziziphus spina-christi*, *Prgularia tomentosa*, *Retama raetam* and *Citrullus colocynthis* which dominate or share the dominance with each other or with other non-medicinal species. The most common plant associates are *Cornulaca monacantha*, *Ochradenus baccatus*, *Zilla spinosa*, *Launaea spinosa*, *Tamarix nilotica*, *Panicum turgidum*, *Echinops spinosissimus*, *Deverra triradiata*, *Suaeda monoica*, *Typha domingensis*, *Haloxylon salicornicum*, *Pennisetum divisum*, *Farsetia aegyptia*, and *Cornulaca monacantha*.

The surveyed wadis in Sohag desert were Wadi Qasab, Wadi El-Kiman and Wadi Bir El-Ain. The noticeable feature of these wadis is the similarity in their vegetation. Fourteen medicinal plant species were recorded in this region. They occur as associated species within non-medicinal plant communities dominated by *Haloxylon salicornicum*, *Ochradenus baccatus*, *Zilla spinosa* and *Tamarix nilotica*. These medicinal species were *Fagonia bruguiieri*, *Zygophyllum coccineum*, *Rumex vesicarius*, *Zygophyllum simplex*, *Leptadenia pyrotechnica*, *Malva parviflora*, *Pulicaria crispa*, *Cleome drosertifolia*, *seriphidium herba–alba*, *Cotula cinerea*, *Anastatica hierochuntica*, *Capparis spinosa*, *Acacia tortilis*, *Zygophyllum coccineum* and *Leptadenia pyrotechnica*.

The Hurghada – El Shayeb area comprises different types of habitats and consequently diverse medicinal plant species, which form communities of their own or associates in other communities of non-medicinal species.
Moringa peregrine, Acacia tortilis, Calligonum polygonoides, Salvadora persica, Pulicaria undulata subsp. undulata, Citrullus colocynthis, Artemisia judaica, Cleome africanum, Solenostemma argel and Aerva javanica dominate or share the dominance with non-medicinal species as Ochradenus baccatus, Zilla spinosa, Lycium shawii, Cornulaca monacantha, Trichodesma africanaum, and Forsskaolea tenacissima.

The Cairo-Suez desert and the northern limestone plateau including Galala Baharia and Galala Qublia have diverse community types. The former is a mosaic of limestone and gravel. The limestone constitutes a table-like blocks that range in size from extensive plateaus to small buttes. The gravel forms rolling plains covered by gravel pavements. The area of Cairo-Suez desert is traversed by a number of drainage systems that originate in the Eocene limestone plateau in the south, extend across the gravel desert and debouch near the fringes of the Delta (Ayyad et al., 1993, Kassas and Girgis 1972 and 1970, Abu-el-Izz 1971, Kassas and El Abyad 1962, Kassas and Imam 1959 and 1954).

The area encompasses several communities in which many medicinal plants are present. They occur as dominant, co-dominant, common, occasional or rare species. Pulicaria undulata subsp. undulata dominates many communities in Wadi Sannur and Wadi Araba. Zilla spinosa and Haloxylon salicornicum are the most common associated species. In some localities, Zilla spinosa becomes the dominant species while Pulicaria crispa occurs as common or occasional species. Pergularia tomentosa shares dominance of some communities with Zilla spinosa in Wadi Sannur. Haloxylon salicornicum, Centaurea scoparia, Ochradenus baccatus and Panicum turgidum are common species within these communities.

Zygophyllum decumbens is a succulent plant growing in habitats drier than those of Zygophyllum coccineum. The species is restricted to a limited part of the limestone habitats of the Eastern Desert. Within the Cairo – Suez desert, the communities of Zygophyllum decumbens occupy the narrow and shallow runnels, dissecting the low limestone ground. The plant often builds small sand mounds that may not exceed 50 cm in height. The soil of these mounds is usually mixed sand with some limestone detritus (cf. Zahran and Willis 1992). The species usually associated with Zygophyllum decumbens are Acacia tortilis, Retama raetam, Zilla spinosa and Achillea fragrantissima.

Stachys aegyptiaca shows occasional occurrence as a chasmophyte abundant in the beds of the limestone wadis, where the rock surface is exposed. The plants which are usually associated with this species include
Capparis spinosa, Achillea fragrantissima, Fagonia mollis and Cocculus pendulus.

Nitraria retusa is a shrub, common in the salt marshes. This shrub is capable of building hillocks. It dominates many communities of the coastal area at Zafarana. Zygophyllum album, Tamarix nilotica, Suaeda monoica are the common associated species.

Juncus rigidus is abundant at the downstream of Wadi Sannur. It shares dominance with Tamarix nilotica, while Zygophyllum album and Cyperus laevigatus are the common associates. Retama raetam is a leafless shrub which dominates several communities in Wadi Araba and Wadi Sannur. Achillea fragrantissima, Ochradenus baccatus and Pulicaria undulata subsp. undulata are the common associated species. Acacia tortilis dominates some communities at the upstream of Wadi Araba, where populations in the downstream were subjected to overcollection and other human impacts. The associated species include Pulicaria crispa, Pergularia tomentosa and Zilla spinosa.

Hyoscyamus muticus occurs as a common species in several plant communities in the Galala Baharia and Qublia. Some of these communities are dominated by Calligonum polygonoides. Other communities, in which Calligonum polygonoides occurs, are dominated by Citrullus colocynthis. Crotalaria aegyptiaca is a palatable leguminous plant, usually trimmed by grazing animals. It shows variations in its growth form according to local habitat conditions. The species is present in association with Zilla spinosa, Retama raetam, Achillea fragrantissima and Zygophyllum decumbens.

Ecologically, the Red Sea coastal area is differentiated into the littoral shore line, the salt marshes and the coastal desert. Avicennia marina is the only mangrove species. Other species, such as Nitraria retusa, Zygophyllum album, and Juncus rigidus, are the most notable medicinal plant species, characterizing, and the salt marsh habitats adjacent to the mangrove sites. The common associates of the medicinal plants in this case are Tamarix nilotica, Phragmites australis, Halocnemum strobilaceum, Suaeda monoica, Limonium axillare and Aeluropus lagopoides. The medicinal plants recorded in the area between the coastal salt marshes and the coastal desert are Zygophyllum simplex, Zygophyllum coccineum, Acacia tortilis and Pergularia tomentosa. The associated non-medical species include Tamarix nilotica, Phragmites australis, Cornulaca monacantha, Tephrosia nubica, Erodium glaucophyllum, Ochradenus baccatus and Zilla spinosa.

The plant cover in the study area is open and the vegetation is composed of a permanent framework of perennials (deciduous and evergreen...
plants), the interspaces of which may be occupied by ephemerals after rains. In places where the soil is not deep, enough for maintenance of permanently wet subsoil, an evergreen plant may acquire a drought deciduous growth form. Due to the shortage of water and long periods of drought, the vegetation in most localities in the southern part of the study region was dry. Based on the life form category, herbs and undershrubs dominated the other categories of life forms growing in the study area.

Floristically, the study area (Fig. 9) found to support growth of about 280 taxa of different botanical families, of which, around 40 medicinal plant species were recorded as dominant/co-dominant or as associate species in the surveyed plant communities.

Fig. 9: Distribution Map of the Study Stands in the North Eastern Desert
G. Human Population

The Northern Eastern Desert is distributed among nine political governorates namely: Suez, Cairo, Giza, Beni Suef, Minya, Assuit, Sohag, Qena and Red Sea. The total population in these governorates (excluding Cairo) is 18,895,749 with 3,539,358 living in the eastern desert where population density evaluated as one person per 90 km² (Table 3). The Red Sea governorate is the most effective in the region where about 90% of its population is living in the eastern desert, part and almost all local dwellers and Bedouins belong to the governorate. The local dwellers and Bedouins of the Ma'aza tribe constitute the main population, who lives in the region between the Nile River and the Red Sea. According to Hobbs (1990), the Ma'aza regard their barren, drought stricken desert as a beloved homeland and consider themselves the caretakers, conserving its few resources to ensure their future livelihood and to be judged by God as good people.

The Western and Eastern boundaries of the Ma'aza territory are respectively, the Nile flood plain and the body of water comprising the Gulf of Suez and Red Sea. The Northern boundary is the plain cut by Wadi Araba. The Southern boundary is the asphalt road, linking town Qeft in the Nile valley to Qusier on the Red Sea coast. Bedouin life is focused around water courses in the mountain and wadi draining system. In winter, the Red Sea Mountains bring moisture out of low pressure weather systems that swing down from the Mediterranean Sea. In summer, the mountains generate convective rain fall, producing short light showers that the nomads call “scorpions” (agrabaan). Torrential rain fall may occur accidentally producing flood (sayl), but such rain is unusual and did not happen over the past nine years.

Table 3: Human Population in the Governorates Included in the Study Region
(Source: CAPMAS, 2004 and 1996):

<table>
<thead>
<tr>
<th>Governorate</th>
<th>Total population</th>
<th>Approximate population in the Northern Eastern Desert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suez governorate</td>
<td>417527</td>
<td>417527</td>
</tr>
<tr>
<td>Giza governorate</td>
<td>4784099</td>
<td>424119</td>
</tr>
<tr>
<td>Beni Suef governorate</td>
<td>1859214</td>
<td>208</td>
</tr>
<tr>
<td>Minya governorate</td>
<td>3310129</td>
<td>68</td>
</tr>
<tr>
<td>Assuit governorate</td>
<td>2802334</td>
<td>721380</td>
</tr>
<tr>
<td>Sohag governorate</td>
<td>3123115</td>
<td>638365</td>
</tr>
<tr>
<td>Qena governorate</td>
<td>2442016</td>
<td>1194840</td>
</tr>
<tr>
<td>Red Sea governorate</td>
<td>157315</td>
<td>142851</td>
</tr>
<tr>
<td>Total</td>
<td>18895749</td>
<td>3539358</td>
</tr>
</tbody>
</table>
The phenomenon of brief, localized rainfall associated with spotty and short-lived plant growth, provides the basis for Bedouin life, people and their domestic animals that are creatures physically fit to withstand drought condition.

As pastoral activities the Ma’aza tribes raise sheep, goat and camel herds. They also may hunt; collect edible and marketable wild medicinal plants. The Ma’aza used to practice “multi-resource nomadism”. Activities such as hunting and gathering were especially important in times of drought, when food and water for livestock are in short supply. Pastoralism is nevertheless the nomad's chief preoccupation. Now Bedouins work for wages and recently work in some tourism activities.

Pastoral nomads are exceptionally protective of their environment and work to maintain balance between themselves, their herds, and wild resources. Their way of life is currently in jeopardy. The principle resource supporting their livelihood is water, but they have no control over rainfall. They have experienced drought for several years and many of the Bedouin people are giving up nomadic life permanently, and they recognize that if drought persists relentlessly in the future eventually no nomads will remain.

The nomads’ adaptation of providing and enduring drought is successful because a set of social patterns and practices has evolved over thousands of years. Some of these social features are shaped by all pastoral nomads. They perceive their desert as the “center of the universe”. This improbable sense of security in the wilderness is largely a result of the social solidarity and practical benefits provided by the nomad's kinship system. Ma’aza identify themselves by the patrilineal decent system.

The Ma’aza of Egypt have their origins in the Arabian Peninsula. Despite the fact that there is no certain explanation of why and when they came to Egypt, some researchers believe that the Ma’aza origin is related to Beni Hashem Ibn Abd Manaf, who originated from Aly Abn Abi Taleb and they had lived in Egypt since the third century of Moslem immigrations.

The Ma’aza are known as the “Bani Atiyaa”, the eldest son of three sons (Atiyya, Okeal and Khamis) and that is why they called Bani Atiyya. They migrated to Egypt where they settled in the Northern half of the Red Sea desert whereas some others migrated to the south of Jordan.

All the Ma’aza are patrilineal descendants of one man. Ma’iiz Ibn Jabal (Goat, son of the mountain) who lived long ago in north western Arabia.
They comprise about twenty clans. Most members of Ma’aza clans have settled in the Nile valley. However, some clans have populations in both of Nile valley and the eastern desert.

The tribe is the largest kinship unit in the Bedouin knowledge. Its membership represents the boundaries of a “chosen people”, where none of the tribesmen are strangers and outsiders: According to the Bedouin ideology outsiders never become members of the tribe because their fathers were not. All Ma’aza tribesmen claim that they are descendants of one man.

The patrilineal system is known as the “segmentary lineage system” as it includes increasingly large segments of people descended from common ancestor. Scholars of nomadic cultures agree that the patrilineal descent system has a far greater importance in Bedouin life than merely designating a person’s identity.

These scholars are concerned especially with the relationship between kinship segments and the economic activities of pastoral nomads. They view membership in household, lineage, clan and tribe as prescriptions for specific social, economic and political activities. In particular, they regard the segmented kinship structure as a cultural mechanism that allows people to disperse or congregate as the environmental conditions change. Patterns of everyday activities of the Ma’aza justify the conclusion about environment and their nomadic culture.

Every aspect of their life tied to segmentary social organization. Kinship is involved in making a living, as common members of patrilineal descent groups congregate and disperse into camping parties to keep up with the changing availability of resources, such as, water and pasture.

Cooperation between households of the same lineage or clan forms the basis for most economic and social activities. Flexible social and economic arrangements between members of household, lineage and clan allow the nomads to exploit wide range of opportunities more efficiently. Men leave the household to work, hunt, harvest or shop, while women move the camp and livestock, and children supervise the animal herds. A single household out of ten, does not have enough members to perform all the assigned tasks particularly during periods of resource deficiency and cycles of drought. The common pattern of the encampment is for two or three households “bayts” from the same clan and usually from the same lineage. Having several households together frees, at least the male household head to be absent for some periods to work for wages, collect wild plants, hunt or travel to town for shopping, while one or more older males remain in camp. It appears that
territories which are as much as kinship segments play important role in every day of Bedouin’s activities.

The natural vegetation plays an important role in the life of the people. The local dwellers still depend upon the natural vegetation as main source of fodder and to produce coal which consumes the wood of trees in their territory. Nowadays, collection of medicinal plants is marginal priority for economy of the tribal livelihood. Due to poor vegetation and extended drought periods, local dwellers collect medicinal plants mainly for their own use as medicine. When vegetation flourishes they may collect plants to sell for tours in safari stations or to herbal shops. Due to the mining and tourism related activities as well as prolonged drought periods, pastoralism is considered of a second priority economic activity to the tribal livelihood and which in turn depends on the natural vegetation.

H. Human Impact

The human impacts that appeared in the area are reviewed in the following:

(1) Overcollection of Plants

Collection of desert species for fuel purposes resulted in the population decline of many species as *Acacia tortilis* subsp. *raddiana* (Forssk.) Hayne and *Moringa peregrina* from many wadis in the eastern desert (Fig.10). The extensive gathering of medicinal plants such as *Hyoscyamus muticus*, *Citrullus colocynthis*, *Senna alexandrina* and *Artemisia judaica* makes the future of these species in jeopardy.

(2) Overgrazing

Overgrazing is a major problem especially in the years of drought. It causes destruction of vegetation and also habitat deterioration.

(3) Tourism Activities

The establishment of many tourist centers and safari stations in the region causes destruction of the natural habitats and consequently their natural vegetation. Also, the uncontrolled tourism and off-road driving in desert safari caused various degrees of deterioration to many medicinal plant communities and habitats (Fig.10).

(4) Urban and Mining Development

Mining and quarrying activities for Urban and industrial development are found in many wadi systems of the northern eastern desert. Large areas have been transformed into mines for the cutting of stones, sand and gravels.
for construction purposes. The majority of these activities showed little regard to the natural environment, which finally caused destruction of the vegetation.

(5) Land Reclamation

The increase in the human population of Egypt necessitates the expansion of the cultivated land. This was achieved by the reclamation of many desert areas particularly in the areas surrounding the cities located in the Nile valley. This leads to the disappearance of desert medicinal plant vegetation in the reclaimed areas.
Fig. 10: Human Impacts on Vegetation in the Region. (A) Camel Safari in Desert Wadis; (B) Beach Buggies and Motor Cycles are Common Desert Sport and Safari around Tourism See Side Resorts; and (C) Wood Cutting of Trees for Fuel. Note Absence of Vegetation in Areas Accessed By Camels and Buggies.
I. Traditional Knowledge

Local dwellers have a quasi settled Bedouin life with various economic activities, trying to depend on the natural environment, or to balance their needs with the available natural resources, depending on social solidarity among the members of the tribe (Hegazy et al., 2000). Labour division between males and females plays an important role in this matter. The males practice the income-generating economic activities like touristic activities, service activities and plant trading, while females practice pasturing in addition to helping the males in their jobs. In case of drought and touristic recession, most of the Bedouins tend to relax and practice some simple activities like housework and pasturing.

Medicinal plants are collected by the household individuals - males, females, and children - so as to be distributed among relatives and acquaintances, or to be sold for tours or herbal shops. The three commonly sold species are *Hyoscymus muticus* (سكران) as a substitute to tobacco. The second species is *Cleome droserifolia* (السموة) for curing diabetes mellitus and *Citrullus colocynthis* (الحنض) for rheumatism treatment. Some people affirmed that medical plants trade has become very difficult because of rarity, on one hand, and because of intensive security arrangements in the area. A Bedouin affirmed this saying, "We couldn’t collect plants and sell them. We could sell *sammo* (*Cleome droserifolia*) for 5 or 6 pounds a kilogram."

The cultural changes are fast. Bedouins used to make green tea with *Pulicaria incisa*, but now the style of life has changed since tourism was introduced. Local dwellers look for fast earning, as they need more money. Bedouins have moved to tourism, as if every customer paid 3 euros for a meal, they gain about 1,000 pounds a week per capita.

The human population plays a limited role as for the direct medicinal use of plants in the study area. This is primarily due to the nature of the physical environment in the region and the rarity of the plants, which makes the population move to other activities that generate more income, especially in the field of tourism, with the related service activities practiced by Bedouins (Hegazy and Amer 2002, Hegazy et al., 2003, Hobbs 1990). Dependence of local people on medicinal plants as a therapy, is contracting as pharmaceutical medicine became available to them through tourism activities.

For Bedouins, plants are an inherited culture that has to be maintained, but natural circumstances and changing life style represent a major obstacle (Krzywinski 1990). At the family level, Bedouins know the different
medicinal uses of plants. The job of local healers is retreating. It was practiced by old wise individuals of the clans.

The Salam (Acacia tortilis) is thought to be "blessed" and its sticks prevent envy. It is thought that Salam trees have religious value and that just touching them is blessing. The Yassar (Moringa peregrina) is used as walking sticks, and it is said that this plant has been used since the time Sahabah (the companions of Prophet Mohammad), and just holding these sticks protects their owners. It is noteworthy that some Bedouins make charcoal from tree trunks, especially at the time of drought, as it is used for roasting meat at safari stations.

Some local people believe that the existence of awliya in the area may constitute a factor of maintaining the botanic wealth, as some of awliya may practiced their botanical knowledge to cure diseases (a wali was a popular curer). But some people, especially researchers, see that the existence of awliya constitute a destructive factor for this wealth; as when holding a mawlid (the anniversary of one of the awliya) near these plants, people misuse them (Fig.11).
Fig. 11: (A) Medicinal Plant Collector in Minya Region Collecting *Artemesia Judaica*, (B) Al Galaly Shop for Spices and Medicinal Herbs, Assuit, (C) & (D) Queen Spices and Medicinal Herbs, Hurghada, (E) & (F) Sabry Kammoun for Spices and Medicinal Herbs, Sohag, and (G) Al-Hag Badawy Refa‘y Nour-El-Dine in Dar Reyad-Al- Salehyn Academy, Sohag.
J. Recipes

The following plants and recipes are recognized by the healers and local dwellers for treatment of many diseases. Local plants are used and sometimes mixed with plant materials brought from outside the region.

(1) *Anastatica hierochuntica* L. — كف مريم – قواطبة

The whole plant is used in gynecology. The boiled plant tea with *Peganum harmala* L. — حرمَل is used as pelvic bath for women to treat inflammations and to increase the opportunity of pregnancy.

(2) *Seriphidium herba – album* Asso. — شيح بلدي

- **Gastric worms:** The boiled plant tea with *Artemesia judaica* L. — شيح بعيثران and *Artemesia cina* Berg L. — شيح خراساني is used as a drink sweetened with black honey (honey of sugar cane) and taken in the morning before breakfast.
- **Treatment of thyroid gland:** The boiled plant tea with *Artemesia judaica* L., and *Artemesia cina* Berg L. and *Matricaria recutita* L. is used as gargle, in the morning before breakfast, to increase the gland secretion.
- **Gastric worms, cold attacks and convulsions:** The boiled plant tea with *Artemesia judaica* L. and *Artemesia cina* Berg L. and *Matricaria chamomilla* L. — شيح باكوني is used as a drink taken in the morning before breakfast.
- **Constipation:** The previous decoction of gastric worms, cold attacks and convulsions is used as an enema.
- **Anti colic:** The boiled plant tea, sweetened with honey bees, is taken in the morning before breakfast and at night. This decoction is used to release all types of gastric and renal colic and convulsions.
- **Face clarification:** The vapour of the plant with *Artemesia judaica* L. and *Artemesia cina* Berg L. and *Matricaria chamomilla* L. is used to clarify the face. The plants are put together with two cups of water in a flask on a small flame, and used as a vapour bath for the face.
- **Abscesses:** The fresh *Seriphidium herba – album* Asso. plant is macerated with onion fleshy leaves and used as mask for the face.

(3) *Citrullus colocynthis* (L.) Schrad. — حنظل

- **Gastric worms:** The fruit is cut into two halves; fresh milk is poured inside one half and taken in the morning before breakfast. The fruit may also be cut into two halves, overnight in fresh milk and put tightly on the venter for 12 hours.
- **Rheumatism:** The fruit is cut into two halves, grilled on a flat metal plate and put tightly on the knees during night. The green fresh fruit may also be
cut into two halves, heated using a light flame and put tightly on the foot overnight.

(4) Cleome droserifolia (Forssk.) Delile
- Wound healing: The leaves are oven dried and added on wounds as powder to accelerate healing especially for Diabetic patients.
- Treatment of hyperglycemia: Half of a teaspoonful of the dried leaves powder is added to a cup of water, boiled, and taken in the morning. Half of a teaspoonful of the dried leaves powder mixed with Lepidium sativum L. may also be taken in the morning before breakfast.

(5) Hyoscyamus muticus L.
The plant is used for treatment of bronchial asthma. The dried plant leaves are wrapped in cigarette paper and smoked as cigarettes when needed. Note: The leaves and seeds are used as an anesthetic. Large doses may be lethal.

(6) Malva parviflora L.
The fresh juice of the plant shoot mixed with Cichorium intybus L. shoot juice is taken three times per day for treatment of hepatitis (virus C) and other liver diseases.

(7) Moringa peregrina (Forssk.) Fiori
- Slimness: The plant is used to increase appetite and to treat slimness as jam of several constituents cooked in black honey. The other plant constituents are Pistacia lentiscus L., Curcuma longa L., and Trigonella foenum-graecum L.

(8) Peganum harmala L.
- Constipation: Hot decoction of seeds is used to treat constipation in the morning before breakfast.
- Gastric worms: The boiled plant tea with Artemesia judaica L., Artemesia cina Berg L., Artemesia herba – alba Asso. and Lepidium sativum L. is used. One teaspoonful is taken, sweetened with black sugar, in the morning before breakfast.
- Gynecology: To increase the probability of pregnancy, the dried leaves and flowers are mixed with Anastatica hierochuntica L. whole plant, boiled in water and used as pelvic bath.
• **Bronchial asthma:** The dried plant powder is mixed with *Tilia sylvestris* Desf. نحيفة لبركة *Psidium guajava* L. حوافة *Nigella sativa* L. حبة لبركة *Peganum harmala* L. حرمل، *Rosmarinus officinalis* L. حصص البان and *Boswellia carterii* Bird.لبدان. The plants are boiled in water and the resulted decoction sweetened with black sugar is taken in the morning before breakfast.

• **Pain of legs:** A bath for the legs is prepared using few seeds in warm water. The legs are placed in the bath for at least one hour.

(9) *Plantago ovata* Forssk. قطنون

The seeds are put in water and left overnight. The whole solution with the seeds is taken in the morning before breakfast for treatment of constipation and nervous colon.

(10) *Pulicaria undulata* subsp. *undulata* (Forssk.) Benth. & Hook شاي الجبل

The plant is used for treatment of renal colic and inflammations and to get rid of renal stones. The plant tea, sweetened with black honey, is taken in the morning before breakfast.

(11) *Salvadora persica* L. سواك

**Treatment of the teeth:** The plant stolons and young stems is used for brushing the teeth to clean and clarify it and for treatment of the gum diseases. A mixture of the stem powder and *Syzygium aromaticum* (L.) Merr. & L. M. Perry قرنفل powder with sodium bicarbonate may be used as a substitute of toothpaste.

(12) *Salvia aegyptiaca* L. شجرة الغزال

The boiled tea of leaves and stem is taken twice a day, in the morning before breakfast and at night for treatment of Bronchial asthma. For better results the decoction is sweetened with black honey.

(13) *Senna alexandrina* Mill. سنان

The boiled tea of leaves, sweetened with black honey, is taken in the morning before breakfast for treatment of Constipation.

(14) *Solenostemma arghel* (Delile) Hayne حرجل

• **Kidney stone lysis:** The tea of leaves and flowers is boiled with *Cymbopogon schoenanthus* (L.) Spreng. حلف ير sweetened with black honey and taken in the morning before breakfast or at night.

• **Gastric colic and cough:** The tea of the dried leaves is taken before breakfast.
(15) Ziziphus spina-christi Willd.

**High blood pressure:** The tea of leaves is taken once in the morning before breakfast.

**Hair fall:** The burned bark mixed with oil of *Olea europaea* L. is used as ointment to prevent falling of hair and to strengthen it.

(16) *Zygophyllum coccineum* L.

The hot decoction of the fruits is used for regulation of kidney functions, treatment of kidney inflammations and for stone lysis. The decoction is taken sweetened with black honey in the morning before breakfast or at night.
K. Cultivation

Status:

Medicinal plants in Egypt are under threat due to over collection and destructive harvesting practices. Many pharmaceutical companies depend largely upon raw medicinal plant materials, produced from naturally or semi-naturally occurring farming systems that are being rapidly depleting. At present, most of the plant materials used in herbal medicine are harvested from the wild by gatherers, who usually collect everything they think can sell without regard to how the plants will survive in the future.

For the North Eastern Desert, it becomes increasingly difficult to collect enough raw plant material from the wild, where several species are no longer found and have to be brought from other localities. To meet the ever-increasing demand for traditional crude drugs, many medicinal plant species are indiscriminately collected in large quantities from the region. The collection of large number of plant species means that the potential for improved plant productivity and management is still limited, except for those common species being developed by medicinal companies.

The market need for medicinal plant raw materials is increasing. It is therefore necessary to find some developmental ways to produce the required plant material to meet the market needs. During recent years there has been a growing consensus among traditional healers and pharmaceutical companies to grow medicinal plants in agricultural farms. Cost data for traditional medicinal plant cultivation in the Nile valley indicated net revenues between USD 5,000 and USD 13,290 per hectare, without inclusion of land cost. Potential cultivation in the region needs to be less intensive and performed on small scale.

The appropriate sites for cultivation are those confined to desert wadis associated with the Nile valley. The challenge is to adapt and simplify the technology and methodologies that suit the small-scale farm operations.

The primary purpose of marketing strategy needs to focus on the quality and high price of medicinal plant products rather than the quantity, thus demand can be reduced to sustainable levels without decreasing revenues. Marketing of raw plant materials to Attarin or herbal shops, visitors and tourists results in wasting the resource with the least revenues.
Cultivation methods which reduce labor input are essential to enable producers to compete on the world market. Organic agriculture production systems are likely to be required to maximize product price.

This poses problems of developing efficient and sustainable organic production systems. Many species require manual harvesting and processing, resulting in high production costs. While some progress has been made, further efforts are required for crop cultivation and production management. Efficient processing is important, where most crops are processed by using well-tried technology. The development and application of new processes in cultivation of economically important medicinal plants requires targeted awareness, education and research programs.

Biotechnological tools such as cell and tissue culture, and cryopreservation are being used for conservation and rapid propagation of rare and endangered plant species. Plant cell culture is viewed as a potential means of producing useful plant products such as that of the conventional agriculture, with all its attendant problems and variables, can be circumvented. Additional advantages of such processes include controlled production according to demand.

Possibilities:

One of the solutions for conservation of wild medicinal plants is to encourage commercial cultivation and to develop efficient in vitro propagation methods to conserve the threatened species. The general objective is to make certain that adequate supplies of water maintained for the entire region to meet the needs of developmental activities within the capacity limits of natural ecosystems. Appropriate agricultural technologies, including the improvement of indigenous technologies, are needed to fully utilize limited water resources and to safeguard those resources against pollution and overexploitation.

The scarcity, gradual depletion and the progressive encroachment of incompatible activities such as tourism and industry, demand integrated water resource planning and management. Such integration must cover all types of interrelated freshwater bodies, including both Nile water and underground water, and duly consider water quantity and quality aspects. Water resource development in the context of medicinal plant socio-economic development must recognize the multi-interest utilization of water resources for agriculture, industry, urban development and mining activities.
Constraints:

Doubtless, the work in cultivation and domestication of wild medicinal plants has its own problems. These problems are aggravated under dry environments in the eastern desert. The major constraints and obstacles to medicinal plant cultivation in the region include: (1) Drought which represent the major constraint for cultivation of medicinal plants. In dry years, the Bedouins become involved in looking for water supplies for their subsistence and raising livestock. The underground water resources in the region are not enough to support economically and environmentally viable medicinal plant cultivation; (2) Tourism and changing life style, where local dwellers are currently used to work for cash wages or have business in tourism related activities. Due to the low revenue from medicinal plants and its depletion in the region, its cultivation is marginal priority for local dwellers.

The following are the obstacles that limit the production of cultivated medicinal plants:

(1) Lack of seeds and propagules, and when they are available their source is unknown. (2) High costs, which led to the monopolizing the products by traders who control prices. (3) Absence of equilibrium between production and consumption because of ignorance of the needs of the market. (4) Affliction with plant disease, and the producers being unaware of and not complying with guidelines and technical directives. (5) Neglecting the safety measures of handling by the producers in the production stages as harvesting, drying, sieving and storage as well as being mixed with botanic and animal wastes, which affects their quality and their exportability.
L- Socio-Economic Assessment

Programs for sustainable development of medicinal plants depend upon the available information of the value and uses of the plants and on the analytical studies of the socioeconomic aspects. Estimating the value of medicinal plant species meets the problem of the absence of fixed market price for some of the common plants. However, the medicinal plant valuation problem need be solved by using the proper methods to support their sustainable development and conservation purposes.

Valuation methods are needed to decide which plant species is more valuable than the others. Ecological valuation methods can be related to the various philosophical views on nature. One can distinguish between the various methods which are compatible with the classical, development and the coevolution views. For the purpose of medicinal plant conservation and sustainable use, the recommended methods are those compatible with the development view.

The following are the appropriate methods for socio-economic analysis of medicinal plants:

1. Alternative Aspects of the Medicinal Plant Valuation:

Medicinal plant management method impacts the socio-economic aspects of this natural and biological product. Emphasis on the management of commercial activities, e.g. selling and manufacturing of medicinal plant products, is important to the different areas and impacts associated with each individual commercial project, particularly the impacts resulting from the self use of medicinal plants as medicine or for subsistence and semi-subsistence activities, which in some cases may be widespread and significant.

In certain cases, loss of, or damage to medicinal plant resource may be justified by the need of people or the environmental constraints. However, the decision to exploit a medicinal plant for commercial use is based solely on the marketable gains. In the value assessment of medicinal plants, ignoring the environmental value and the consequences of species loss due to over use, often irreversibly, may result in degradation and deterioration of the supporting ecosystem. The economic value of the medicinal plant resources and their ecological role is far exceeding the gains from converting it to an alternative use.

In order to make a rational choice between conservation and development options of medicinal plants, or between a decision to halt,
modify or continue, the alternative management options must be properly evaluated. The appropriate methodology for medicinal plants focuses on the approach of cost-benefit analysis of their alternative uses.

2. Medicinal Plant Valuation Methods:

Any planning and development decisions for medicinal plants should be made on the bases of solid economic grounds and the forces of the free market system. To meet this requirements, it is necessary to valuate the social and economic aspects. Economic valuation of medicinal plants needs to assign quantitative values for the plants as a product or resource provided by the environment. The availability of the market price of the product assists in arriving to the fair value of the medicinal plant species. Valuation of the medicinal plant species essentially means valuing the characteristics of the ecosystem.

The purpose of economic analysis is to make the total economic value of the medicinal plant resource, such values may be fully incorporated into the economic assessment process.

Methods of assessing the value of medicinal plant species are described in the following:

(i) Market Price Method:

For environmental products that have a market price, their monetary value is estimated by: Total Value = unit market price x quantity.

This method is used in computing the economic value of medicinal plant species which are sold in the market. Market price of medicinal plant species can be derived from a variety of sources including: the existing literature on economic and social studies published or privately held statistics, socio-economic survey and consultation with agricultural extension offices, forestry service personnel, government market specialists and statisticians.

(ii) Cost Price Method:

Many medicinal plant species may be used for domestic purposes in agriculture, livestock and industry. It is unlikely that markets will exist for these uses. Maintenance costs can be the base of estimating the cost price of the species. In addition, the operating cost of medicinal plant production is an important source of information needed to compute the cost price of the quantity produced. This method requires a cost accounting system to trace and allocate costs of medicinal plants.
(iii) The Travel Cost Method:
This method relies on the assumption that people make repeated trips to production sites until the marginal utility derived from a trip equals the marginal costs of a trip. The marginal costs are travel costs in terms of time cost and transportation cost. These travel costs can be regarded as a directly revealed preference for recreation and an indirectly revealed preference for nature.

The travel cost method assumes that the demand for trips to a specific site is dependent on travel costs, income, characteristics of the site, prices of substitute, etc. Travel costs are, however, related to distance. In order to determine the cost, distance circles are drawn in the production area of the site. The percentage of inhabitants of each circle that will visit the site at a fixed amount of travel cost per circle is determined by means of a survey.

The application of the travel cost method to make a socio-economic analysis for medicinal plants depends on the survey of the visitors for each site and the income realized, the population of visitors, and the total cost of traveling to the medicinal plant site.

(iv) Contingent Valuation Method:
This method aims at asking the beneficiary groups how much they are willing to pay for the use or conservation of the medicinal plants. Contingent method is based on: (i) Description of the medicinal plant resource that is valued, which includes identifying all valuable attributes of the resource; (ii) Description of the payment pool as it pertains to how the money will be paid; and (iii) The description of the hypothetical market should include an identification of who will provide and who will pay for the conservation and sustainable use.

(V) The Production Factor Method:
This method is based on the fact that many natural resources, processes and qualities are used as production factors. The production factor method tries to valuate the resource quality by valuing the different impacts on production costs.

The first step of this method is to determine the impact quality and quantity, and the environmental effects on medicinal plant production.

(Vi) Integrated Socio-Economic Method:
As medicinal plant species have many economic and social aspects, an integrated methodology for the socio-economic valuation of the transitions of consuming and trading of the medicinal plant needs to
be identified. The major elements required to identify and quantify the production of medicinal plant species are to: (1) Identify the communities who are producing medicinal plants and the quantity produced; (2) Compute the value of the quantity produced by each community using one of the previously discussed valuation methods; (3) Identify and quantify the social aspects of producing, consuming and trading medicinal plants; (4) Compute the socio-economic and environmental costs and benefits of the medicinal plant species; and (5) Select methods and techniques of conservation and sustainable use of the medicinal plant species and compute costs and benefits for every method and technique.
List of Medicinal Plants in the Region:

*Acacia tortilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan
*Achillea fragrantissima* (Forssk.) Sch. – Bip.
*Aerva javanica* (Burm. f.) Juss. ex Schult. in Roem. & Schult.
*Anastatica hierochuntica* L.
*Artemisia judaica* L.
*Seriphidium herba-alba* Asso. (used to be in the area but rarely found in this survey)
*Avicennia marina* (Forssk.) Vierh.
*Balanites aegyptiaca* (L.) Delile (used to be in the area but not found in this survey)
*Calligonum polygonoides* L. subsp. *comosum* (L’Her.) Soskov.
*Calotropis procera* (Aiton) W. T. Aiton
*Capparis spinosa* L. var. *aegyptia* (Lam.) Boiss.
*Cistanche phelypaea* (L.) Cout.
*Citrullus colocynthis* (L.) Schrad.
*Cleome amblyocarpa* Barratte & Murb.
*Cleome drosierifolia* (Forssk.) Delile
*Cocculus pendulus* (J. R. & G. Forst.) Delile
*Costula cinerea* Delile
*Crotalaria aegyptiaca* Benth.
*Ephedra aphylla* Forssk.
*Fagonia bruguieri* DC.
*Fagonia glutinosa* Delile
*Ficus palmata* Forssk.
*Hyoscyamus muticus* L.
*Juncus rigidus* Desf.
*Leptadenia pyrotechnica* (Forssk.) Decne.
*Moringa peregrina* (Forssk.) Fiori
*Nitraria retusa* (Forssk.) Asch.
*Peganum harmala* L.
*Pergularia tomentosa* L.
*Plantago ovata* Forssk.
*Pulicaria undulata* subsp. *undulata* (Forssk.) Benth. & Hook
*Pulicaria incisa* (Lam.) DC.
*Retama raetam* (Forssk.) Webb & Berthel
*Rumex vesicarius* L.
*Salvadora persica* L.
*Salvia aegyptiaca* L. (used to be in the area but not found in this survey)
*Senna alexandrina* Mill.
*Solenostemma arghel* (Delile) Hayne
*Stachys aegyptiaca* Pers.
Teucrium polium L. (used to be in the area but not found in this survey)
Trigonella stellata Forssk.
Ziziphus spina-christi (L.) Desf.
Zygophyllum album L.
Zygophyllum coccineum L.
Zygophyllum decumbens Delile
Zygophyllum simplex L.

Categories of Medicinal Plants:

Potential species list of medicinal plants in the region:

1. **Pharmacopoeial Plants:**
   Citrullus colocynthis (L.) Schrad.
   Hyoscyamus muticus L.
   Plantago ovata Forssk.
   Senna alexandrina Mill.

2. **Plants (Non-Pharmacopoeial) Used in Preparation of Industrial Drugs:**
   Balanites aegyptiaca (L.) Delile
   Ephedra aphylla Forssk.
   Rumex vesicarius L.
   Salvadora persica L.
   Solenostemma arghel (Delile) Hayne

3. **Plants Used in Folk and Traditional Medicine:**
   Acacia tortilis (Forssk.) Hayne subsp. raddiana (Savi) Brenan
   Achillea fragrantissima (Forssk.) Sch. – Bip.
   Anastatica hieruchuntica L.
   Seriphidium herba-album Asso.
   Artemisia judaica L.
   Balanites aegyptiaca (L.) Delile
   Capparis spinosa L. var. spinosa
   Cleome drosorifolia (Forssk.) Delile
   Citrullus colocynthis (L.) Schrad.
   Convolvulus hystrix Vahl
   Cotula cinerea Delile
   Ephedra aphylla Forssk.
   Hyoscyamus muticus L.
   Juncus rigidus Desf.
   Leptadenia pyrotechnica (Forssk.)Decne.
   Moringa peregrina (Forssk.) Fiori
   Peganum harmala L.
Plantago ovata Forssk.
Pulicaria undulata subsp. undulata (Forssk.) Benth. & Hook
Pulicaria incisa (Lam.) DC.
Rumex vesicarius L.
Salvadora persica L.
Salvia aegyptiaca L.
Senna alexandrina Mill.
Solenostemma arghel (Delile) Heyne
Teucrium polium L.
Ziziphus spina – christi (L.) Desf.
Zygophyllum coccineum L.

4. Plants (Studied in the Laboratory) Potentially Considered Medicinal:

Anastatica hieruchuntica L.
Calligonum polygonoides L. subsp. comosum (L’Hér.)Soskov
Cistanche phelypaea (L.) Cout.
Juncus rigidus Desf.

5. Plants with Restricted Use to the Area but Not Spread among Healers

Juncus rigidus Desf.
1. Acacia tortilis (Forssk.) Hayne subsp. raddiana (Savi) Brenan, Fabaceae.

It is an important Egyptian medicinal plant used as sedative, contraceptive for toothache. Dried powdered bark used as disinfectant for healing wounds. Also, gums from the tree is dispensed in water and used to treat ocular affections, jaundice and pulmonary diseases. Seeds (entire or powdered) used for diarrhea. Stem bark (covered with gum) used as a remedy against asthma in Somalia (Quracol A and B).

The plant is characterized by the presence of flavonoid glycosides, 5,7-dihydroxy-4′-p-Me benzyl isoflavone, flavones (apigenin, luteolin and quercetin), proanthocyanidins.

The stem bark contains triterpenoids, hexacosanol, betulin, β-amyrin, β-sitosterol, and α-amyrin. Also, octacosanol, 3-acetyl-β-sitosterol and betulin were isolated from the heartwood. Arabinogalactan-protein and Uronic acid are present in gums. Quracol A (1-(2,4-dihydroxyphenyl)-3-(3,4-dihydroxyphenyl)-propan-2-ol) and Quracol B (1-(2,4-dihydroxy-phenyl)-3-(3,4-dihydroxyphenyl)-propan-2-ol.) were present only in the gum of A. tortilis whereas (+) - fisetinidol is present both in the gum and the bark.

As the quracols are more efficient smooth muscle relaxants than (+)-fisetinidol, this finding confirms the traditional healer's opinion that gum-covered bark should be used in preparation of a remedy against asthma.

The species needs conservation measures for its protection against wood collection as fuel.

The plant is distributed in Qossier–Safaga road, Wadi Qena, Wadi Al-Assiut, Wadi El-Nakhil, Wadi Hagoul, Wadi Araba nce Gabel El-Shayeb region. The species is threatened by overcollection as a fuel, overgrazing and severe drought.

2. Achillea fragrantissima (Forssk.) Sch. – Bip. Flora (Regensburg) 38: 13 (12855), Asteraceae

Infusion of the dry or fresh leaves and flowering shoots are used for the treatment of cough and as aromatic bitter stomachic and anthelmintic.

Fresh herb contains essential oil, which contains santolina alcohol, artemisia alcohol, artemisia ketone, cis-thujone and trans-thujone. The plant
also contains, flavonoids, from which, afroside, cirsimartins and cirsiliol were identified.

Monoterpines and sesquiterpene lactones: 13-O-desacetyl-1-β-hydroxyafraglouclide and achilloide A were isolated. Its tannins content reaches 8%, composed of resorcin, phloroglucin, methyl phloroglucin and pyrocatechol; the plant also contains Lauric, myristic, palmitic, stearic, linoleic, linolenic and oleic acids, bitter substance named keissoside and Taraxasterol and pseudotaraxasterol acetates.

The plant is also used as antidiabetic. The essential oil showed antibacterial and antifungal activities.

The plant is distributed in Wadi Etheili, Wadi Houf, Wadi Sannur, wadi Hagul, Wadi Al-Assiuty and El-Minia region. The species is threatened by overcollection for herbal medicine.

3. **Aerva javanica** (Burm. f.) Juss. ex Schult. in Roem. & Schult., Syst. Veg. ed. 15,5: 565 (1819), var. javanica, Amaranthaceae

Decoction of the plant shoot is used to remove swelling.

The plant contains flavonoid glycosides (acylatedisorhamnetin). Roots are used for headache.

The plant grows in Wadi Qena, Wadi Hof, Wadi El-Reshrash and Gabel Shayeb El-Banat area.


The whole plant is used in gynecology. The boiled plant tea with *Peganum harmala* L. is used as pelvic bath for women to treat inflammations and to increase the opportunity of pregnancy. The dried plant crushed with sugar is taken as energetic purge for cases of jaundice, followed by milk as diet. Its resemblance to a clutched hand has led to being linked to the Arabic folklore to the hand of the Virgin Mary at childbirth. Generally, the plant is used during childbirth, where the dried plant is soaked in water and used by women at childbirth. Infusion of dry plant reduces the pains & facilitates childbirth.
The plant contains Flavonoids (Anastatins A & B), luteolin-7-glucoside, isovitexin, kaempferol 7-glucoside, kaempferol 3-rhamnoglucoside, quercetin, rutin and sterols. Fruits contain glucose, galactose, fructose, sucrose, raffinose and stachyose.

The isolated flavonoids, anastatins A and B, showed hepatoprotective activity.

Also, the plant has been reported as an abortifacient and it has contraceptive properties.

The plant grows in wadi Hagul, wadi Houf, wadi Bir El-Ain and El Minya region.

5. *Artemesia judaica* L., Mant.: 281 (1771), Asteraceae.

An infusion prepared from the flowering plant is used as stomachic, anthelmintic, expectorant, diaphoretic, analgesic, and antispasmodic in case of intestinal colic. Leaves inhaled to relieve congestion of colds. Infusion of flowering branches relieves gastro-intestinal cramps, stomachic, abdominal disturbances and constipation.

The main constituents of the essential oil (2.0%) include piperitone, camphor, caryophyllene, bornyl acetate, borneol, isoborneol, p-cymene, α- and β-pinene, camphene, myrecene, limonene, sabinyl acetate, thymol and nerolidol were identified.

The volatile oil exhibited insecticidal, anthelmintic, anti-inflammatory, analgesic, antipyretic, stimulant and antimicrobial activities.

The plant grows in Wadi Qena, Wadi El Ibrahimi, Qena – Safaga road, Wadi Al-Assiuty, Wadi Qena, wadi Al-assiuty, El-Minea region, wadi Hagul, wadi Houf and Gabel Shayeb El-Banat area.


Stem bark is used as astringent, young roots used as aphrodisiac and unripe seeds are used as poultice for boils and abscesses.

Aqueous and ethanolic extracts showed antimicrobial activity.
The plant contains flavonoids (luteolin, chrysoeriol, isorhamnetin glycosides) and Iridoid glucosides (Geniposidic acid derivatives).

The plant is distributed in El Gouna, Hurghada and Safaga. The species is threatened by overcollection as forage and by habitat change along the coast due to sea-side resorts and establishments.


It is used as fish poison but not toxic to man. It is used as anthelmentic, purgative, vermifuge, emetic and in the treatment of boils, leucoderma, herpes, malaria, wounds, syphilis, cold and liver. The oil of fruit kernel is used for dressing wounds and in rheumatism.

The aqueous extract of *Balanites aegyptiaca* bark is used in Sudanese folk medicine in the treatment of jaundice.

The plant contains balanitin-1,-2,-3; balantin-1 for example possesses a yamogenin aglycone with a branched glucose and rhamnose side chain. The plant is reported to contain 5.6% diosgenin. Seeds contain furanocoumarins. Flavonoids, isorhamnetin-3-O-robinobioside and isorhamnetin-3-O-rutinoside. Alkaloids, N-trans-feruloyltamamine and three common metabolites, vanillic acid, syringic acid were also found. In addition to furostanol saponin (in mesocarp) 26-O-beta-D-glucopyranosyl-(25R)-furost-5-ene-3,22,26-triol, 3-O-[[alpha-L-rhamnopyranosyl-(1-->2)],[beta-D-xylopyranosyl-(1-->2)]-beta-D-xylopyranoside (balanitesin). Pregnane glycosides (in mesocarp) pregn-5-ene-3 beta,16 beta,20(R)-triol 3-O-(2,6-di-O-alpha-L-rhamnopyranosyl)-beta-D-glucopyranoside (balagyptin) and pregn-5-ene-3 beta,16 beta,20(R)-triol 3-O-beta-D-glucopyranoside.

The plant extracts or the saponins exhibited anti-inflammatory, antinociceptive, anti-oxidant, hepatoprotective and antidiabetic activities.

The plant was not found in the surveyed area. The species seems to be eradicated by cutting for fuel wood or lack of regeneration due to habitat disturbance and drought.

The plant contains flavonoids e.g. (kaempferol, quercetin, quercetin-3-O-β-D-glucoside (isoquercitrin), kaempferol-3-O-β-D-glucuronide), procyandins, carotenoids (violaxanthin and neoxanthin), stilbene derivatives and tannins.

The plant showed anti-inflammatory, anti-ulcer and hypoglycemic activities.

The plant grows in Wadi el Ibrahimi, Kuraimat-Zafarana road, *Galala* baharia and qublia, wadi Al-Assiuty, El-Minea region and Gabel Shayeb El-banat area.


A decoction of the drug is used in veterinary medicine as antileprosy drug. The powdered leaves are used as vermifuge in small doses. They are smoked in cases of asthma. Fresh leaves are used in the form of cataplasm for sun stroke. Leaf extracts used as cardio tonic. Roots are emetic and expectorant. Root bark is used for dysentery. Latex causes serious inflammations and may lead to blindness. It is used for scabies of the camels and goats. It is applied on the teeth to loosen them. It is used as a drastic purgative, emmenagogue, for bites and skin diseases. Flowers are used in small doses for cold, cough, asthma and in digestion.

The alcoholic extract stimulates rabbit's intestine, rectum, abdomen’s muscle of frog and contracts the uterus of virgin female rats.

The plant contains cardenolides (calotropin, calotoxin) and saponin and choline.

The plant is distributed in Suez gulf, El Muqattam and Qena-Safaga road. The species is threatened by overcollection as fuel and herbal medicine.


Roots are used as tonic, astringent and diuretic. Root bark is used as appetizer, purgative, anthelmintic, emmenagogue and analgesic. Also, flower buds and root are utilized as renal disinfectants, diuretic, tonic and for
arteriosclerosis and chills, as well as compresses for the eyes. Leaves and fruits are carminative and aphrodisiac.

The plant extracts showed anti-inflammatory, analgesic, antipyretic, hepatoprotective, antitumor and immunosuppressive effects.

The plant contains alkaloids (Stachydrine), flavonoids (Quercetin-3-rutinoside), Glucocapparin, volatile oil, sterols and saponins.

The plant grows in Wadi Rishrash, wadi Bir El-ain, Gabel Shayeb El-Banan and Wadi Houf.


The plant has slight analgesic, antipyretic & diuretic, with min. acute toxicity.

The plant contains Iridoid glycosides.

The plant grows in Qena-Safaga road, Cairo-Suez road and Wadi Houf.


The plant is a medicinal pharmacopouial used for treatment of gastric worms, the fruit was used for rheumatism, also leaves are diuretic and used in treatment of jaundice and asthma. In addition, the root is useful in inflammation of breasts, amenorrhea, rheumatism, and joint pains and used externally in ophthalmia and uterine pains. The fruit is pungent, cooling, purgative, anthelmintic, antipyretic and carminative. The fruit also cures tumors, leucoderma, ulcers, asthma, bronchitis, and urinary discharge, enlargement of spleen tuberculosis glands of the neck, dyspepsia, constipation, anaemias and throat diseases. The plant is used as Purgative. The drug exhibited anti-inflammatory and antitumor activities. The leaves and pulp extract (i.v.) caused a dose-independent increase in blood pressure. The leaf extract exhibited anti-inflammatory activity. Also, the ethanolic extract of the fruits produced stimulation, accompanied by increased motor activity, tremors, convulsions, diarrhea and rapid irregular respiration preceeding death in mice.
Colocynthia contains cucurbitacin B and E (α-eleatrin), colocynthin, Sterols (α-spinasterol and others) and Alkanes, aliphatic alcohols alkaloids, and choline base.

The plant grows in Wadi Qenna; Qena – Safaga road; Gebel El Qatar.


Traditionally, infusion of plant leaves has an immediate effect on abdominal and rheumatic pains. The plant contains triterpene (dammarane type). It is reported to have anti-inflammatory, analgesic (alcohol extract). It possesses cytotoxic activity against P388 cells.

The plant grows in Qena-Safaga road and Cairo-Suez road.


The leaves and shoot (paste, infusion or powdwer) are reported as wound healing to accelerate healing especially for Diabetes mellitus patients. Half of a teaspoonful of the air-dried leaves powder is added to a cup of water, boiled, and taken in the morning for treatment of hyperglycemia. Half of a teaspoonful of the dry leaf powder mixed with Lepidium sativum L. and Rhus coriaria L. may also be taken in the morning before breakfast. Washing of body with the infusion treats skin allergy. The plant contains: sesquiterpenes oxide (buchariol), carotol and dihydrodihydroxy carotol, triterpenes, diactyl triterpene lactone (drosericarpone), Flavonoids (0.295%), kaempferol-3,7-rhamnoside,isorhamnetin-3-gluco-7-rhamno-side, kaempferol-3-gluco-7-rhamnoside, quercetin-3-gluco-7-rhamnoside, kaempferol, arteinin, 5,7,4-trihydroxy-3-methoxyflavone, 5,7,4-trihydroxy-3,3-dimethoxyflavone, 5,7,4-trihydroxy-3,6-dimethoxyflavone(jaceosidin), 5,4-dihydroxy-3,6,7-trimethoxy-flavone (penduletin), 5,7,4-tetrahydroxy-3,6-dimethoxy flavone (axillarin), 5,3-dihydroxy-3,6,4,5-tetramethoxy flavone, 5,4-dihydroxy-3,6,7,8,3',pentamethoxyflavone, 5-hydroxy-3,6,7,3',4',5'-hexamethoxyflavone, Sterols (β-sitosterol and stigmasterol), saponins, coumarins, alkaloids and docosanio acid.

The aqueous and chloroformic extracts of the herb showed a significant reduction of blood glucose in rats. The aqueous extracts of the
herb showed a good antimicrobial activity against *Staphylococcus aureus*, *Streptococcus faecalis*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Escherichia coli* and *Candida albicans*. Ethanol (70%) extract of the plant has antihistaminic effect, inhibitory effect on rabbit's duodenum, uterus, and rabbit's heart, a relaxant effect on guinea pigs trachea, decrease in arterial blood pressure, diuretic and mild tranquilizing effect with moderate progesterone-like action. Plant extracts have inhibitory effect on soil fungi. It also showed hypoglycemic and hepatoprotective activities. Also, it is safe for oral administration. It causes decrease in body weight in rats. LD$_{50}$ = 2175 mg/Kg. Toxicity symptoms: tremors, convulsions, arched back, sweating, rapid and shallow respiration, coma followed by death.

The plant is distributed in Qena-Safaga road, Cairo-Suez road, Wadi Hagul and Gable Shayeb El-Banat area.


The plant contains alkaloids (Bisbenzyl isoquinoline gp.) Coesulin, Pendulin. It possesses cholinesterase inhibitory activities due to the alkaloids.

The plant grows in Wadi Houf and wadi Degla.


Infusion of flower heads is stomachic and used to flavor tea replacing peppermint. Also, it is useful for broncho-pulmonary conditions, against scorpion bites, rheumatism, vomiting, nausea and stomach pains.

The antipyretic effect was comparable to that of acetylsalicylic acid used as the standard drug. Also, the extracts were tested for their antiprotozoal, analgesic, molluscicidal activities as well as their larvicidal properties against *Anopheles labranchiae* mosquito larvae.

Essential oils (23 components) were identified, with camphor as the major component, 50.1%). The roots of *B. cinerea* afforded, in addn. to known spiroketaleneolether polyynes and sesquiterpene- coumarin ethers, 2 new isofraxidin-derived sesquiterpene ethers, pectachol B and acetylpectachol B, 8-farnesylscopeotenin. The aerial parts of *C. cinerea* gave
diacetylenic spiroketal enol ether and several sesquiterpene lactones, three of them being glucoconol-like lactones. The aerial parts of *C. cinerea* contain luteolin and its 7-O-β-D-glucoside, 7-O-β-D-diglucoside, and 6-hydroxy-7-O-β-D-glucoside, and apigenin 7-O-α-L-rhamnopyranoside and isoschaftoside as primary flavonoid constituents. In addition, minor amounts of quercetin 3-O-β-D-glucoside, quercetin 3-O-β-D-galactoside, quercetin 7-O-β-D-glucoside, and 5,3′,4′-tri-hydroxy-3,6,7-trimethoxy-flavone were isolated.

The plant grows in Qena -Safaga road, Wadi Qena, Wadi Bir El-in and Wadi El-Assiuty.


The plant contains pyrrolizidine alkaloids. It possesses persistent hypoglycemic activity.

The plant grows in Wadi Hagul, Wadi Houf and Cairo-Suez desert road.


The plant possesses hypotensive effect (ephedradine C alkaloid). Traditionally, boiled infusion treats common cold and analgesic for gastric pains. Also, the plant contains alkaloids (ephedradine C, hordenine, flavonoids (di-C-glucosyl-flavone, 2″,2″-di-O-β-glucopyranosyl-vicenin II, flavonol di-O-glycoside, herbacetin 3-O-β-rhamnopyranoside-8-O-β-glucopyranoside. Vicenin II, the 7-methoxy-4-quinolone 2-carboxylic acid, ephedralone, p-hydroxybenzoic, p-coumaric, protocatechuic acids and herbacetin7-Me ether, were also isolated from the aerial parts of Ephedra aphylla.

The plant grows in Cairo Suez road and Qattamia-Ain Sokhna road.


The plant contains erythroxan diterpenes: 15, 16-dihydroxy-7-β-hydroxy-cis-ent-erythrox-3-ene (7-β-hydroxyfagonene), 15,16-dihydroxy-7-
oxo-cis-ent-erythrox-3-ene (fagonone, I) and 16- O- acetylfagonone, and flavonoids (8- methoxyflavones).

The plant grows in Wadi Hagul, Shayb El Banat area, Qena Safaga road, Asyut and Minya regions.


Traditionally, the plant was reported for treatment of skin lesions. The plant contains triterpenoid saponins, flavonol glycosides and erythroxan diterpenes. Aerial parts of *F. glutinosa* yielded ent-erythroxane diterpene series, most based upon a 15, 16-dihydroxy-cis-ent-erythrox-3-ene structure, trivially named fagonene.

The plant grows in Wadi Hagul, Qattamia road and Galala Baharia.


Traditionally, Fresh or dry fruits are edible and used for treatment of constipation. Latex is added to goat milk to make yoghurt.

The plant contains β-sitosterol and bergapten, Ca (1.00%), Mg (0.63%), ascorbic acid (0.083 mg/g), and crude fat (4.71%).

The plant grows in Gebel Shayeb El Banat, Qattar and Wadi Houf.

22. *Hyoscyamus muticus* L., Mant. 1: 45 (1767), Solanaceae.

The dry plant leaves are wrapped in cigarette paper and smoked as cigarettes for treatment of Bronchial asthma. The leaves and seeds are used as an anesthetic. Large doses may be lethal. The plant relieves painful spasmodic conditions of non-striated muscles, characteristic of lead colic and irritation of the bladder. It is used to allay nervous irritation of hysteria and irritable cough. Fresh leaf cataplasm allays pain. It is used in toothache, cough mixtures and for treatment of fever.

It is used as cerebral and spinal sedative, hypnotic, and narcotic in insomnia when opium cannot be used. It relieves the griping caused by
drastic purgatives. It is prescribed in cases of irritable bladder, in irritable cough. It is used to allay nervous irritation of various forms of hysteria.

It contains up to 1.3% and not less than 0.8% of total alkaloids, calculated as hyoscyamine (Leaf alkaloids 1.70%, ripe fruits 1.34%, stems 0.569%, flowers, 2.0%). Other alkaloids are hyoscine (0.02%), tigloidine, cuscohygrine, hygrine, apohyoscine, atropine, norhyoscine, 3α-tigloyloxytropine, noratropine and apoatropine.

The plant grows in Cairo -Suez desert road, Ain Sokhna area, Galala Baharia, Wadi Araba and Wadi El Asyuti.


Paste prepared from ground culms and inflorescences are used for treatment of skin diseases and irritability.

Phytochemical screening of the plant revealed the presence of flavonoids.

The plant grows in El-Ain Al- Sokhna region, Al-Qusier, Wadi Bir El-Ain and in all Nile governorates in sites with high water table. Also, few populations of this species were recorded around wells and in salt marsh habitats


Infusion of branches is used for urine retention and to expel uroliths and as diuretic. Pregnane glycosides (18 new Pregnane glycosides), Triterpenoid (leptadenol), Sterols (β-sitosterol, β-amyrin, lupeole, betulin) and Flavonols (quercetin, kaemferol glucoside, quercetin glucoside, isorhamnetin rutinoside & rutin) were isolated from the whole plant.

Betulin isolated from the plant showed antitumor activity since it shows moderate DNA- binding activity at IC$_{50}$ 42 μg/ml.

The plant grows in Wadi El-Assiuty, Al -Qusier-Qift road, Wadi Bir El-Ain, Wadi Qasab, wadi Hagul, Gebel Dokhan and Gabel Shayeb El-Banat area.

For slimness, the plant seeds are used to increase appetite and to treat slimness as jam of several constituents cooked in black honey. Hot decoction of seeds is used to treat constipation in the morning before breakfast. The seed oil is used to treat headache, fever, abdominal pain and constipation, burns, back and muscle pains and during labour in childbirth. The leaf extract is rubbed over the skin to soothe rash. The seed oil is valuable for preparing cosmetics.

The plant contains isothiocyanates (e.g. 2-propyl, 2-butyl and 2-methylpropyl isothiocyanate, and flavonoids(e.g. rutin, quercetin-3-rhamnoside, quercetin-3-galactoside andisorhamnetin-3-rhamnoside ). The Seeds contained oil 54.3, protein 22.1, carbohydrate 15.3, and fiber 3.6%.

The plant is distributed in Qena – Safaga road, Gebel Shayeb El-Banat and Dokhan.


The plant extract exhibited hypoglycemic effect.

Flavonol glycosides, including flavonol trioside, isorhamnetin-3-O-4-rham-galactosyl-robinobioside and five known flavonol glycosides,isorhamnetin 3-robinobioside, isorhamnetin 3 -rutinoside, isorhamnetin 3-galactoside, isorhamnetin 3-glucoside and free isorhamnetin were isolated from the leaves and young stems of *Nitraria retusa*.

The plant grows in El Qattamia road and Red Sea coast.


The different parts of the plant (seeds, leaves, flowers) are used as vermifuge, a narcotic, antiseptic, anthelmintic, abortifacient, antidiabetic, analgesic, stomachache, depurative and for the treatment of rheumatism asthma, colic, jaundice laryngitis, hemorrhoides and cardiac disorders. The seeds reported as aphrodisic due to its content of hallucinogenic components possesed CNS stimulant effect, followed by paralysis.
The plant extracts showed antimicrobial activity. The alkaloids, isolated from the plant (harmine, harmaline and harmalol) exhibited antitumor, antilishmanial, anticoxiceptive, vasorelaxant and insecticidal activities.

The seeds contain alkaloids (harmine, harmaline, harmalol, peganine dipeginol) and an N,N'-bis[(3-hydroxy-5-methyl)phenyl]oxamide (I), two anthraquinones 3,6-dihydroxy-8-methoxy-2-methylanthraquinone-6-O-α-L-rhamnopyranosyl-(1-6)-β-D-glucopyranoside. The following flavonoids were isolated from the aerial parts: acacetin-7-O-rhamnosome, acacetin-7-O-[6''-O-glucosyl-2''-O-(3'''-acetylrhamnosyl)] glucoside and acacetin-7-O-(2''-O-rhamnosyl-2''-O-glucosylglucoside), and the glycoflavone 2''-O-rhamnosyl-2''-O-glucosylectytoside. (β-sitosterol and α-amyrin) were also identified from the plant.

The plant grows in Wadi El-Ratam, Qattamia-Ain Sokhna road and El-Galala El-Baharia.


In Egypt, Bedouins in eastern desert area used the roots to treat haemorroids.

The plant is used in several countries as laxative, vomiting, anthelmintic and for the treatment of bronchitis haemoptysis skin infections. The cardiac glycosides isolated from the plant are molluscicidal.

Ghalakensiside (I) reported as a cytotoxic cardiac glycoside. The roots contain cardiac glycosides (e.g. desglucouzarin, coreglaucigenin, uzarigenin, calactin and pergularoside. Two flavonoids (quercetin, kaemferol) and B-sitosterol glucoside were identified from the plant.

The plant grows in El Qusier-Qift road, Ras Gharib-El Qusier road, Qena Safaga road, wadi Houf, Wadi Hagul and Galala El-Baharia.

29. **Plantago ovata** Forssk., Fl. Aegypt. Arab.: 31 (1775), Plantaginaceae.

The ground seeds are used for treatment of constipation and nervous colon.
The seeds of isubgol (*Plantago ovata*) are used in food manufacture as thickener or stabilizer, also used in herbal medicine as demulcent and laxative for treatment of chronic constipation, dysentery diarrhea and cystitis. The methanolic extracts of the seeds, showed an antioxidative effect. Psyllium is an effective and safe drug for the treatment of hypercholesterinemia.

Mucopolysaccharides derived from the husk of psyllium (*Plantago ovata*) have beneficial properties for wound cleansing and wound healing. Recent studies indicate that these mucopolysaccharides also limit scar formation. The ethanolic extract fractions (2g/kg) and the major constituent verbascoside (400 mg/kg) exhibited significant analgesic and anti-inflammatory activities.

*Plantago ovata* contains several constituents mainly mucilage 10-30% (mixture of polysaccharides as d-xylose), alkaloids, iridoid glycoside (aucubin), amino acids, sterols & triterpenes, tannins and other phenolic compounds. Also, Apigenin, genkwanin, luteolin (flavonoids), mussaenoside, aucubin (iridoids), verbascoside, poliumoside (phenylpropanoids), oleanolic acid (triterpene) and β-sitosterol glucoside (sterol) were isolated from both chloroform and Ethyl acetate extracts of the aerial parts of *Plantago ovata* Forsk. The ethyl acetate extract afforded a major compound identified as verbascoside and 4 flavonoids identified as luteolin-7-O-β-glucopyranoside, luteolin-4'-O-β-glucopyranoside, quercetin-3-O-rhamnoside and the highly methoxylated calycopterin.

The plant grows in Wadi Hagul, Cairo -Suez road, Wadi El-Ratam, Qattamia road and El Kuraimat- Zafrana road.


The plant tea, sweetened with black honey, is taken in the morning before breakfast for treatment of renal colic and inflammations and to get rid of renal stones.

The plant extracts and some isolated Sesquiterpene lactones exhibited cytotoxic, antineoplastic and antioxidant activities.

The plant contains volatile oil (the main constituents of which were β-Caryophyllene and its oxide), β-sitosterol, choline, β-amyrin and sesquiterpene lactones (e.g. 1 beta, 4 beta-dihydroxy-5 alpha (H)-guaia-10(14),11(13)-dien-8 alpha,12-olide).
The plant is common in Wadi Et'heili; Wadi El Gibrawi, Wadi Araba, Galala El-Baharia, Wadi Sannur, Wadi Qena, Shayeb El-Banat area and Wadis around Safaga and Qusier.

31. **Pulicaria incisa** (Lam.) DC., Prodr. 5:479 (1836) subsp. *Incise*, Asteraceae.

Boiled leaves or shoots used as refreshing drink and anticoic. The essential oil has antibacterial activity and showed a marked sedative effect on animal behavior.

Essential oil, the main components of which are carvotanacetone (37.4%), linalool (19.2%), piperitone (14.1%), and benzyl acetate. The oil is rich in phenolic compds. and monoterpane hydrocarbons and is comparatively low in sesquiterpene hydrocarbons.

The plant grows in all the study region and occurs as associate species with *Pulicaria undulata*


Traditionally, the plant was reported as nutritive seeds when mixed with flour.

The plant contains alkaloids (e.g. (+)-12α-hydroxylupanine, (+)–retamine, (+)-sparteine, (--)-lupanine, (--)-anagyrine, (--)-cysisine, (--)-N-methylcysisine) and flavonoids (e.g. 7-glucosides of apigenin, luteolin and chrysoeriol. In addition to orientin, orientin-4'-glucoside and apigenin-6,8-di-C-glucoside. Also, daidzein and daidzein-7,4'-dimethyl ether.

The plant grows in Wadi El-Ratam, Wadi Hagul, Qattamia road, Wadi Araba, Wadi Sannur and El-Minia area.


Traditionally, used for gastrointestinal problems including constipation, indigestion, dyspepsia and flatulence. Also, it is used for liver and spleen diseases, particularly against jaundice.
The plant contains flavonoid C- glycosides: Vitexin, Isovitexin, Orientin and Iso-orientin, Anthraquinones: Emodin and Chrysophanol, Sterols and triterpenes.

The plant grows in Wadi Qena, El Qattamia road, Wadi Hagul, Wadi Qasab and around the Cairo-Suez road.


The plant stolons and young stems are used for brushing the teeth to clean and clarify it and for treatment of the gum diseases. A mixture of the stem powder and *Syzygium aromaticum* (L.) Merr. & L. M. Perry powder with sodium bicarbonate may be used as a substitute of toothpaste. Meswak is used for gonorrhoea, spleen, boils, sores and gum diseases, also for stomach ache. It is used for bites of poisonous snakes. The wood boiled in oil and used as a liniment for contusions. Leaves are used as anti-syphilitic drug. Leaves, roots, barks and flowers contain diuretic oil. Fruits are edible, stomachic, carminative, febrifuge and appetizer. The use of the miswak is recommended by the *Prophet Mohammed* (Peace be upon Him), specially before each of the five prayers every day. The recent studies proved its efficiency in cleaning the mouth, teeth and gums. Some companies produced tooth-paste preparations containing the extract of arak.

The plant extracts exhibited sedative, anti convulsant, anti ulcer, hypolipidemic and antimicrobial activities, as well as adverse effects on male and female reproductive system and fertility.

The plant contains Lignan glycosides, 5 glycosides [sodium-1-O-benzyl-β-D-glucopyranoside-2-sulphate (salvadoside), 5,5’-dimethoxylariciresinol 4,4’ bis-O- β-D-glucopyranoside (salvadoraside), syringin, liriodendrin and sitosterol 3-O-glucopyranoside] were isolated from the stems of *Salvadora persica*. Flavonoid, 11 flavonoid glycosides were isolated and identified from the ethanolic extract of the leaves of *Salvadora persica* and volatile oil (benzyl nitrile, eugenol, thymol, isothymol, eucalyptol, isoterpinolene, and beta-caryophyllene).

The plant grows in Qusier-Safaga area, Gebel Dokhan and Gebel Qattar area.
35. **Salvia aegyptiaca** L., Sp. Pl. ed. 1: 23 (1753), Lamiaceae.

*Salvia aegyptiaca* L. is used for treating various unrelated conditions that include nervous disorders, dizziness, trembling, diarrhea and piles.

The plant's extracts have CNS depressant, antinociceptive, antipyretic, anti-inflammatory and hypoglycemic effects.

The plant contains *Diterpenoids* (6-methylcryptoacetalide, 6-methyl-epicryptoacetalide and 6-methyl-cryptotanshinone) have been isolated and characterized from the whole plant. *Triterpenoids* (3beta-hydroxy-olean-12-en-28-oic acid, 3beta-hydroxy-oleana-11,13(18)-dien-28-oic acid). *Sterols* (sitosterol-3beta-glucoside, sitosterol, stigmasterol). *Flavonoids*, (5-hydroxy-7,3',4'-trimethoxyflavone and 5,6-dihydroxy-7,3',4'-tri-methoxy-flavone).

The plant was not found in the surveyed area.

36. **Senna alexandrina** Mill., Gard. Dict. ed. 8 no. 1 (1768), Fabaceae.

The boiled tea of leaves, sweetened with black honey, is taken in the morning before breakfast for treatment of Constipation. The plant is stimulant laxative (in cases of habitual constipation), wound dressing, anti-dysenteric, carminative, for treatments of gonorrhea, skin diseases, dyspepsia, fever and hemorrhoids. The plant has antitumor and virucidal activities.

It contains anthraquinone glycosides (sennoside A, A1, B, C, D and G. Hydroxy anthracene derivatives (2.5%). 6-hydroxymuscisin. Aloe-emodin and rhein, naphthalene glycosides, mucilage) flavonoids (myricyl alcohol, phytosterol [Franz, 1993]. Emodin, 8-O-sophoroside and dianthrone diglucosides) and volatile constituents from the leaves (menthol, geranylacetone and anethole).

The plant grows in El Qusier - Qift road.

37. **Solenostemma arghel** (Delile) Heyne, Getreue Darstell. Gew. 9,t.38 (1825), Apocyanaceae.

The tea of dry leaves and flowers is boiled with *Cymbopogon schoenanthus* (L.) Spreng, sweetened with black honey and taken in the morning before breakfast or at night for kidney stone lysis. The leaves of the plant are used for the treatment of cough and as a purgative, antipyretic, expectorant and antispasmodic, and in cases of bile congestion. Several
herbal prescriptions containing parts of Argel are used as immuno-stimulant for the treatment of hypercholesterolemia and viral hepatitis B and C.

Extracts of the leaves showed fungitoxic, spasmolytic and uterine relaxant activities.


The plant grows in Wadi Sudr, Gebel Shayeb El-Banat and Dukhan.

38. *Stachys aegyptiaca* Pers., Lamiaceae.

The boiled tea of *Stachys aegyptiaca* and *Salvia officinalis* leaves is used as nerve sedative. The cold decoction of seeds is used for treatment of rheumatism.

The plant grows in Wadi Houf and Galala Baharia.


Boiled infusion used to cure common cold, diabetes mellitus and fever. Hot infusion of the tender parts of the plant is taken for stomach and intestinal troubles.

The plant is used in as vermifuge, stimulant, depurative, astringent, It is used as appetizer, expectorant, hypoglycaemic and for the treatment of cold, gastric ulcer, feminine sterility, fever, small pox and itching.

The plant extracts exhibited hypoglycemic, anti-inflammatory, hypolipidemic, antiulcer, analgesic and condulonic effects. It also stimulates the neuromotor centers for uterine and intestinal musculature.

It contains Diterpenes (neo-clerodane, teulolin A(15,16-epoxy-6\(\beta\),7\(\beta\),18,19-tetrahydroxy-neo -cleroda-3(4),13(16),14-trien-20,12(S)-olide) and teulolin B(15,16-epoxy-3\(\alpha\), 6 \(\beta\),7\(\beta\),18,19-tetrahydroxy-neo-cleroda-
4(18),13(16),14 -trien-20,12(S)-ole) Iridoids, flavonoids, hedragenin, Ursolic acid, α- and β-amyrins and volatile oils.

The plant was not known in the studied area.


The sapogenins contents (diosgenin and 25-spirosta-3,5-diene) were detected in roots, stems, leaves, and pericarp. In addition to these genins, gitogenin was isolated from the seeds of the plant. Flavonoid glycosides, fifteen glycosides were found based on the aglycones kaempferol, quercetin and the less common 7,4'-dihydroxyflavone and 7,3',4'-tri hydroxyflavone. One isoflavone (formononetin) was found in all *Trigonella* species. The nitrate content of the edible parts amounted 6743 mg/kg in *Trigonella Stellata* (star fenugreek).

The plant grows in Cairo-Suez road, Wadi Houf, Wadi Hagul, Wadi El-ratam, around Qattamia road and El Kuraimat- Zafrana road.


The plant extracts exhibited antihypertensive, anthelmintic, antidiarrheal, the plant used as astringent, demulcent, anodyne, pectoral, stomachic, tonic, for tooth-aches and in tumors.

The plant possesses Molluscicidal activity, antimicrobial, antispasmodic, analgesic, antipyretic, demulcent, antitumour, depurative, emollient, laxative, pectoral, stomachic, tonic, antinociceptive and hypoglycemic activities.

The plant contains Cyclopeptide alkaloids (amphibines A, E and F and mauritine C), sterols (β-sitosterol and its glycoside), triterpenes (betulic acid, ceanothic acid, octacosanol and n-noncosane, in addition to, sugars. The main constituents of volatile oils were (geranyl acetone (14.0%), methyl hexadecanoate (10.0%), methyl octadecanoate (9.9%), farnesyl acetone C (9.9%), hexadecanol (9.7%) and ethyl octadecanoate (8.0%)), several phenolic compounds were isolated from leaves viz (rutin, hyperin, quercitin and quercitin glycoside, hyperoside, rutin and quercetin -3-O-[xylosyl-(1-2)-rhamnoside] 4'-O- - rhamnoside. Dihydrokaempferol and apigenin 7-O-
glucoside, taxifolin and taxifolin 3-O-glucoside, Dodeca-acetylprodelphinidin B3 I, galloatechin and (-)-epigallocatechin.

The plant grows in Wadi Houf, Wadi Sidr, Gebel Dukhan and Wadi Bir El-Ain.


The crude saponins showed significant analgesic activity and some antimicrobial one. The plant extracts also exhibited antidiarrheal and hypoglycemic activities.

The plant grows in Along the Red Sea coast.


The hot decoction of the fruits is used for regulation of kidney functions, treatment of kidney inflammations and for stone lysis. The decoction is taken sweetened with black honey in the morning before breakfast or at night. In the form of infusion, it is used as a remedy for rheumatism, gout, cough, asthma, hypertension, and flatulent colic and as diuretic. The juice expressed from the fresh leaves and stems are used as abrasive cleanser and as remedy for the treatment of certain skin diseases.

The extracts have anti-inflammatory activity, cortisone-like action, hypotensive, choleric, diuretic, antipyretic, local anaesthetic antihistaminic, hypoglycemic, hyperinsulinemic, Insecticidal and antimicrobial activities.

Triterpenoid saponins, Zygophyllin, Quinovic acid, Kaempferol-3-rutinoside and other flavonoids were isolated from the plant.

The plant is recorded in all sites of the study region.

44. Zygophyllum decumbens Delile, Descr. Egypte, Hist. Nat.: 221, t. 27, f. 3 (1813), Zygophyllaceae.

The aqueous extract of the plant shows hypotensive, antipyretic, spasmylytic, diuretic and local anaesthetic effects.

The plant is distributed around Cairo-Suez road, Wadi Hagul, Wadi El-Ratam.

45. *Zygophyllum simplex* L., Man.: 68 (1767), Zygophyllaceae.

The plant possesses insecticidal and larvicidal activities. It is used as a substitute of *Zygophyllum coccineum*. Acylated isorhamnetin glucoside, isorhamnetin, isorhamnetin 3-\(O\)-glucoside, kaempferol 3-\(O\)-rutinoside, sitosterol glucoside and quinovic acid 3-\(\alpha\)-L-rhamnoside were isolated from the species.

The plant is recorded in all sites of the study region.
General Recommendations

1- Preparation of digital maps (regardless any potential importance of such maps) and its distribution at public level will threaten the future of medicinal plants in the wild as this will encourage and help the illegal plant collectors and herbalists to locate the plant populations. Reference to locality or to the closest landmark or city will be good enough for location of medicinal plant taxa.

2- The prolonged periods of drought, scarcity of water resources and inappropriate quality of permanent water resources (wells) are major obstacles for agricultural development of medicinal plants in the region. Valuable species can be propagated and agriculturally developed in areas having adequate and permanent water resources, such as areas adjacent to the agricultural land of the Nile basin.

3- There is an urgent need for an integrated approach to multipurpose land use in the region, aiming at conserving the productivity of the natural ecosystems and meeting the socioeconomic needs of the local people and the national economy.

4- Propagation trials on the tested medicinal plants in the study region demonstrated that seed germination, cuttings and tissue culture techniques (in vitro methods) are appropriate for medicinal plants and are species specific. Vegetative propagation by cuttings and tissue culture methods are required to maintain some species, particularly rare or threatened species and those having seeds attacked by insects and rodents.

5- Development of income generation activities as based on the indigenous knowledge of medicinal plants and keeping the Bedouin life style will save the vanishing medicinal plant resources and keep the local dwellers from leaving their traditional life style and their interest in medicinal plants.

6- It is recommended to develop the production of medicinal materials from all pharmacopoeial species and the non- pharmacopoeial species, viz, *Balanites aegyptiaca*, *Calligonum polygonoides*, *Cleome droserifolia*, *Ephedra aphylla*, *Leptadenia pyrotechnica*, *Moringa peregrina*, *Peganum harmala*, *Plantago ovata*, *Pulicaria incisa*, *Senna alexandrina*, *Solenostemma arghel* and *Teucrium polium* to encourage their cultivation due to the potential economic importance and promising value. Conservation of the species in their natural habitats is required for protection of the population gene bank.
Appendices
Source of climatic data of the study region (average of ten years): CNARE (1979) and CLAC (2004).

**Appendix Table 1:** Monthly mean air temperature (°C).

<table>
<thead>
<tr>
<th>Station</th>
<th>Month</th>
<th>Helwan</th>
<th>Beni Suef</th>
<th>Minya</th>
<th>Assiut</th>
<th>Souhag</th>
<th>Qena</th>
<th>Suez</th>
<th>Hurghada</th>
<th>Quseir</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td></td>
<td>13.1</td>
<td>12.2</td>
<td>11.8</td>
<td>13.2</td>
<td>13.8</td>
<td>14.8</td>
<td>14.7</td>
<td>15.7</td>
<td>18.1</td>
</tr>
<tr>
<td>February</td>
<td></td>
<td>14.7</td>
<td>14.5</td>
<td>13.4</td>
<td>15.1</td>
<td>15.7</td>
<td>16.7</td>
<td>16.0</td>
<td>16.6</td>
<td>18.5</td>
</tr>
<tr>
<td>March</td>
<td></td>
<td>17.3</td>
<td>17.6</td>
<td>16.7</td>
<td>18.5</td>
<td>18.6</td>
<td>20.6</td>
<td>18.0</td>
<td>19.0</td>
<td>20.6</td>
</tr>
<tr>
<td>April</td>
<td></td>
<td>21.2</td>
<td>22.0</td>
<td>21.4</td>
<td>23.2</td>
<td>23.8</td>
<td>25.6</td>
<td>22.0</td>
<td>22.5</td>
<td>23.5</td>
</tr>
<tr>
<td>May</td>
<td></td>
<td>24.3</td>
<td>25.8</td>
<td>25.7</td>
<td>27.5</td>
<td>28.0</td>
<td>29.8</td>
<td>25.0</td>
<td>25.8</td>
<td>26.3</td>
</tr>
<tr>
<td>June</td>
<td></td>
<td>27.4</td>
<td>28.7</td>
<td>28.0</td>
<td>30.0</td>
<td>30.0</td>
<td>32.0</td>
<td>27.9</td>
<td>28.7</td>
<td>28.9</td>
</tr>
<tr>
<td>July</td>
<td></td>
<td>26.1</td>
<td>29.1</td>
<td>28.5</td>
<td>29.6</td>
<td>29.7</td>
<td>32.3</td>
<td>28.9</td>
<td>29.6</td>
<td>29.5</td>
</tr>
<tr>
<td>August</td>
<td></td>
<td>27.7</td>
<td>28.9</td>
<td>28.2</td>
<td>29.7</td>
<td>30.8</td>
<td>32.4</td>
<td>28.9</td>
<td>30.0</td>
<td>29.9</td>
</tr>
<tr>
<td>September</td>
<td></td>
<td>26.2</td>
<td>27.4</td>
<td>25.8</td>
<td>27.3</td>
<td>27.1</td>
<td>30.2</td>
<td>27.0</td>
<td>27.9</td>
<td>28.2</td>
</tr>
<tr>
<td>October</td>
<td></td>
<td>23.5</td>
<td>23.6</td>
<td>23.1</td>
<td>24.3</td>
<td>25.2</td>
<td>27.0</td>
<td>24.2</td>
<td>25.0</td>
<td>25.9</td>
</tr>
<tr>
<td>November</td>
<td></td>
<td>19.1</td>
<td>18.6</td>
<td>18.2</td>
<td>19.0</td>
<td>19.7</td>
<td>21.6</td>
<td>20.4</td>
<td>20.9</td>
<td>22.6</td>
</tr>
<tr>
<td>December</td>
<td></td>
<td>14.5</td>
<td>13.7</td>
<td>13.4</td>
<td>14.7</td>
<td>15.2</td>
<td>16.7</td>
<td>15.8</td>
<td>17.0</td>
<td>19.4</td>
</tr>
</tbody>
</table>

**Appendix Table 2:** Monthly mean rainfall (mm).

<table>
<thead>
<tr>
<th>Station</th>
<th>Month</th>
<th>Helwan</th>
<th>Beni Suef</th>
<th>Minya</th>
<th>Asyout</th>
<th>Souhag</th>
<th>Qena</th>
<th>Suez</th>
<th>Hurghada</th>
<th>Quseir</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td></td>
<td>3.7</td>
<td>2.0</td>
<td>0.5</td>
<td>Trace</td>
<td>0.3</td>
<td>0.2</td>
<td>5.0</td>
<td>0.2</td>
<td>Trace</td>
</tr>
<tr>
<td>February</td>
<td></td>
<td>3.6</td>
<td>0.9</td>
<td>1.5</td>
<td>0.5</td>
<td>2.3</td>
<td>0.6</td>
<td>0.3</td>
<td>0.4</td>
<td>Trace</td>
</tr>
<tr>
<td>March</td>
<td></td>
<td>2.1</td>
<td>0.7</td>
<td>0.3</td>
<td>Trace</td>
<td>Trace</td>
<td>0.1</td>
<td>2.6</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>April</td>
<td></td>
<td>1.0</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>1.5</td>
<td>0.2</td>
<td>0.6</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>May</td>
<td></td>
<td>2.6</td>
<td>0.1</td>
<td>0.4</td>
<td>Trace</td>
<td>Trace</td>
<td>0.3</td>
<td>2.6</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>June</td>
<td></td>
<td>Trace</td>
<td>0.0</td>
<td>Trace</td>
<td>Trace</td>
<td>Trace</td>
<td>0.0</td>
<td>Trace</td>
<td>0.0</td>
<td>Trace</td>
</tr>
<tr>
<td>July</td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>August</td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>Trace</td>
<td>Trace</td>
<td>Trace</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>September</td>
<td></td>
<td>Trace</td>
<td>0.0</td>
<td>Trace</td>
<td>Trace</td>
<td>Trace</td>
<td>0.0</td>
<td>Trace</td>
<td>0.0</td>
<td>Trace</td>
</tr>
<tr>
<td>October</td>
<td></td>
<td>1.1</td>
<td>Trace</td>
<td>0.4</td>
<td>Trace</td>
<td>Trace</td>
<td>0.4</td>
<td>6.2</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>November</td>
<td></td>
<td>3.2</td>
<td>2.5</td>
<td>0.1</td>
<td>Trace</td>
<td>Trace</td>
<td>1.3</td>
<td>1.0</td>
<td>0.3</td>
<td>1.9</td>
</tr>
<tr>
<td>December</td>
<td></td>
<td>6.0</td>
<td>1.4</td>
<td>0.5</td>
<td>Trace</td>
<td>Trace</td>
<td>0.6</td>
<td>1.3</td>
<td>1.5</td>
<td>0.1</td>
</tr>
</tbody>
</table>
### Appendix Table 3: Monthly mean water evaporation (mm day\(^{-1}\)).

<table>
<thead>
<tr>
<th>Station</th>
<th>Month</th>
<th>Helwan</th>
<th>Beni Suef</th>
<th>Minya</th>
<th>Asyout</th>
<th>Souhag</th>
<th>Qena</th>
<th>Suez</th>
<th>Hurghada</th>
<th>Quseir</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>6.0</td>
<td>5.5</td>
<td>4.6</td>
<td>7.0</td>
<td>3.2</td>
<td>6.2</td>
<td>7.4</td>
<td>10.0</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>7.6</td>
<td>7.6</td>
<td>5.9</td>
<td>9.1</td>
<td>4.3</td>
<td>8.3</td>
<td>8.2</td>
<td>11.0</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>10.2</td>
<td>10.9</td>
<td>8.0</td>
<td>12.5</td>
<td>6.3</td>
<td>12.0</td>
<td>10.7</td>
<td>12.1</td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>13.0</td>
<td>15.7</td>
<td>10.8</td>
<td>17.0</td>
<td>8.7</td>
<td>16.2</td>
<td>13.0</td>
<td>14.1</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>15.6</td>
<td>18.4</td>
<td>14.6</td>
<td>21.0</td>
<td>11.2</td>
<td>19.1</td>
<td>14.0</td>
<td>16.3</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>16.2</td>
<td>20.1</td>
<td>15.9</td>
<td>22.3</td>
<td>12.0</td>
<td>21.2</td>
<td>15.4</td>
<td>18.8</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>14.0</td>
<td>17.7</td>
<td>14.0</td>
<td>19.0</td>
<td>9.5</td>
<td>18.8</td>
<td>14.5</td>
<td>17.7</td>
<td>14.1</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>13.4</td>
<td>16.0</td>
<td>11.9</td>
<td>17.6</td>
<td>8.2</td>
<td>18.3</td>
<td>13.2</td>
<td>17.1</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>12.3</td>
<td>15.6</td>
<td>10.0</td>
<td>16.6</td>
<td>8.0</td>
<td>16.4</td>
<td>12.9</td>
<td>16.2</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>10.9</td>
<td>11.8</td>
<td>8.7</td>
<td>12.8</td>
<td>7.2</td>
<td>12.6</td>
<td>11.8</td>
<td>12.6</td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>7.5</td>
<td>7.9</td>
<td>6.1</td>
<td>8.7</td>
<td>4.4</td>
<td>8.0</td>
<td>9.0</td>
<td>10.7</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>6.2</td>
<td>5.7</td>
<td>4.6</td>
<td>7.0</td>
<td>3.2</td>
<td>6.0</td>
<td>7.6</td>
<td>9.8</td>
<td>9.6</td>
<td></td>
</tr>
</tbody>
</table>

### Appendix Table 4: Monthly mean relative humidity (%).

<table>
<thead>
<tr>
<th>Station</th>
<th>Month</th>
<th>Helwan</th>
<th>Beni Suef</th>
<th>Minya</th>
<th>Assiut</th>
<th>Souhag</th>
<th>Qena</th>
<th>Suez</th>
<th>Hurghada</th>
<th>Quseir</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>55.0</td>
<td>56.0</td>
<td>58.0</td>
<td>50.0</td>
<td>39.0</td>
<td>37.0</td>
<td>55.0</td>
<td>51.0</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>48.0</td>
<td>48.0</td>
<td>53.0</td>
<td>42.0</td>
<td>33.0</td>
<td>31.0</td>
<td>53.0</td>
<td>49.0</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>42.0</td>
<td>41.0</td>
<td>48.0</td>
<td>34.0</td>
<td>28.0</td>
<td>23.0</td>
<td>46.0</td>
<td>49.0</td>
<td>46.0</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>37.0</td>
<td>36.0</td>
<td>40.0</td>
<td>26.0</td>
<td>20.0</td>
<td>17.0</td>
<td>42.0</td>
<td>47.0</td>
<td>47.0</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>36.0</td>
<td>35.0</td>
<td>35.0</td>
<td>21.0</td>
<td>16.0</td>
<td>15.0</td>
<td>44.0</td>
<td>44.0</td>
<td>46.0</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>39.0</td>
<td>36.0</td>
<td>39.0</td>
<td>27.0</td>
<td>17.0</td>
<td>16.0</td>
<td>44.0</td>
<td>43.0</td>
<td>45.0</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>50.0</td>
<td>43.0</td>
<td>45.0</td>
<td>35.0</td>
<td>28.0</td>
<td>19.0</td>
<td>50.0</td>
<td>47.0</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>52.0</td>
<td>47.0</td>
<td>51.0</td>
<td>37.0</td>
<td>30.0</td>
<td>19.0</td>
<td>54.0</td>
<td>47.0</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>52.0</td>
<td>47.0</td>
<td>54.0</td>
<td>40.0</td>
<td>27.0</td>
<td>27.0</td>
<td>55.0</td>
<td>51.0</td>
<td>52.0</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>52.0</td>
<td>49.0</td>
<td>54.0</td>
<td>43.0</td>
<td>25.0</td>
<td>33.0</td>
<td>55.0</td>
<td>55.0</td>
<td>54.0</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>58.0</td>
<td>57.0</td>
<td>60.0</td>
<td>50.0</td>
<td>36.0</td>
<td>37.0</td>
<td>56.0</td>
<td>54.0</td>
<td>53.0</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>56.0</td>
<td>57.0</td>
<td>62.0</td>
<td>50.0</td>
<td>38.0</td>
<td>38.0</td>
<td>55.0</td>
<td>54.0</td>
<td>51.0</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2: List of Bedouins and Herbalists or Spice Dealers who Offered Information about Traditional Use and Knowledge of Medicinal Plants in the Study Region.

(A) Local Dwellers (Bedouins)

1- Qena-Safaga-Qusier Area
- *Sheikh / Salem Musallam* (Different members of the family: males and females)
- *Salama Musallam Awad* (Different members of the family: males and females)
- *Mohamed Awad*
- *Sobhy Awad* (Different members of the family: males and females)
- *Salama Sobhy Awad*
- *Abdel Hamid Mohamed* Gabriel (Different members of the family: males and females)
- *Ahmed El Ababdi*

2- Qattamia, Galala Baharia and Asyut Area
- *Sheikh Saleh Mohamed* family (Qattamia and Galala Baharia area) belonging to Huwaitat
- *Sayed Abdallah* from Arab Mottair
- Some few people from Wadi El Asyuti

3- ElShayeb and Qattar Area

Qattar and Dokhan Area:
1. Sobhy Selim
2. Mobarak Selim

ElShayeb Area:
1. Moslem Soliman
2. Mahmoud Moslem Soliman
3. Salem Dakhil-Allah
4. Saleh Abou Aly
5. Farag Abou Ayed

(B) Spice Dealers and Herbalists
1- Qena - Safaga - Qusier Area

- Abdel Rehim Mazhar Abdel Wahab
- Ahmed Selim (sons)- Qena
- El Haj Salama- Qena
- El Haj Awad- Qena
- El Haj Abu Ahmed- Qena
- Rafeal Stores (Bazzar)- Safaga
- Raafat Badry (Bazzar)- Safaga

2- Asyut

- El Nazzawy spice shop (Asyut)
- Abdel Moaty El Gelaly (Asyut)
- Ahmed El Amin El Samalouty (Asyut)
- Sheikh Gamal Eddin El Asyuti (Asyut)
- El Haj Abdel Hamid El Gelaly (Asyut)

3- Sohag and Hurghada

Sohag:

Hurghada:
- Queen Spices and medicinal plants store in down town Hurghada.
- Sheikh El-Arab for spices and medicinal herbs store in down town Hurghada.
- Attara and Bazar Awlad El-Sheikh store in down town Hurghada.
Appendix 3: GPS locations of the surveyed areas in the study region

<table>
<thead>
<tr>
<th>Site number</th>
<th>Location</th>
<th>Site number</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26 16 42 N 32 48 49 E</td>
<td>24</td>
<td>26 11 41 34 02 24</td>
</tr>
<tr>
<td>2</td>
<td>26 19 08 32 46 38</td>
<td>25</td>
<td>26 09 25 34 06 39</td>
</tr>
<tr>
<td>3</td>
<td>26 20 07 32 46 22</td>
<td>26</td>
<td>26 08 48 34 07 30</td>
</tr>
<tr>
<td>4</td>
<td>26 21 03 32 45 48</td>
<td>27</td>
<td>26 06 36 34 12 19</td>
</tr>
<tr>
<td>5</td>
<td>26 21 32 32 46 54</td>
<td>28</td>
<td>26 08 20 33 59 26</td>
</tr>
<tr>
<td>6</td>
<td>26 31 47 32 46 01</td>
<td>29</td>
<td>25 58 40 33 38 13</td>
</tr>
<tr>
<td>7</td>
<td>26 14 15 32 49 00</td>
<td>30</td>
<td>25 85 52 33 32 41</td>
</tr>
<tr>
<td>8</td>
<td>26 24 26 33 5 28</td>
<td>31</td>
<td>30 05 12 31 32 56</td>
</tr>
<tr>
<td>9</td>
<td>26 26 30 33 16 32</td>
<td>32</td>
<td>29 58 38 31 44 16</td>
</tr>
<tr>
<td>10</td>
<td>26 26 35 33 16 56</td>
<td>33</td>
<td>29 58 23 31 48 36</td>
</tr>
<tr>
<td>11</td>
<td>26 31 48 33 22 11</td>
<td>34</td>
<td>30 01 17 31 48 56</td>
</tr>
<tr>
<td>12</td>
<td>26 36 08 33 26 39</td>
<td>35</td>
<td>29 53 36 32 14 08</td>
</tr>
<tr>
<td>13</td>
<td>26 42 22 33 38 28</td>
<td>36</td>
<td>29 37 01 32 18 54</td>
</tr>
<tr>
<td>14</td>
<td>26 42 18 33 39 12</td>
<td>37</td>
<td>29 08 16 32 38 47</td>
</tr>
<tr>
<td>15</td>
<td>26 36 49 34 00 41</td>
<td>38</td>
<td>29 06 38 32 30 57</td>
</tr>
<tr>
<td>16</td>
<td>26 16 47 34 11 26</td>
<td>39</td>
<td>29 06 07 32 29 39</td>
</tr>
<tr>
<td>17</td>
<td>26 19 06 34 5 35</td>
<td>40</td>
<td>29 06 02 32 20 31</td>
</tr>
<tr>
<td>18</td>
<td>26 20 21 34 05 29</td>
<td>41</td>
<td>29 09 01 32 17 39</td>
</tr>
<tr>
<td>19</td>
<td>26 20 15 34 02 50</td>
<td>42</td>
<td>29 10 18 32 16 53</td>
</tr>
<tr>
<td>20</td>
<td>26 18 40 34 01 47</td>
<td>43</td>
<td>29 10 50 32 10 31</td>
</tr>
<tr>
<td>21</td>
<td>26 16 44 34 01 00</td>
<td>44</td>
<td>29 11 49 32 16 04</td>
</tr>
<tr>
<td>22</td>
<td>26 16 21 34 00 19</td>
<td>45</td>
<td>28 57 39 32 06 05</td>
</tr>
<tr>
<td>23</td>
<td>26 14 9 34 00 9</td>
<td>46</td>
<td>29 02 35 31 36 07</td>
</tr>
</tbody>
</table>
Appendix 3 (contd.)

<table>
<thead>
<tr>
<th>Site number</th>
<th>Location</th>
<th>Site number</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>29 24 31</td>
<td>68</td>
<td>28 53 56</td>
</tr>
<tr>
<td></td>
<td>31 31 37</td>
<td></td>
<td>32 19 30</td>
</tr>
<tr>
<td>48</td>
<td>29 25 08</td>
<td>69</td>
<td>28 57 28</td>
</tr>
<tr>
<td></td>
<td>31 31 10</td>
<td></td>
<td>32 05 44</td>
</tr>
<tr>
<td>49</td>
<td>29 26 45</td>
<td>70</td>
<td>28 57 52</td>
</tr>
<tr>
<td></td>
<td>31 27 16</td>
<td></td>
<td>32 00 12</td>
</tr>
<tr>
<td>50</td>
<td>29 52 18</td>
<td>71</td>
<td>28 59 39</td>
</tr>
<tr>
<td></td>
<td>31 47 41</td>
<td></td>
<td>32 00 30</td>
</tr>
<tr>
<td>51</td>
<td>29 50 32</td>
<td>72</td>
<td>28 55 40</td>
</tr>
<tr>
<td></td>
<td>31 48 38</td>
<td></td>
<td>31 49 49</td>
</tr>
<tr>
<td>52</td>
<td>29 50 01</td>
<td>73</td>
<td>28 33 41</td>
</tr>
<tr>
<td></td>
<td>31 49 39</td>
<td></td>
<td>32 02 32</td>
</tr>
<tr>
<td>53</td>
<td>29 49 09</td>
<td>74</td>
<td>28 35 41</td>
</tr>
<tr>
<td></td>
<td>31 50 11</td>
<td></td>
<td>32 12 05</td>
</tr>
<tr>
<td>54</td>
<td>29 46 44</td>
<td>75</td>
<td>28 58 22</td>
</tr>
<tr>
<td></td>
<td>31 50 47</td>
<td></td>
<td>31 03 50</td>
</tr>
<tr>
<td>55</td>
<td>29 42 34</td>
<td>76</td>
<td>28 52 13</td>
</tr>
<tr>
<td></td>
<td>31 55 12</td>
<td></td>
<td>31 10 09</td>
</tr>
<tr>
<td>56</td>
<td>29 39 55</td>
<td>77</td>
<td>28 49 58</td>
</tr>
<tr>
<td></td>
<td>31 57 11</td>
<td></td>
<td>31 10 08</td>
</tr>
<tr>
<td>57</td>
<td>29 53 09</td>
<td>78</td>
<td>28 46 49</td>
</tr>
<tr>
<td></td>
<td>32 15 53</td>
<td></td>
<td>31 11 37</td>
</tr>
<tr>
<td>58</td>
<td>29 55 07</td>
<td>79</td>
<td>28 45 32</td>
</tr>
<tr>
<td></td>
<td>32 11 50</td>
<td></td>
<td>31 12 57</td>
</tr>
<tr>
<td>59</td>
<td>30 05 08</td>
<td>80</td>
<td>28 44 18</td>
</tr>
<tr>
<td></td>
<td>31 57 42</td>
<td></td>
<td>31 13 12</td>
</tr>
<tr>
<td>60</td>
<td>29 52 44</td>
<td>81</td>
<td>28 53 18</td>
</tr>
<tr>
<td></td>
<td>31 23 22</td>
<td></td>
<td>31 10 08</td>
</tr>
<tr>
<td>61</td>
<td>29 53 51</td>
<td>82</td>
<td>28 57 50</td>
</tr>
<tr>
<td></td>
<td>31 23 16</td>
<td></td>
<td>31 05 13</td>
</tr>
<tr>
<td>62</td>
<td>29 53 09</td>
<td>83</td>
<td>28 37 17</td>
</tr>
<tr>
<td></td>
<td>31 21 36</td>
<td></td>
<td>31 16 12</td>
</tr>
<tr>
<td>63</td>
<td>29 56 05</td>
<td>84</td>
<td>29 03 34</td>
</tr>
<tr>
<td></td>
<td>31 34 03</td>
<td></td>
<td>31 30 34</td>
</tr>
<tr>
<td>64</td>
<td>29 54 24</td>
<td>85</td>
<td>29 02 56</td>
</tr>
<tr>
<td></td>
<td>31 40 40</td>
<td></td>
<td>31 34 48</td>
</tr>
<tr>
<td>65</td>
<td>29 02 37</td>
<td>86</td>
<td>29 02 18</td>
</tr>
<tr>
<td></td>
<td>32 21 23</td>
<td></td>
<td>31 34 38</td>
</tr>
<tr>
<td>66</td>
<td>28 55 46</td>
<td>87</td>
<td>29 02 56</td>
</tr>
<tr>
<td></td>
<td>32 21 03</td>
<td></td>
<td>31 35 03</td>
</tr>
<tr>
<td>67</td>
<td>28 54 49</td>
<td>88</td>
<td>27 19 41</td>
</tr>
<tr>
<td></td>
<td>32 19 46</td>
<td></td>
<td>33 41 62</td>
</tr>
</tbody>
</table>
Appendix 3 (contd.)

<table>
<thead>
<tr>
<th>Site number</th>
<th>Location</th>
<th>Site number</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>89</td>
<td>27 20 46.7</td>
<td>111</td>
<td>27 19 769</td>
</tr>
<tr>
<td></td>
<td>33 41 60.5</td>
<td></td>
<td>33 38 184</td>
</tr>
<tr>
<td>90</td>
<td>27 24 85.1</td>
<td>112</td>
<td>27 19 562</td>
</tr>
<tr>
<td></td>
<td>33 40 66.3</td>
<td></td>
<td>33 37 569</td>
</tr>
<tr>
<td>91</td>
<td>27 25 05.0</td>
<td>113</td>
<td>27 12 824</td>
</tr>
<tr>
<td></td>
<td>33 40 66.3</td>
<td></td>
<td>33 19 780</td>
</tr>
<tr>
<td>92</td>
<td>27 05 41.8</td>
<td>114</td>
<td>27 11 677</td>
</tr>
<tr>
<td></td>
<td>33 50 78.5</td>
<td></td>
<td>33 21 009</td>
</tr>
<tr>
<td>93</td>
<td>26 57 63.8</td>
<td>115</td>
<td>27 09 928</td>
</tr>
<tr>
<td></td>
<td>33 54 70.2</td>
<td></td>
<td>33 25 187</td>
</tr>
<tr>
<td>94</td>
<td>26 51 96.6</td>
<td>116</td>
<td>27 01 907</td>
</tr>
<tr>
<td></td>
<td>33 58 37.2</td>
<td></td>
<td>33 55 427</td>
</tr>
<tr>
<td>95</td>
<td>26 40 11.6</td>
<td>117</td>
<td>27 03 304</td>
</tr>
<tr>
<td></td>
<td>33 56 11.4</td>
<td></td>
<td>33 26 093</td>
</tr>
<tr>
<td>96</td>
<td>26 26 80.8</td>
<td>118</td>
<td>27 10 577</td>
</tr>
<tr>
<td></td>
<td>34 05 26.8</td>
<td></td>
<td>33 19 601</td>
</tr>
<tr>
<td>97</td>
<td>26 23 95.1</td>
<td>119</td>
<td>27 03 681</td>
</tr>
<tr>
<td></td>
<td>34 06 89.9</td>
<td></td>
<td>33 16 782</td>
</tr>
<tr>
<td>98</td>
<td>26 20 80.0</td>
<td>120</td>
<td>27 03 302</td>
</tr>
<tr>
<td></td>
<td>34 09 19.5</td>
<td></td>
<td>33 16 871</td>
</tr>
<tr>
<td>99</td>
<td>26 09 31.7</td>
<td>121</td>
<td>26 57 150</td>
</tr>
<tr>
<td></td>
<td>34 14 68.4</td>
<td></td>
<td>33 31 503</td>
</tr>
<tr>
<td>100</td>
<td>27 33 39.0</td>
<td>122</td>
<td>27 10 439</td>
</tr>
<tr>
<td></td>
<td>33 32 50.5</td>
<td></td>
<td>33 20 698</td>
</tr>
<tr>
<td>101</td>
<td>27 41 52.1</td>
<td>123</td>
<td>27 11 841</td>
</tr>
<tr>
<td></td>
<td>33 29 80.4</td>
<td></td>
<td>33 21 968</td>
</tr>
<tr>
<td>102</td>
<td>27 45 52.9</td>
<td>124</td>
<td>27 12 623</td>
</tr>
<tr>
<td></td>
<td>33 29 66.5</td>
<td></td>
<td>33 22 534</td>
</tr>
<tr>
<td>103</td>
<td>27 49 75.3</td>
<td>125</td>
<td>27 18 24.6</td>
</tr>
<tr>
<td></td>
<td>33 27 01.3</td>
<td></td>
<td>33 36 34.0</td>
</tr>
<tr>
<td>104</td>
<td>27 59 87.1</td>
<td>126</td>
<td>27 12 20.7</td>
</tr>
<tr>
<td></td>
<td>33 20 44.4</td>
<td></td>
<td>33 22 24.1</td>
</tr>
<tr>
<td>105</td>
<td>28 08 59.5</td>
<td>127</td>
<td>27 11 51.2</td>
</tr>
<tr>
<td></td>
<td>33 14 42.9</td>
<td></td>
<td>33 21 36.3</td>
</tr>
<tr>
<td>106</td>
<td>28 12 94.1</td>
<td>128</td>
<td>27 09 02.6</td>
</tr>
<tr>
<td></td>
<td>33 11 10.5</td>
<td></td>
<td>33 19 05.2</td>
</tr>
<tr>
<td>107</td>
<td>28 17 22.8</td>
<td>129</td>
<td>27 07 55.2</td>
</tr>
<tr>
<td></td>
<td>33 06 71.8</td>
<td></td>
<td>33 18 10.9</td>
</tr>
<tr>
<td>108</td>
<td>27 34 12.0</td>
<td>130</td>
<td>27 05 03.7</td>
</tr>
<tr>
<td></td>
<td>33 26 58.2</td>
<td></td>
<td>33 14 21.5</td>
</tr>
<tr>
<td>109</td>
<td>27 33 90.0</td>
<td>131</td>
<td>27 04 39.7</td>
</tr>
<tr>
<td></td>
<td>33 26 07.0</td>
<td></td>
<td>33 16 04.7</td>
</tr>
<tr>
<td>110</td>
<td>26 58 020</td>
<td>132</td>
<td>27 03 52.8</td>
</tr>
<tr>
<td></td>
<td>33 33 490</td>
<td></td>
<td>33 16 54.8</td>
</tr>
<tr>
<td>Site number</td>
<td>Location</td>
<td>Site number</td>
<td>Location</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td>133</td>
<td>27 02 55.2</td>
<td>158</td>
<td>28 02 47.7</td>
</tr>
<tr>
<td></td>
<td>33 16 53.8</td>
<td></td>
<td>30 58 24.4</td>
</tr>
<tr>
<td>134</td>
<td>27 04 19.5</td>
<td>159</td>
<td>28 04 00.5</td>
</tr>
<tr>
<td></td>
<td>33 12 47.0</td>
<td></td>
<td>30 59 42.2</td>
</tr>
<tr>
<td>135</td>
<td>26 55 51.1</td>
<td>160</td>
<td>28 06 01.6</td>
</tr>
<tr>
<td></td>
<td>33 04 42.3</td>
<td></td>
<td>30 56 38.6</td>
</tr>
<tr>
<td>136</td>
<td>26 53 26.9</td>
<td>161</td>
<td>28 06 35.3</td>
</tr>
<tr>
<td></td>
<td>33 28 17.3</td>
<td></td>
<td>30 53 20.0</td>
</tr>
<tr>
<td>137</td>
<td>26 54 23.7</td>
<td>162</td>
<td>27 55 34.1</td>
</tr>
<tr>
<td></td>
<td>33 24 16.5</td>
<td></td>
<td>31 01 1.9</td>
</tr>
<tr>
<td>138</td>
<td>26 56 34.6</td>
<td>163</td>
<td>28 24 20.9</td>
</tr>
<tr>
<td></td>
<td>33 22 41.1</td>
<td></td>
<td>30 50 56.9</td>
</tr>
<tr>
<td>139</td>
<td>26 57 29.2</td>
<td>164</td>
<td>28 22 51.8</td>
</tr>
<tr>
<td></td>
<td>33 22 22.3</td>
<td></td>
<td>30 52 21.8</td>
</tr>
<tr>
<td>140</td>
<td>26 59 10.0</td>
<td>165</td>
<td>28 20 40.8</td>
</tr>
<tr>
<td></td>
<td>33 18 15.0</td>
<td></td>
<td>30 54 08.1</td>
</tr>
<tr>
<td>142</td>
<td>26 58 36.7</td>
<td>166</td>
<td>28 20 52.7</td>
</tr>
<tr>
<td></td>
<td>33 17 00.7</td>
<td></td>
<td>30 56 29.1</td>
</tr>
<tr>
<td>143</td>
<td>27 01 19.0</td>
<td>167</td>
<td>28 21 22.7</td>
</tr>
<tr>
<td></td>
<td>33 13 00.3</td>
<td></td>
<td>30 58 49.7</td>
</tr>
<tr>
<td>144</td>
<td>27 18 30.7</td>
<td>168</td>
<td>28 22 48.6</td>
</tr>
<tr>
<td></td>
<td>33 20 48.1</td>
<td></td>
<td>31 01 20.5</td>
</tr>
<tr>
<td>145</td>
<td>27 17 40.2</td>
<td>169</td>
<td>28 19 36.1</td>
</tr>
<tr>
<td></td>
<td>33 17 46.5</td>
<td></td>
<td>30 53 53.2</td>
</tr>
<tr>
<td>146</td>
<td>27 02 03.6</td>
<td>170</td>
<td>27 22 40.4</td>
</tr>
<tr>
<td></td>
<td>33 35 36.2</td>
<td></td>
<td>31 10 39.8</td>
</tr>
<tr>
<td>147</td>
<td>27 02 01.9</td>
<td>171</td>
<td>27 23 14.0</td>
</tr>
<tr>
<td></td>
<td>33 34 12.8</td>
<td></td>
<td>31 11 36.0</td>
</tr>
<tr>
<td>149</td>
<td>27 03 07.2</td>
<td>172</td>
<td>27 25 04.0</td>
</tr>
<tr>
<td></td>
<td>33 33 15.9</td>
<td></td>
<td>31 21 34.5</td>
</tr>
<tr>
<td>150</td>
<td>27 00 20.7</td>
<td>173</td>
<td>27 25 22.3</td>
</tr>
<tr>
<td></td>
<td>33 30 31.8</td>
<td></td>
<td>31 14 32.4</td>
</tr>
<tr>
<td>151</td>
<td>26 59 52.1</td>
<td>147</td>
<td>27 25 24.5</td>
</tr>
<tr>
<td></td>
<td>33 34 11.1</td>
<td></td>
<td>31 09 03.7</td>
</tr>
<tr>
<td>152</td>
<td>27 33 24.0</td>
<td>157</td>
<td>27 26 02.4</td>
</tr>
<tr>
<td></td>
<td>33 24 53.9</td>
<td></td>
<td>31 09 47.1</td>
</tr>
<tr>
<td>153</td>
<td>27 34 00.8</td>
<td>176</td>
<td>27 26 42.3</td>
</tr>
<tr>
<td></td>
<td>33 23 22.3</td>
<td></td>
<td>31 10 20.4</td>
</tr>
<tr>
<td>154</td>
<td>27 32 04.2</td>
<td>177</td>
<td>27 24 25.2</td>
</tr>
<tr>
<td></td>
<td>33 27 37.3</td>
<td></td>
<td>31 07 34.5</td>
</tr>
<tr>
<td>155</td>
<td>27 26 55.8</td>
<td>178</td>
<td>27 24 07.6</td>
</tr>
<tr>
<td></td>
<td>33 30 55.8</td>
<td></td>
<td>31 05 40.5</td>
</tr>
<tr>
<td>156</td>
<td>27 23 14.0</td>
<td>179</td>
<td>27 16 44.5</td>
</tr>
<tr>
<td></td>
<td>33 33 11.8</td>
<td></td>
<td>31 22 16.7</td>
</tr>
<tr>
<td>157</td>
<td>27 22 30.7</td>
<td>180</td>
<td>27 20 19.0</td>
</tr>
<tr>
<td></td>
<td>33 33 40.4</td>
<td></td>
<td>31 30 00.6</td>
</tr>
</tbody>
</table>
Appendix 3 (contd.)

<table>
<thead>
<tr>
<th>Site number</th>
<th>Location</th>
<th>Site number</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>181</td>
<td>27 21 36.6</td>
<td>193</td>
<td>26 20 41.0</td>
</tr>
<tr>
<td></td>
<td>31 38 25.8</td>
<td></td>
<td>32 03 21.2</td>
</tr>
<tr>
<td>182</td>
<td>27 19 07.2</td>
<td>194</td>
<td>26 21 46.0</td>
</tr>
<tr>
<td></td>
<td>31 40 46.4</td>
<td></td>
<td>32 04 24.9</td>
</tr>
<tr>
<td>183</td>
<td>27 18 13.8</td>
<td>195</td>
<td>26 22 29.4</td>
</tr>
<tr>
<td></td>
<td>31 41 54.2</td>
<td></td>
<td>32 04 58.9</td>
</tr>
<tr>
<td>184</td>
<td>27 01 20.0</td>
<td>196</td>
<td>26 27 36.2</td>
</tr>
<tr>
<td></td>
<td>31 26 11.5</td>
<td></td>
<td>32 07 30.8</td>
</tr>
<tr>
<td>185</td>
<td>27 01 33.1</td>
<td>197</td>
<td>26 16 17.9</td>
</tr>
<tr>
<td></td>
<td>31 27 29.2</td>
<td></td>
<td>32 04 46.9</td>
</tr>
<tr>
<td>186</td>
<td>27 02 13.0</td>
<td>198</td>
<td>26 18 41.6</td>
</tr>
<tr>
<td></td>
<td>31 28 13.0</td>
<td></td>
<td>32 04 19.1</td>
</tr>
<tr>
<td>187</td>
<td>27 02 13.0</td>
<td>199</td>
<td>26 37 28.1</td>
</tr>
<tr>
<td></td>
<td>31 28 02.0</td>
<td></td>
<td>31 48 02.1</td>
</tr>
<tr>
<td>188</td>
<td>27 02 59.3</td>
<td>200</td>
<td>26 37 51.8</td>
</tr>
<tr>
<td></td>
<td>31 19 54.5</td>
<td></td>
<td>31 48 34.0</td>
</tr>
<tr>
<td>189</td>
<td>27 12 34.8</td>
<td>201</td>
<td>26 37 48.0</td>
</tr>
<tr>
<td></td>
<td>31 20 21.7</td>
<td></td>
<td>31 49 05.2</td>
</tr>
<tr>
<td>190</td>
<td>27 08 35.9</td>
<td>202</td>
<td>26 38 19.1</td>
</tr>
<tr>
<td></td>
<td>31 20 07.1</td>
<td></td>
<td>31 50 06.3</td>
</tr>
<tr>
<td>191</td>
<td>26 19 46.2</td>
<td>203</td>
<td>26 38 39.8</td>
</tr>
<tr>
<td></td>
<td>32 02 57.2</td>
<td></td>
<td>31 50 28.0</td>
</tr>
<tr>
<td>192</td>
<td>26 19 55.8</td>
<td>204</td>
<td>26 38 45.0</td>
</tr>
<tr>
<td></td>
<td>32 03 01.8</td>
<td></td>
<td>31 50 43.9</td>
</tr>
</tbody>
</table>
Plate 1: *Acacia tortilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan. (a) Individual plant and (b) close up view showing fruits.
Map 1: Distribution map of *Acacia toritilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan in the surveyed area in the study region.
Plate 2: *Achillea fragrantissima* (Forssk.) Sch. – Bip. (a) individual plant and (b) close up view.
Map 2: Distribution map of *Achillea fragrantissima* (Forssk.) Sch. – Bip. in the surveyed area in the study region.
Plate 3: *Aerva javanica* (Burm. f.) Juss. ex Schult. in Roem. & Schult.

Map 3: Distribution map of *Aerva javanica* (Burm. f.) Juss. ex Schult. in Roem. & Schult. in the surveyed area in the study region.
Plate 4: *Anastatica hierochuntica* L. (a) green plants and (b) dry skeletons.
Map 4: Distribution map of *Anastatica hierochuntica* L. in the surveyed area in study region.
Plate 5: *Artemisia judaica* L. (a) individual plant and (b) close up view.
Map 5: Distribution map of *Artemisia judaica* L. in the surveyed area in study region.
Plate 6: *Avicennia marina* (Forssk.) Vierh.

Map 6: Distribution map of *Avicennia marina* (Forssk.) Vierh. in the surveyed area in the study region.
Plate 7: *Calligonum polygonoides* L. subsp. *comosum* (L’Her.) Soskov.

Map 7: Distribution map of *Calligonum polygonoides* L. in the surveyed area in the study region.
**Plate 8:** *Calotropis procera* (Aiton) W. T. Aiton.

**Map 8:** Distribution map of *Calotropis procera* (Aiton) W.T.Aiton in the surveyed area of the study region.
Plate 9: *Capparis spinosa* L. var. *aegyptia* (Lam.) Boiss.

Map 9: Distribution map of *Capparis spinosa* L. in the surveyed area in the study region.
Plate 10: *Cistanche phelypaea* (L.) Cout.

Map 10: Distribution map of *Cistanche phelypaea* (L.) Cout. in the surveyed area in the study region.
Plate 11: *Citrullus colocynthis* (L.) Schrad.

Map 11: Distribution map of *Citrullus colocynthis* (L.) Schrad. in the surveyed area in the study region.
Plate 12: *Cleome amblyocarpa* Barratte & Murb.

Map 12: Distribution map of *Cleome amblyocarpa* Barratte & Murb. in the surveyed area in the study region.
Plate 13: *Cleome droserifolia* (Forssk.) Delile.

Map 13: Distribution map of *Cleome droserifolia* (Forssk.) Delile in the surveyed area in the study region.
Plate 14: *Cocculus pendulus* (J. R. & G. Forst.) Delile. (a) individual plant and (b) close up.
Map 14: Distribution map of *Cocculus pendulus* (J. R. & G. Forst.) Delile in the surveyed area in the study region.
Plate 15: *Cotula cinerea* Delile.

Map 15: Distribution map of *Cotula cinerea* Delile in the surveyed area in the study region.
Plate 16: *Crotalaria aegyptiaca* Benth. (a) individual plant and (b) close up view showing fruits.
Map 16: Distribution map of *Crotalaria aegyptiaca* Benth. in the surveyed area in the study region.
Plate 17: *Ephedra aphylla* Forssk.  (a) *Ephedra aphylla* Forssk. individual, (b) male flowers and (c) female flowers.
Map 17: Distribution map of *Ephedra aphylla* Forssk. in the surveyed area in the study region.
Plate 18: *Fagonia bruguieri* DC.

Map 18: Distribution map of *Fagonia bruguieri* DC. in the surveyed area in the study region.
Plate 19: *Fagonia glutinosa* Delile. (a) Individual plant and (b) close up view.
Map 19: Distribution map of *Fagonia glutinosa* Delile in the surveyed area in the study region.
Plate 20: *Ficus palmata* Forssk. (a) Individual plant and (b) close up view showing fruits.
**Map 20:** Distribution map of Ficus palmata Forssk. in the surveyed area in the study region.
Plate 21: Hyoscyamus muticus L. (a) community and (b) individual plant.
Map 21: Distribution map of *Hyoscyamus muticus* L. in the surveyed area in the study region.
Plate 22: *Juncus rigidus* Desf. (a) Individual plant and (b) close up view.
Map 22: Distribution map of *Juncus rigidus* Desf. in the surveyed area in the study region.
Plate 23: *Leptadenia pyrotechnica* (Forssk.) Decne

Map 23: Distribution map of *Leptadenia pyrotechnica* (Forssk.) Decne. in the surveyed area in the study region.
Plate 24: *Moringa peregrina* (Forssk.) Fiori. (a) individual plant and (b) fruits and seeds.
Map 24: Distribution map of *Moringa peregrina* (Forssk.) Fiori in the surveyed area in the study region.
Plate 25: *Nitraria retusa* (Forssk.) Asch. (a) individual plant and (b) close up view showing flower buds and flowers.
Map 25: Distribution map of *Nitraria retusa* (Forssk.) Asch. in the surveyed area in the study region.
Plate 26: *Peganum harmala* L. (a) individual plant and (b) close up view.
Map 26: Distribution map of *Peganum harmala* L. in the surveyed area in the study region.
Plate 27: *Pergularia tomentosa* L. (a) individual plant and (b) close up view.
Map 27: Distribution map of *Pergularia tomentosa* L. in the surveyed area in the study region.
Plate 28: *Plantago ovata* Forssk.

Map 28: Distribution map of *Plantago ovata* Forssk. in the surveyed area in the study region.
Plate 29: *Pulicaria crispa* (Forssk.) Benth. & Hook. (a) individual plant and (b) close up view.
Map 29: Distribution map of *Pulicaria crispa* (Forssk.) Benth. & Hook in the surveyed area in the study region.
Plate 30: *Pulicaria incisa* (Lam.) DC.

Map 30: Distribution map of *Pulicaria incisa* (Lam.) DC. in the surveyed area in the study region.
Plate 31: *Retama raetam* (Forssk.) Webb & Berthel. (a) individual plant and (b) close up view showing fruits.
Map 31: Distribution map of *Retama raetam* (Forssk.) Webb & Barthel. in the surveyed area in the study region.
Plate 32: *Rumex vesicarius* L.

Map 32: Distribution map of *Rumex vesicarius* L. in the surveyed area in the study region.
Plate 33: *Salvadora persica* L.

Map 33: Distribution map of *Salvadora persica* L. in the surveyed area in the study region.
Plate 34: *Senna alexandrina* Mill. (a) Individual plant and (b) close up view.
Map 34: Distribution map of *Senna alexandrina* Mill. in the surveyed area in the study region.
Plate 35: *Solenostemma arghel* (Delile) Hayne

Map 35: Distribution map of *Solenostemma arghel* (Delile) Heyne in the surveyed area in the study region.
Plate 36: *Stachys aegyptiaca* Pers. (a) individual plant and (b) close up view.
Map 36: Distribution map of *Stachys aegyptiaca* Pers. in the surveyed area in the study region.
Plate 37: *Trigonella stellata* Forssk.

Map 37: Distribution map of *Trigonella stellata* Forssk. in the surveyed area in the study region.
Plate 38: Ziziphus spina-christi (L.) Desf. (a) Individual plant and (b) close up view.
Map 38: Distribution map of *Ziziphus spina-christi* (L.) Desf. in the surveyed area in the study region.
Plate 39: *Zygophyllum album* L. (a) individual plant and (b) close up view.
Map 39: Distribution map of *Zygophyllum album* L. in the surveyed area in the study region.
Plate 40: Zygophyllum coccineum L. (a) individual plant and (b) fruits and seeds.
Map 40: Distribution map of *Zygophyllum coccineum* L. in the surveyed area in the study region.
Plate 41: *Zygophyllum decumbens* Delile. (a) Individual plant and (b) close up view.
Map 41: Distribution map of Zygophyllum decumbens Delile in the surveyed area in the study region.
Plate 42: *Zygophyllum simplex* L.

Map 42: Distribution map of *Zygophyllum simplex* L. in the surveyed area in the study region.
References:

• Batanouny, K.H. 1999. Wild Medicinal Plants in Egypt; An inventory to support conservation and sustainable use. With contribution by E. Aboutabl, M. Shabana and F. Soliman. Academy of Scientific Research and Technology, Egypt and IUCN, Switzerland. 208 pp + 48 coloured plates.


• **Boulos, L. 1983.** Medicinal Plants of North Africa. Reference Publications.


• **Can, D.P. and Khafagi A.A. 1981.** A hydrogeological evaluation of the environs of Lake Nasser. WMP technical report no. 18. Ministry of Irrigation, Cairo.


- **Chaplin, M.F. 2004.** The structure of Plantago ovata arabinoxylan. Special Publication No. 294 (Gums and Stabilisers for the Food Industry), Royal Society of Chemistry. pp 509-516.
- **CLAC 2004.** Database of the Central Laboratory for Agricultural Climate. Agricultural Research Center, Dokki, Giza.
- **CNARE 1979.** Climatological Normals of the Arab Republic of Egypt. Ministry of Civil Aviation, Meteorological Authority, Cairo.
- **Diab, L. 1992.** Pharmacognostical Study of Certain Cleome Species Growing in Egypt. MS Thesis, Faculty of Pharmacy (Boys), Al-Azhar University, Cairo.
- **El Belasy, I.M. 1994.** Quaternary geology of some selected drainage basins in Upper Egypt (Qena- Edfu area). Ph. D., Cairo University, Egypt.


• El-Deeb, K.S. 1985. Chromatographic and thermal analysis of certain volatile oils containing drugs. Cairo University, Cairo.


- **Mahran, G.H.** 1967. Medicinal Plants. Anglo-Egyptian Bookshop, Cairo.

Arabic references

1- هيئة المساحة المدنية، الخريطة الطبوغرافية مقياس 050000، 1991.
2- هيئة المساحة العسكرية، الخريطة الطبوغرافية مقياس 050000، 1995.
3- هيئة المساحة المدنية، خرائط المدن السياحية، مقاييس مختلفة 10000، 15000.
4- محمد صبري محسوب، الصحراء الشرقية، 1991، دار الفكر العربي، القاهرة، الطبعة الأولى.
5- محمد صبري محسوب، الكوارث الطبيعية، 1998، دار الفكر العربي، القاهرة، الطبعة الأولى.
6- العطر وأخرين، السيو وسبل مواجهتها على مدن البحر الأحمر، هيئة الاستشعار عن بعد، 1997، القاهرة.
7- معاوی شحاته، السيو على مدينة القصير، 1997، أكاديمية البحث العلمي.
8- أحمد سالم صالح، السيو نظرياً وعملياً، 1999، القاهرة.
9- غزوان سلوم، 2004، جيومورفولوجية أحواض التصرف المائي شرق النيل، بين حوض وادي ستور شمالاً وجبيل قرارة جنوباً، رسالة دكتوراه، كلية الآداب، جامعة أسوان.
11- الجهاز المركزي للتعبئة العامة والإحصاء (CAPMAS)، الكتاب الإحصائي السنوي (2004).
أما بالنسبة لعلاقة الوضع الاقتصادي والاجتماعي للسكان بالنباتات الطبية، فإن إنشغال السكان المحليين بأعمال أخرى قائمة على السياحة صرف إهمالهم عن الاعتماد على النباتات الطبية، وذلك لم يكن من السير توفر آية إحصاءات دقيقة حول أهمية النباتات التي يتم جمعها من المنطقة وتسويقها. ويمثل الجاف وندرة المياه عملية رئيسية حول تنمية زراعة النباتات الطبية في المنطقة. إلا أنه من الممكن استخدام الأراضي المستتصصة حديثا في الظهير الصحراوي في شرق وادي النيل وزراعتها الطبية مع ريا بها مياه النيل.

يشتمل هذا المجلد على تقييم وتوثيق الوضع القائم للنباتات الطبية في منطقة الصحراء الشرقية الشمالية وساحل البحر الأحمر. ويشمل التقرير عرض للموضوعات المتعلقة بالمجتمعات النباتية للنباتات الطبية، وتوسيع النباتات وبيئتها وتصنيفها، والسكان ووضعهم الاقتصادي، والنباتات الطبية الموجودة في المنطقة وأهم استخداماتها، وتوثيق معارف السكان المحليين، وزراعة وإكثار النباتات الطبية. كما يشمل صور وخرائط توزيع النباتات الطبية في المنطقة.

وتتمثل أهم العوائق التي تحد من إنتاج وزراعة النباتات الطبية في منطقة الصحراء الشرقية وساحل البحر الأحمر فيما يلي:

- نقص البذور وأعضاء التكاثر من مصادر طبيعية وذلك نظرا لندرة معظم النباتات، وإن وجدت في السوق فغالبا ما تكون مجهولة المصدر.
- ارتفاع أسعار المنتجات الطبية نتيجة تحكم أفراد قليلون في أسعار السوق.
- عدم التوازن بين الإنتاج والاستهلاك والتسويق العشوائي لمنتجات النباتات الطبية.
- أمراض النبات وعدم الالتزام بضوابط وإرشادات إنتاج وتخصيص وتدوالي واستخدام منتجات النباتات الطبية مما يؤثر على جودة المنتج ويفلل من فرص تدسيمه.
المستخلص العربي

يوجد العديد من النباتات الطبية في الصحراء الشرقية الشمالية وساحل البحر الأحمر. وقد كانت هذه النباتات حتى زمن قصير مضى تعتبر أحد المصادر الهامة لعلاج أمراض السكان المحليين ومصدر هام للدخل. في الوقت الراهن يعتبر معظم النباتات الطبية في المنطقة مهددة بالانقراض نتيجة الاستغلال الجائر والتغليف وندرة المياه وإنحراف السكان المحليين إلى أعمال أخرى مثل السياحة والمحاجر المنتشرة في المنطقة.

تحتوي هذه المنطقة على حوالي 280 نوعا نباتيا بريا منها حوالي 45 نوعا له فائدة طبية في المنطقة. وتحتوي هذه النباتات على مواد فعالة عديدة لها نشاط بيولوجي وتعالج العديد من الأمراض مثل أمراض البدن والسكر وضغط الدم والروماتيزم وغيرها. وتتميز منطقة الصحراء الشرقية الشمالية وساحل البحر الأحمر بتنوع الموائل والمجتمعات النباتية نتيجة تفاوت التضاريس في المنطقة، وتشمل الموائل ستة أنواع هي: الشريط الساحلي والمستنقعات المحالية الساحلية والسهول الساحلية والسهول الداخلية والوديان والجبال والهضاب والموائل الصحراوية.

يسود المنطقة مناخ جاف جدًا في الموائل الداخلية ومناخ جاف مع أمطار شتوية في موائل الجبال. ويزداد متوسط درجات الحرارة بينما يقل معدل المطر كلما اتجهنا جنوبًا في المنطقة. ويسود المنطقة ندرة الموارد المائية خاصة الأمطار ومياه الأنهار.

ينتسب سكان المنطقة المحليين إلى قبيلة المعرة، ولأراضي القليل منهم يمارس حياة البدو ويعتمدون جزئيًا على الموارد الطبيعية المتاحة، وقد استغلت الغالبية العظمى منهم في تجمعات صغيرة تمارس أنشطة وأعمال متعلقة بالتنمية السياحية القائمة في المنطقة.

بالنسبة لاستخدام النباتات الطبية، فمازال القليل من السكان المحليين يعتمدون على النباتات الطبية في العلاج، وقد تم حصر عدد 16 وصفة طبية تعود إلى الأعشاب الموجودة في المنطقة. وتتأثر النباتات الطبية وموانئها بالإثاث السلبي الناتجة عن الجمع والرعي الجائر، والأنشطة السياحية غير منظمة، وأعمال المحاجر والتحدين واستصلاح الأراضي لغرض الزراعة خاصة في المناطق المتاخمة لوادي النيل.
صـون النباتات الطبية
واستخدامها المستدام
في مصر

المسوح الوطنية
مجلد 4
منطقة الصحراء الشرقية الشمالية
وساحل البحر الأحمر

الجهة المنفذة: كلية العلوم - جامعة القاهرة
الباحث الرئيسي: أ.د. أحمد كامل حجازى
الباحث المناوب: أ.د. تهانى محمد عبد الرحمن

القاهرة - جمهورية مصر العربية
2016