

Full Length Research Paper

Medicinal plants diversity and their conservation status in the United Arab Emirates (UAE)

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This paper was an attempt to assimilate the medicinal plant status of the United Arab Emirates (UAE) by analyzing their diversity and conservation status against the knowledge management practices of traditional medicine practitioners. Information was gathered through extensive literature survey, field trips and semi structured questionnaire. A total of 132 plants (nearly 20% of total species) were found to possess medicinal properties in the UAE traditionally, a rich density considering the hyper-arid conditions that prevail in the region. These plant species belongs to 115 genera and 49 families. Asteraceae and Fabaceae families have the maximum number of species. The medicinal plants were categorized into various life forms such as chamaephyte (41%), therophyte (36%), phanerophyte (11%), hemicryptophytes (4%), geophytes (4%) and lianas (4%). Maximum number of medicinal plant species were recorded from mountains and wadi habitat (44.7%). This study revealed the diversity in plant parts used in the treatment of different ailments. The traditional knowledge gathered here can be considered a good starting point for effective *in situ* conservation, which requires accurate and up-to date information on the status of medicinal plant populations, extent and nature of plant use by local communities.

Key words: Medicinal plants, diversity, conservation status, traditional uses.

INTRODUCTION

Plants are a great source of medicines, especially in traditional medicine, which are useful in the treatment of various diseases (Bako et al., 2005). Traditional medicine has not only played a vital role in providing healing but has also contributed to the discovery of most pharmaceutically active substances in plants (Principe, 1991; Pearce and Puroshothaman, 1992) which have been used in the commercial production of drugs. It has been estimated that, up to 90% of the population in developing countries rely on the use of medicinal plants to meet their primary health care needs (WHO, 2002). According to Schippmann et al. (2002) more than 50,000 plant species are used for medicinal purposes worldwide, of which almost 13% are flowering plants. Medicinal plants containing active chemical constituents (alkaloid, glycoside, saponin, essential oil, bitter principle, tannins

and mucilages) in its parts for example, root, stem, leaves, bark, fruit and seeds, which produces a definite curing physiological response in the treatment of various ailments in humans and other animals (Adhikari et al., 2010). In different civilizations the contribution of floral biodiversity to health care has been well documented (Posey, 1999). Because of the accelerated local, national and international interest in recent years, the demand for medicinal and aromatic plants has increased manifolds and pharmaceutical industry views plant wealth as a source of income. Due to easy availability, no side-effects and sometimes only source of health care, the demand for medicinal plants is increasing in both developing and developed countries.

Arab has a rich tradition of herbal medicine, (Ghazanfar, 1994) which blended with Greek practices to become what is known as the unani (Greco-Arab medicine) system. According to Ghazanfar (1994), several traditional systems of medical treatment were used in the Arabian Peninsula. In addition to the use of plants as medicines, bone settings, cupping and

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cauterization are also practiced, in which specific medicinal plants and foods may be used as part of the treatment. There are about 260 medicinal plants in the whole of Arabian Peninsula, including some of the commonly used exotic species. The vegetation of UAE, as with the Arabian Peninsula in general, has traditionally received little attention. Despite the hyper arid conditions, UAE is home to 731 vascular plant species and has the 4th largest number of angiosperms in Arabian Peninsula in spite of its relatively smaller size. Although traditional medicine has been practiced in the UAE for many years; literature on most of the plants used for the treatment of diseases is very little. There is no complete list of medicinal plants of the region. The recent work published by Zayed Complex for Herbal Research and Traditional Medicine listed 29 species of plants, all of which are not indigenous (ZCHRTM, 2005). The increasing alarming rate of habitat destruction coupled with over-exploitation of medicinal plants makes it imperative for an inventory on medicinal plants to be conducted in UAE. The present study was aimed to determine the diversity and conservation of medicinal plants in the UAE. Moreover this work also attempts to document the traditional knowledge about medicinal plants and to evaluate the current status of knowledge of medicinal plant resources of the country. It also focuses on the importance of documenting traditional knowledge and practices related to conservation and sustainable utilization of medicinal plants in UAE.

MATERIALS AND METHODS

Study area

The UAE is a subtropical desert country located in the east of the Arabian Peninsula between latitudes 22°30' and 26°30'N, and longitudes 51° and 56° E. It has two coasts, the western, which extends approximately 600 km along the Arabian Gulf and the eastern, which extends approximately 75 km along the Gulf of Oman. The UAE is a federation of seven emirates. The total area is approximately 83000 km²; Abu Dhabi Emirate being the largest occupying about 84% of the total area (Böer, 1998). The climate is a bi-seasonal Mediterranean type with high temperature and low rainfall. The summers (May to October) are distinctly hot; with day time temperature exceeding 40°C. Cooler winter months are from November to April (Brown, 2005). Annual rainfall amounts vary according to location, but precipitation generally decreases along a north east to south-west gradient (Brown, 2005). Due to harsh climatic conditions, soils are generally extremely poor in both organic matter and biological activity. The properties of the little-altered parent material (sand, silt, gravel and bed rock) therefore extend a dominant influence on the species composition of the vegetation (Brown, 2005). The soils can be taxonomically be divided into solon chalks, yermosols (aridic soil) and litho sol (Böer, 1998).

Methods

Apart from the field surveys, an extensive literature survey includes several publications such as Karim et al. (2007a, b); ZCHTM (2005); Jongbloed (2003); Ghazanfar (1994); Ghazanfar et al.

(1998); and Western (1989) was carried out. Semi structured questionnaire were prepared and interviews were carried out. Herbal market survey was also carried out. Additionally, we have visited the local market in the eastern region of UAE, Al Ain (Souk as Samakh) where traditional local healers sell herbal medicines. Data was collected on the sources and uses and were recorded.

RESULTS

Diversity of medicinal plants

In the present investigation, a total of 132 plants species were found to possess medicinal properties. It belongs to 114 genera and 49 families. Two species were pteridophyte that belongs to the family Adiantaceae and Aspleniaceae and the rest were angiosperms, which were represented in six life forms (Raunkier, 1934); chamaephyte (41%), therophyte (36%), phanerophyte (11%), hemicryptophytes, geophytes and lianas (4%) Figure 1. The plant families which representing the maximum number of medicinal plants were Asteraceae (9), Fabaceae (9), Poaceae (7), Solanaceae (6), Capparaceae (6), Euphorbiaceae (6), Asclepiadaceae (5) and Brassicaceae (5) Figure 3. Twenty families were mono specific and had one species per genus. In Abu Dhabi Emirate, 84 species of native plants (total about 411 in Abu Dhabi) were considered to be medicinal and being used traditionally by the people. Among the plant parts, leaves were the maximum used part (37%) followed by whole plant (19%), seeds (12%), roots (11%) and stem (9%) for various ailments. Other plant parts used include fruits, latex, flowers, etc Figure 2. The grasses and sedges (Cyperaceae) were used as whole plants and roots. Flowers were usually used for fragrances or dyes and seeds normally for oil extraction.

Distribution of medicinal plants

In the present investigation, around 84 species were found in Abu Dhabi Emirate. The majority of medicinal plant species were mainly distributed in the northern and eastern parts of the country. The north eastern part of the Emirate is the most species rich area where more than 80% of the species were found (Figure 4). Nine major habitat types were described for UAE by Brown and Sakkir (2004), which include coastal habitat, sabkha (salt flats), sand sheets, dunes and megadunes, alluvial and interdunal (which are developed between the numerous dune fields in many part of the Emirate) plains, mountains and wadis (Arabic term for valleys), inland water habitat, oases, farmlands and plantations, urban habitats and offshore islands. Maximum number of medicinal plant species were recorded from mountains and wadi habitat (44.7%) followed by alluvial and interdunal plain (29.5%), oases, farmlands and plantations (19.7%), inland sand sheets, dunes and mega dunes (18%) coastal and saline habitat (9.8%), urban habitat (8.3%), inland water habitat

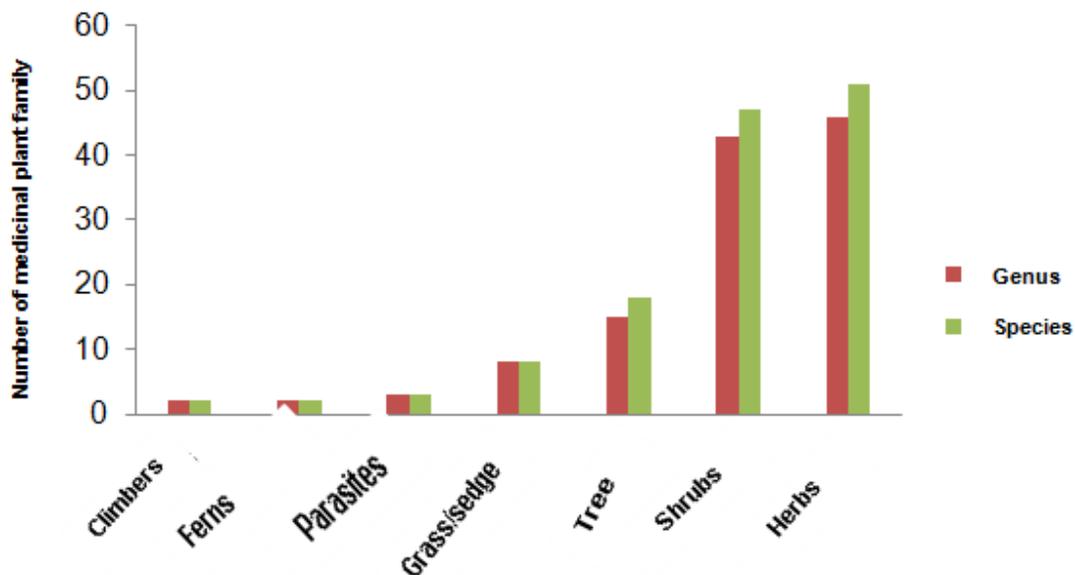


Figure 1. Total medicinal plant family, genera and species in different taxa.

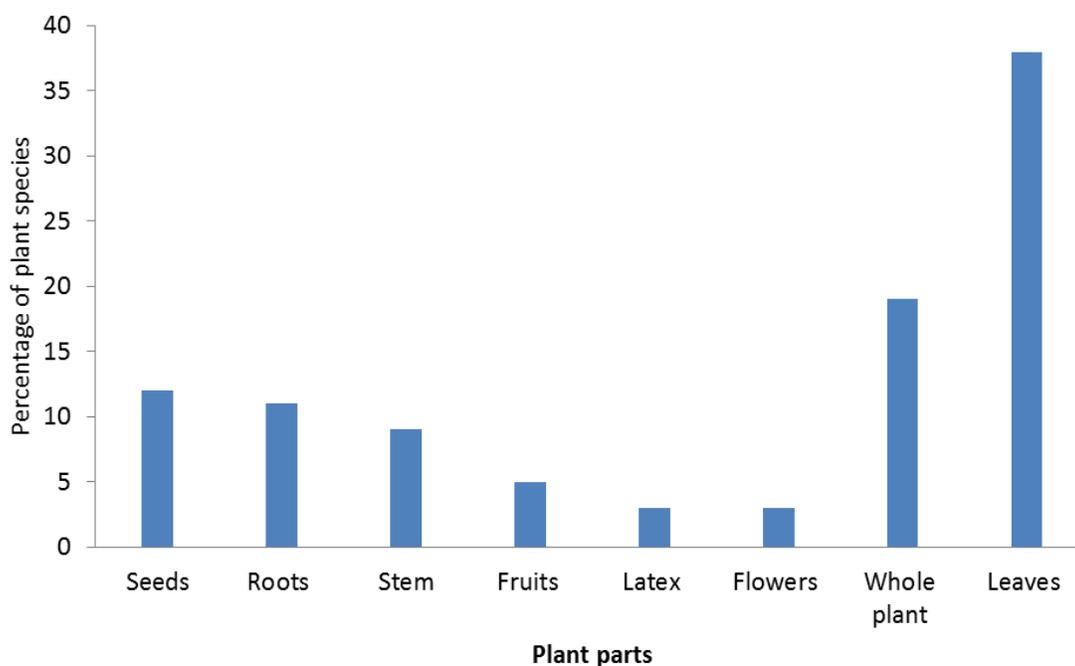


Figure 2. Plant parts used in the treatment of diseases.

(3%). Species possessing medicinal properties were not recorded from sabkha and off shore islands (Figure 5).

Use in ailments

The maximum number of species, 37%, were being used

for treating skin disorders, burns, wounds, bruises, stings and bites, followed by 22% being used as carminatives, laxatives and antidiarrheal, 20% were used as anthelmintic plants, 15% used for treating cold, cough, fever and headaches, 12% used to treat muscular pain and swollen joints, 6% were used as health tonic and 4.5% used for treating fertility, childbirth and post and

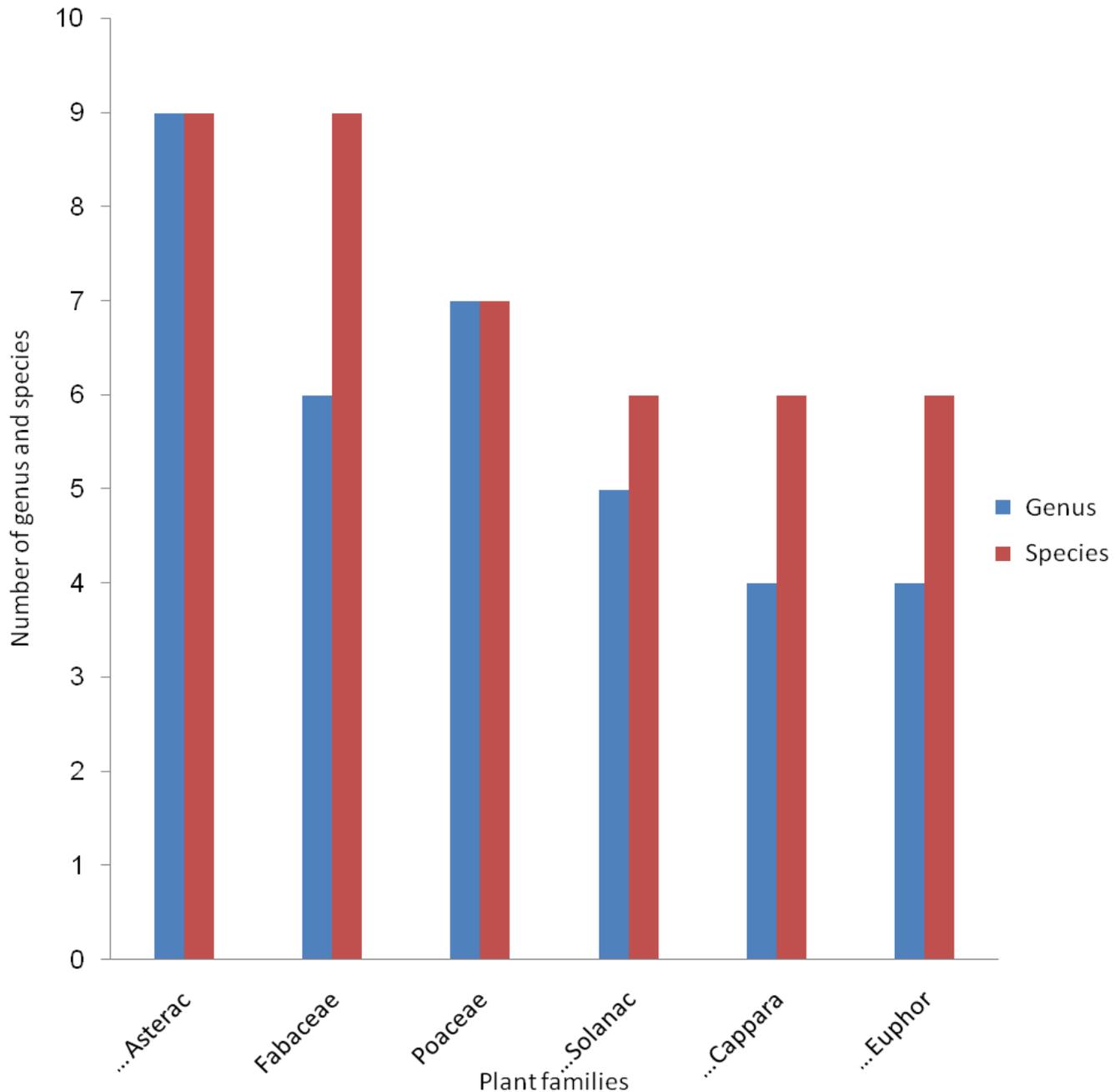


Figure 3. Relative numbers of genus and species in the major medicinal plant families in UAE.

prenatal care (Figure 6).

Conservation status of medicinal plants

As the local herbalists were very keen in giving information, many non-local herbalists did not want to be interviewed. The local herbalist collects plant parts from the wild, whereas the non-local herbalists used products which are imported from France, Oman, Egypt and Syria.

Both groups were not aware of the cultivation methods. But both groups reported a decline in the richness and abundance of some of the medicinal plant species as they used to be available earlier. According to UAE Red Data plant list (Ghazanfar et al., 2010) of the 132 species of medicinal plants, six species fell under the threatened category. A single species fell under the vulnerable category (Appendix 1) which meant a high risk of becoming endangered in the near future. Five species happened to be in the Near Threatened category. These

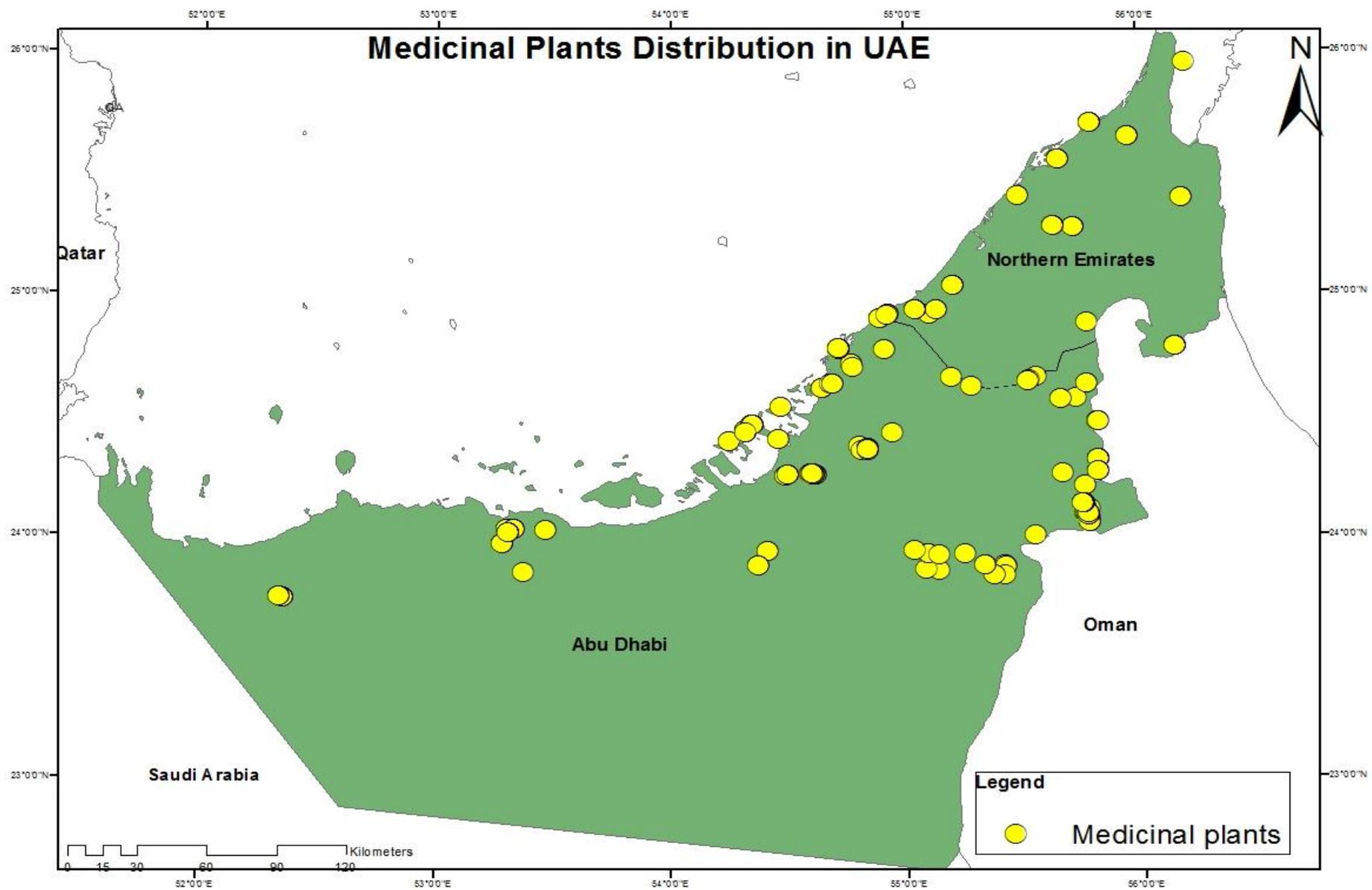


Figure 4. Distribution map of medicinal plant species in the United Arab Emirates.

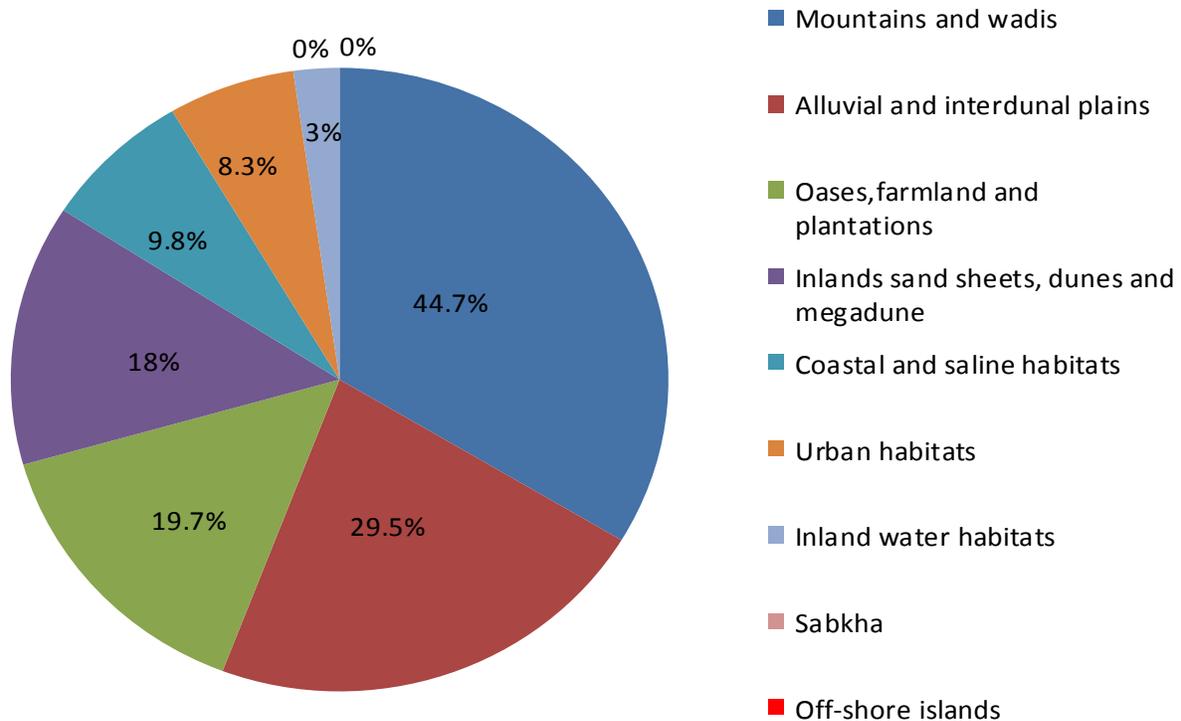


Figure 5. Percentage distribution of medicinal plants in different habitat types.

species were presently not under threat, but might soon move into one of the threat categories, if the threats continued to be ignored. Majority of the species (118 species) were in the least concern category. These species were widespread in distribution and were common to both UAE and the Arabian Peninsula. No documented information was available on the cultivation practices of wild medicinal plants in UAE. There are farms owned by local people where exotic species has been cultivated.

DISCUSSION

Though medicinal plants in UAE constituted only about 18% of the total plant species, it is highly probable that the medicinal properties of the remaining 82% have not been yet discovered or documented. The analysis of the medicinal plants data also suggested a propensity for family dominance, for instance, families like Fabaceae and Asteraceae seemed to be more prominent sources of potential medicinal plants than others. The present study showed that, the family Fabaceae and Asteraceae contributed most species of the medicinal plants diversity in UAE. The families Asteraceae, Fabaceae, Poaceae, Solanaceae, Capparaceae, Euphorbiaceae, Asclepiadaceae and Brassicaceae contributed nearly 40% of the medicinal plant species presented in UAE.

The medicinal plant diversity in the family Fabaceae has been observed in other studies globally (Kakudidi et al., 2000; Bukenya – Ziraba and Kamoga, 2007) and the richness of medicinal plant species in mountains and wadi habitat can be attributed to their rich floral diversity as well (Brown, 2005). The analysis also revealed the diversity in plant parts used in the treatment of different ailments. Consistent with other studies (Addo- Fordjour et al., 2008; Kamatenesi-Mugisha et al., 2008; Okello and Ssegawa, 2007; Yineger et al., 2008) leaves still remained the most commonly harvested parts in herbal medicine preparation.

Herbal medicines were rarely prepared from single plants; instead a number of plants were usually prescribed for treating a particular disease or condition. Traditional healers believed that, medicines prepared by combining two or more plants were more potent than those prepared with single plants. This has been attributed to the combined effects of the plants (Okello and Ssegawa, 2007). Variations in plant parts used, their combinations, mode of preparation and even their administration differed among the herbalists as these practices suffered from a systematic and documented scientific approach. Most of the medications were prepared by boiling the medicinal plants and administered by drinking as recorded by Addo- Fordjour et al. (2008). Studies also covered the harvesting methods used by the local herbalists and most were

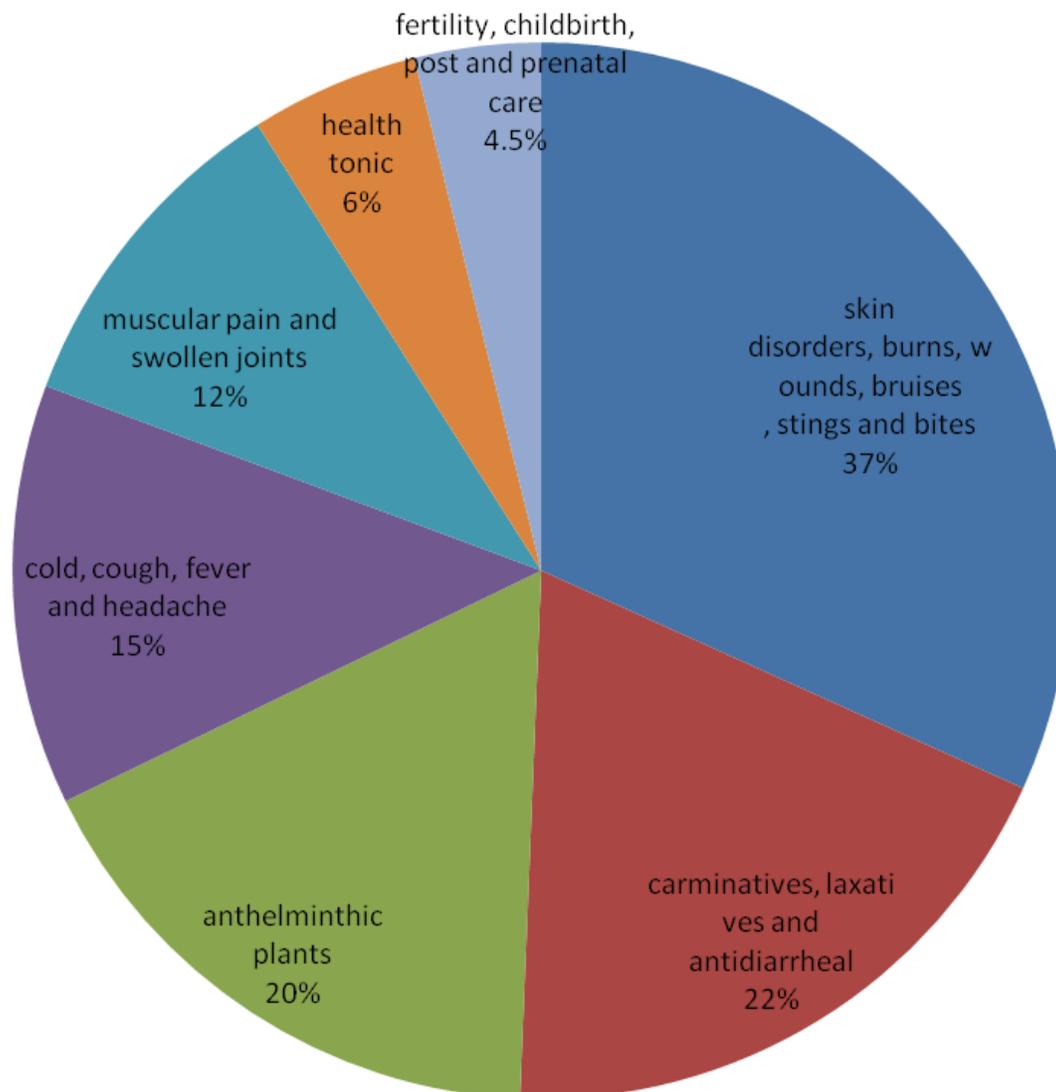


Figure 6. Percentage of medicinal plants used in various ailments.

found to be destructive such as the uprooting of whole plants to retrieve just the roots or chopping entire branches for leaves. Such practices clearly wasted flowers and fruits thereby affecting dispersal and regeneration of the species. Excessive harvesting of roots and barks of plants affect the survival of the plant itself (Kamatenesi-Mugisha et al., 2000; Kamatenesi-Mugisha and Bukonya-Ziraba, 2002).

It was also noted that medicinal species that have been overexploited due to their relatively higher medicinal importance and the same affected plant species were listed as threatened in UAE Red Data Plant List (Ghazanfar et al., 2010). Also, most medicinal plants were still being collected from wild population and hardly cultivated and many were being seriously threatened by overgrazing and habitat degradation. While WHO (WHO et al., 1993) recommends cultivation of medicinal plants

in gardens to ensure continual supply of plant materials needed for medicine, majority of the herbalists in UAE preferred plant materials from the wild, which they believed were potent. With such beliefs still remaining popular, the utilization of plant materials from UAE can no longer be sustainable, if the continual dependence on the wild, depleted the wild stocks and possibly declined the habitats of the native plants. Harvesting cultivated materials from gardens would have ideally reduced the pressure on the wild species, especially the rare, endangered or over-exploited ones. Studies on the cultivation and domestication of wild medicinal plants were still found to be fragmentary.

It is recommended that botanical collection and documentation of ethno-botanical knowledge be carried out before such rich habitats are lost due to various anthropogenic and other natural causes. Further studies

should be conducted on these medicinal plants to determine their functionalities and their parts responsible for curing the ailments listed by the herbalists. Even in the case of medicinal plants, standard approaches of conservation should apply, such as; *ex-situ* and *in situ* conservation, education and training and research. *In situ* conservation can be accomplished by identifying areas of high density of medicinal plant species and protecting them from grazing and over exploitation (especially, the mountains and wadis of UAE). *Ex-situ* conservation can be done by collecting seeds of these plants and storing them for future use as seed banks. Effective conservation also requires awareness about the importance of medicinal plants through education and awareness campaigns. In this regard, in 1996, the UAE has established the Zayed Complex for Herbs Research and Traditional Medicine with a mission to collect record and analyze the traditional medicine knowledge from traditional practitioners (Correa, 2002). But conservation requires the involvement and support of those communities who ultimately depend on those plant resources.

There is a clear need for government and non-government institutions to empower the communities about the importance and sustainable use of medicinal plants. Analysis on conservation thus suggests a new thinking, that the traditional knowledge of medicinal plants and their practitioners could be extremely useful in the medicinal plants' conservation. However, additional challenges do exist. Most of the traditional herbalists are aged and majority of them did not have enough trainees. Transmission of knowledge to the trainees also remained informal and undocumented as with any traditional practices. As Yineger et al. (2008) observed only few herbalists kept records of the ailments treated and their cure. These pose threat to conservation of medicinal plants as such traditional practices could die with the practitioners.

Conclusion

As long as the habitat destruction continues, medicinal plants and their natural habitats will remain under the threat of overexploitation just as any species. Within the context of discussion, as the ultimate goal of conservation is to preserve the natural and wild habitats of vulnerable medicinal plant species and to limit their sustainable exploitation in less vulnerable areas, we must tailor general conservation strategies to focus on medicinal species. Confidence building measures among the medical practitioner community, such as, special grants to promote sustain the profession should be enacted. The Government agencies should also devise educational and awareness campaigns in consultation with the herbalists and healers to increase the general awareness about the rich heritage in herbal medicinal practices of the country and its practitioners. It is

absolutely necessary to support and sustain the practitioners and their knowledge along with standard conservation practices to protect the medicinal species.

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Appendix 1. List of medicinal plants; parts used and ailments, conservation status and life form (Raunkiaer, 1934); Ghazanfar (1994); Ghazanfar et al. (1998); Western (1989); Jongbloed (2003); ZCHTM (2005) and Ghazanfar et al. (2010).

Species	Part used	Treatment	Status	Life form
<i>Acacia nilotica</i> (L.) Delile	Gum resin, leaves	Applied to soothe burns; leaves are pounded into a paste and used a poultice on boils and swellings or applied around boils to draw out the pus.	LC	Ph
<i>Acacia ehrenbergiana</i> Hayne	Wood	Used for treating paralysis by passing the smoke of burning wood over affected limb.	LC	Ch
<i>Achyranthes aspera</i> L.	Roots	Crushed roots applied to scorpion stings to reduce swelling. Also used as a dye plant.	LC	Ch
<i>Acridocarpus orientalis</i> A. Juss.	Seed oil	Massaged on forehead to relieve headache	LC	Ph
<i>Adiantum capillus veneris</i> L.	Fronds	Infusion made of fronds used for chest diseases, as an expectorant. Also used to induce vomiting, and to treat obstructions of the liver and spleen.	NT	He
<i>Aerva javanica</i> (Burm.f.) Juss.	Flowers	Mixed with water, made in to a paste and used as a wound dressing and to stop bleeding.	LC	Ch
<i>Alhagi graecorum</i> Boiss.	Whole plant	The whole plant is used for treating cataracts, jaundice, migraine, painful joints and as an aphrodisiac.	LC	Ch
<i>Aloe vera</i> L.	Leaves	Juice extracted from the leaves is either used by itself or mixed with indigo and applied to treat skin rashes.	LC	Ch
<i>Amaranthus graecizans</i> L.	Leaves	Crushed and applied on scorpion stings, snake bites and itchy skin rash.	LC	Th
<i>Amaranthus viridis</i> L.	Leaves	Crushed and applied on scorpion stings, snake bites and itchy skin rash.	LC	Th
<i>Ammi majus</i> L.	Seeds	Seeds used to treat asthma and heart disease; also a tonic and digestive.	LC	Th
<i>Anagallis arvensis</i> L.	Whole plant	Crushed and applied to soothe skin rash, snakebite and skin ulcers.	LC	Th
<i>Anastatica hierochuntica</i> L.	Dried plant	Dried plant used during childbirth.	LC	Th

Appendix 1. Contd.

<i>Andrachne aspera</i> Spreng.	Roots	Roots used for treating eye inflammation.	LC	Th
<i>Aristolochia bracteolata</i> Lam.	Whole plant	Whole plant used to treat snake and scorpion bites and to treat skin problems.	LC	Ch/Th
<i>Arnebia hispidissima</i> (Sieber ex Lehm.) DC.	Whole plant	Whole plant used for treating fevers including malarial fever.	LC	Th
<i>Artemisia sieberi</i> Besser	Leaves	Crushed and infusion made, taken orally. (the plant contains essential oils, which are reported to be toxic against <i>Ascaris</i>).	LC	Ch
<i>Asphodelus tenuifolius</i> (Cav.) Baker	Seeds, whole plant	Seeds soaked on vinegar, burned and smoke inhaled to treat toothache. Whole plant boiled in water used as a laxative, diuretic. Crushed plant used as ulcer treatment.	LC	Ge
<i>Asplenium ceterach</i> L.	Whole plant	Used for the treatment of kidney stones and urinary tract diseases.	LC	He
<i>Avicennia marina</i> L.	Bark	Bark boiled in water taken orally as an aphrodisiac.	VU A2 (a and c)	Ph
<i>Blepharis ciliaris</i> (L.) B. L. Burtt	Flowering parts, seeds	Flowering parts and seeds burned and ground to a fine powder, used on burns and cuts to stop bleeding. Seeds used to treat hemorrhoids and inflammations.	LC	Ch
<i>Calligonum comosum</i> L'Herit.	Leaves and stems	Dried leaves and stems chewed to treat toothache; young shoots collected as salad, green or powdered to add to milk as tonic for flavorings.	LC	Ch
<i>Calotropis procera</i> W. T. Aiton	Leaves, latex, bark.	Leaves and the latex used for treating wounds, pain, and scorpion stings and for strengthening muscles affected by paralysis. Bark of the root also used medicinally.	LC	Ph
<i>Capparis cartilaginea</i> Decne.	Leaves and stems	Leaves and stems used for bruises, childbirth, earache, headache, paralysis, snakebite and swellings.	LC	Ch
<i>Capparis spinosa</i> L.	Leaves, roots and bark	Leaves of the plant used for treating earache, coughs, expelling stomach worms and for diabetes.	LC	Ch
<i>Capsella bursa-pastoris</i> (L.) Medik.	Whole plant	Infusion of dried plants used for uterine bleeding and pain; also used to stop nosebleeds.	LC	Th

Appendix 1. Contd.

<i>Carthamus oxyacantha</i> M. Bieb.	Whole plant	Extract from the whole plant used to treat conjunctivitis. Used for red dye, also as cosmetic. Fruits thought to be aphrodisiac.	LC	Th
<i>Centaurium pulchellum</i> (Sw.) Druce	Whole plant	Used to treat fevers, diabetes, kidney and gallstones.	LC	Th
<i>Chrozophora oblongifolia</i> (Delile) A. Juss.	Fruits	Fruits have wound- healing properties, used to heal fissures.	LC	Th
<i>Cichorium intybus</i> L.	Leaves and fruits	Leaves boiled in water used as fever treatment. Fruits eaten for treating headache and boiled in water for treating jaundice, roots are aromatic and used with coffee.	LC	Ch
<i>Cistanche phelypaea</i> (L.) Cout.	Stem	Stem used for treating diarrhea.	LC	P
<i>Citrullus colocynthis</i> (L.) Schrad.	Leaves, fruits, seeds and roots	Leaves, seeds, roots and dried fruits used to treat dog, insect and snake bites, as a laxative, to relieve pain in joints and as a hair color.	LC	Ch/He
<i>Cleome amblyocarpa</i> Barratte and Murb.	Leaves	Infusion of leaves used to treat abdominal and rheumatic pain.	LC	Th
<i>Cleome rupicola</i> Vicary	Whole plant	Extract made from the entire plant used to treat cataract.	LC	Ch
<i>Cocculus hirsutus</i> (L.) Diels	Leaves and roots	Used for lowering fevers	NT	Li
<i>Cocculus pendulus</i> (J.R.Forst.) Diels	Leaves and roots	Leaves and roots used to treat constipation and skin problems.	LC	Li
<i>Convolvulus arvensis</i> L.	Leaves and roots	Roots and leaves used as anti-hemorrhagic.	LC	Ch
<i>Cordia myxa</i> L.	Leaves, fruits, seeds	Seeds eaten to treat worm infections and diarrhea; dried leaves as poultice for wounds; tea of leaves to treat abdominal pains.	NA	Ph
<i>Cornulaca monacantha</i> Delile	Leaves	Leaves used to treat jaundice.	LC	Ch
<i>Cressa cretica</i> L.	Whole plant	All parts of the plant used as an aphrodisiac, expectorant and as a tonic.	LC	Ch
<i>Cuscuta planiflora</i> Ten.	Whole plant	Infusion of plant used to treat jaundice, liver problems; also used as diuretic, laxative.	LC	Li
<i>Cymbopogon schoenanthus</i> (L.) Spreng.	Leaves	Used for the treatment of stomach disease and fever.	LC	He

Appendix 1. Contd.

<i>Cynodon dactylon</i> (L.) Pers.	Roots and leaves	Infusion of roots and leaves used to treat hemorrhoids and wounds. Also used to treat cough and kidney problems.	LC	Ge
<i>Cynomorium coccineum</i> L.	Whole plant	Whole plant used as a laxative.	LC	Ch
<i>Cyperus rotundus</i> L.	Tubers	Tubers used as an insecticide. Seeds used as a diuretic, for treating earache, teeth and gum problems.	LC	Ge
<i>Dactyloctenium aegyptium</i> (L.) Willd.	Seeds, roots	Seeds used for the treatment for kidney inflammations; roots for uterus problems.	LC	Th
<i>Datura metel</i> L.	Whole plant	Plants boiled in water taken or dried flowers and leaves smoked as treatment for asthma and as sedative; seeds in small doses give pain relief; poultices from whole plant applied as treatment for muscle, joint and nerve pains , abscesses, hemorrhoids and other inflammations.	LC	Th
<i>Desmidorchis arabicus</i> (N. E. Br.) Meve and Liede	Stem	Pounded to make tea for liver ailments. Used to treat high blood pressure.	NT	Ch
<i>Dipterygium glaucum</i> Decne.	Whole plant	Used to treat respiratory diseases.	LC	Ch
<i>Dodonaea viscosa</i> L.	Leaves	Leaves are used for treating toothache.	LC	Ch
<i>Ducrosia anethifolia</i> (DC.) Boiss.	Seeds, leaves	Leaves eaten to treat stomach disorders; seeds used as a condiment.	LC	Ch
<i>Dyerophytum indicum</i> (Gibs. ex Wight) Kuntze	Young shoots and stem	Stems dried and pounded to be smoked as treatment for breathing difficulties; young shoots are salty and were used for cooking in times of salt shortages.	LC	Ch
<i>Echinochloa colona</i> (L.) Link	Whole plant	Used as digestive and to treat constipation.	LC	Th
<i>Echiochilon kotschyi</i> (Boiss. And Hohen.) I.M. Johnst.	Leaves and stems	Pounded with salt, turmeric and ginger, applied on burns and ulcers; paste of leaves used for ringworm, eczema, wounds and skin sores.	LC	Ch
<i>Emex spinosa</i> (L.) Campd.	Leaves and roots	Leaves boiled in water taken as drink to treat dyspepsia and constipation and as a diuretic.	LC	Th
<i>Eruca sativa</i> Mill.	Leaves	Leaves used to heal scurvy.	LC	Th
<i>Euphorbia granulata</i> Forssk.	Milky sap	Milky sap applied on site of poisonous bites.	LC	Th
<i>Euphorbia larica</i> Boiss.	Latex	Latex used for skin problems.	LC	Th
<i>Euphorbia peplus</i> L.	Latex	Plant extract used for liver disorders.	LC	Th

Appendix 1. Contd.

<i>Fagonia indica</i> Burm. f.	Leaves, stems and roots	Leaves, stems and roots used for treating abdominal colic, dyspepsia, and fever.	LC	Ch
<i>Ficus carica</i> L.	Fruit	Juice or fruit, eaten for general health tonic and as a laxative.	NA	Ph
<i>Ficus cordata</i> subsp. <i>salicifolia</i> Thunb. subsp. (Vahl) C.C. Berg.	Sap	Sap of new leaves used to treat bruises and scorpion stings. Milky juice from stems and unripe fruits used to remove warts; also applied on inflammations on the skin to draw out pus and to relieve hemorrhoids.	LC	Ph
<i>Ficus johannis</i> subsp. <i>johannis</i> Boiss.	Sap	Sap used to remove warts.	LC	Ph
<i>Fumaria parviflora</i> Lam.	Whole plant	Whole plant used as an anthelmintic, laxative and for treating dyspepsia. Also used for skin disorders.	NT	Th
<i>Haloxylon salicornicum</i> (Moq.) Boiss.	Stems	The stems used for treating hypoglycemia.	LC	Ch
<i>Haplophyllum tuberculatum</i> (Forssk.) A. Juss.	Leaves	Infusion of plant used in treatment of liver disease, also a diuretic and abortive; dried powdered leaves used as a poultice to treat scorpion stings. Leaves are eaten as a sedative. Crushed leaves in water drunk to treat painful joints. (In North Africa it is used for many different ailments. In Dhofar (a region in Southern Oman), leaves are used as an insecticide.)	LC	Ch
<i>Heliotropium bacciferum</i> L.	Leaves	Poultice of leaves used to treat snake and scorpion bites.	LC	Th
<i>Herniaria hemistemon</i> J. Gay	Whole plant	Rupture wart was used in Europe as a treatment for hernias.	LC	Th
<i>Hyoscyamus muticus</i> L.	Whole plant	Used as sedative to treat insanity, epilepsy, insomnia, toothache and to relieve pain in snake or scorpion bites as well as treatment for a host of other ailments; extract of these plants are still used today; for instance to dilate pupils and to speed up a slow heartbeat.	LC	Ch
<i>Imperata cylindrica</i> (L.) Raeusch.	Roots and young shoots	Roots boiled in water ingested to relieve painful joints, combat fever and as a diuretic. Roots and young shoots used to stop bleeding.	LC	He
<i>Indigofera coerulea</i> Roxb.	Roots	Roots crushed to apply to snake bites, swellings and burns.	LC	Ch

Appendix 1. Contd.

<i>Indigofera oblongifolia</i> Forssk.	Roots, leaves	Roots crushed with or without leaves applied to snake bites, insect stings and swellings.	LC	Ch
<i>Ipomoea pes-caprae</i> (L.) R. Br.	Seeds	Seeds used as a purgative.	NA	Ch
<i>Launaea procumbens</i> (Roxb.) Ramayya and Rajagopal	Leaves	Infusion or paste made with water applied to cool the forehead and body.	LC	Ch
<i>Lavandula subnuda</i> Benth.	Leaves	Leaves as cold remedies and to relieve headaches; crushed leaves are insect repellent	LC	Ch
<i>Lawsonia inermis</i> L.	Leaves	Leaves yield a red dye used as hair color and as a cosmetic. Leaves are also used for fevers, as a local anesthetic, anti-inflammatory and for treating mouth ulcers.	NA	Ch
<i>Leptadenia pyrotechnica</i> (Forssk.) Decne.	Branches and stems	Branches and stems are used as a diuretic.	LC	Ph
<i>Limonium stocksii</i> Kuntze	Whole plant	Crushed plant, mixed with water, ingested to treat diarrhea; ash of dry wood used as snuff.	NE	Ch
<i>Lycium shawii</i> Roem. And Schult.	Stem	Stems used as a diuretic, laxative and tonic.	LC	Ch
<i>Maerua crassifolia</i> Forssk.	Leaves	Filtered solution of leaves boiled in water drunk to treat constipation and abdominal colic. Paste of powdered leaves mixed with leaves of <i>Lawsonia inermis</i> (henna plant) and water as poultice on bone fracture to ease the pain.	LC	Ph
<i>Malva parviflora</i> L.	Seeds and leaves	Infusion of seeds and leaves applied to soothe skin and treat fevers and headaches or used as gargle; leaves cooked as a vegetable.	LC	Th
<i>Matricaria aurea</i> (Loefl.) Sch. Bip.	Flower heads	Medicinal tea, like chamomile, brewed from flower heads to treat abdominal complaints.	LC	Th
<i>Medicago laciniata</i> (L.) Mill. var. <i>brachyacantha</i> Boiss	Leaves	Mixed with leaves of tamarind and salt, applied on bruises.	LC	Th
<i>Melilotus alba</i> Desr.	Whole plant	Whole plant used as an astringent and as a narcotic. Also used to treat rheumatic pain.	LC	Th
<i>Melilotus indica</i> (L.) All.	Whole plant	Whole plant crushed and used to soothe skin rash.	LC	Th

Appendix 1. Contd.

<i>Monsonia nivea</i> (Decne.) Decne. ex Webb	Leaves	Tea made from dried leaves boiled in water used to treat fever.	LC	Ch
<i>Moringa peregrina</i> (Forssk.) Fiori	Seed oil	Taken orally for constipation and stomach cramp; mixed with clove oil, cardamom oil, taken during labor.	LC	Ph
<i>Nerium oleander</i> L.	Leaves	Leaves used for the treatment of bronchitis and coughs.	LC	Ph
<i>Ochradenus arabicus</i> Chaudhary, Hillc. and A.G. Mill.	Fruits	Unripe fruits eaten as treatment for digestive problems.	LC	Ch
<i>Ocimum forskolei</i> Benth.	Leaves	Fragrance eases headaches and dizziness; crushed leaves placed in nose to treat colds and in ears to treat ear aches; juice from young leaves used as eye drops or for insect bites.	NE	Th
<i>Paronychia arabica</i> (L.) DC.	Whole plant	Entire plant used as an aphrodisiac.	LC	Th
<i>Pentatropis nivalis</i> (J.F. Gmel.) D.V. Field and J.R.I. Wood	Roots	Roots used for the treatment of gonorrhoea.	LC	Li
<i>Pergularia tomentosa</i> L.	Whole plant, latex	The plant used for skin problems, as an expectorant and as a purgative.	LC	Li
<i>Periploca aphylla</i> Decne.	Whole plant	Whole plant used for treating skin disorders and reduces swellings.	LC	Ch
<i>Phoenix dactylifera</i> L.	The male inflorescence (spadix), pollen and fruits.	The male inflorescence (spadix) and pollen used as an aphrodisiac and as a general tonic.	NA	Ph
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Whole plant	Infusion of whole plant used to treat vomiting.	LC	He/Ge
<i>Physorhynchus chamaerapistrum</i> Boiss.	Leaves and stems	Leaves and stems used for treating earache and the seeds used for removing warts.	LC	Th
<i>Plantago afra</i> L.	Seeds	Seeds soaked overnight in milk used to treat all kinds of gastro-intestinal problems.	LC	Th
<i>Plantago ovata</i> Forssk.	Seeds	Ground seeds mixed with water used to treat venereal disease and as a diuretic; soaked seeds used as a poultice for boils and ulcers; also used as a cosmetic for hair.	LC	Th

Appendix 1. Contd.

<i>Pluchea arabica</i> (Boiss.) Qaiser and Lack	Whole plant	Infusion made from boiling whole plant used to treat skin ailments; juice of leaves used as ear drops; fresh leaves rubbed on body as deodorant.	NT	Ch
<i>Polycarpaea repens</i> (Forssk.) Aschers and Schweinf.	Whole plant , leaves	The whole plant used as an antidote for snake bite.	LC	Ch
<i>Portulaca oleracea</i> L.	Leaves	Leaves has laxative and diuretic effect; leaves also applied to soothe skin or draw abscesses; whole plant effective as a bactericide in bacterial dysentery and diarrhea; also a treatment for worm infection.	LC	Th
<i>Portulaca quadrifida</i> L.	Leaves	Ground with salt applied to swellings and wounds to draw out pus. Leaves have a diuretic effect.	LC	Th
<i>Prosopis cineraria</i> (L.) Druce	Pods	Pods mixed with leaves of <i>Oscimum basilicum</i> (basil) and lemon juice used as eye drops to treat cataracts. Extract of leaves used as eye drops, extract of crushed pods used as ear drops; leaves chewed for toothache and dyspepsia. Ashes of burnt bark mixed with water applied to site of fracture to relieve pain; bark also used for rheumatism and applied to scorpion bites; sap from branches used as an antiseptic.	LC	Ph
<i>Prunus arabica</i> (Oliv.) Meikle	Seeds	Crushed almonds mixed with milk taken as a tonic.	LC	Ph
<i>Pteropyrum scoparium</i> Jaub. and Spach		Leaves eaten to treat dyspepsia and as a blood purifying tonic.	LC	Ch
<i>Reichardia tingitana</i> (L.) Roth.	Leaves	Leaves used for treating colic, constipation, swollen and inflamed eyes and conjunctivitis.	LC	Ch
<i>Rhazya stricta</i> Decne.	Whole plant	The whole plant including the seeds used for medicinal purposes. Also used for improving bad breath, chest pain, conjunctivitis, constipation, diabetes; used for lowering fevers, skin rash, as an anthelmintic, and to increase lactation.	LC	Ch
<i>Rhynchosia minima</i> (L.) DC.	Whole plant	Used as abortive.	LC	Ch
<i>Ricinus communis</i> L.	Leaves and roots	Leaves and roots used for treating bad breath, blisters and ulcers, toothache and inflamed eyes. Also used as a purgative and to relieve rheumatic pain.	LC	Ch

Appendix 1. Contd.

<i>Rumex vesicarius</i> L.	Leaves and seeds	Eaten as an antidote for scorpion stings.	LC	Th
<i>Salvadora persica</i> L.	Leaves	Fresh or dried, powdered, applied on skin blisters and scorpion sting.	LC	Ch
<i>Salvia aegyptiaca</i> L.	Seeds	The seeds used as a demulcent, for diarrhoea and for piles.	LC	Th
<i>Senna alexandrina</i> L.	Leaves and seeds	Decoction of leaves, often mixed with other herbs, used as a laxative and for stomach cramps.	LC	Ch
<i>Senna italica</i> Mill.	Leaves and seeds	The leaves and seeds used to treat constipation and stomach cramps.	LC	Ch
<i>Sisymbrium irio</i> L.	Seeds	The seeds used as an expectorant and as a febrifuge.	LC	Th
<i>Solanum incanum</i> L.	Leaves, fruits and roots	Leaves, fruit (berries) and roots used for bruised fingers, dyspepsia, earache, hemorrhoids and for toothache.	LC	Ch
<i>Solanum nigrum</i> subsp. <i>nigrum</i> L.	Whole plant	The whole plant used as an expectorant, for fevers, gonorrhoea, kidney and bladder inflammation, stomach ache and skin ulcers.	LC	Th
<i>Sonchus oleraceus</i> L.	Whole plant	As a coolant, diuretic, laxative and as a general tonic.	LC	Th
<i>Suaeda aegyptiaca</i> (Hasselq.) Zohary	Stem and leaves	Stems and leaves used for tooth and gum infections. Used as snuff for dizziness, headaches, hysteria, nausea, calming the nervous system and improving poor vision.	LC	Th
<i>Suaeda vermiculata</i> Forssk. Ex J. F. Gmel.	Stems	The stems used to relieve difficult breathing.	LC	Ch
<i>Tamarix aphylla</i> (L.) H. Karst.	Leaves	Dried leaves applied on wounds to stop bleeding.	LC	Ph
<i>Tamarix arabica</i> Bunge	Bark	Bark boiled in water added to vinegar to treat lice infestations.	LC	Ch
<i>Tephrosia apollinea</i> (Delile) DC.	Leaves and roots	Leaves and roots used for treating bronchitis, cough, earache, wounds and relieving pain in bone fractures.	LC	Ch
<i>Tetraena simplex</i> (L.) Beier and Thulin	Leaves	Extract of leaves applied to red or swollen eyes.	LC	Ch
<i>Teucrium polium</i> L.	Leaves and stems	Fresh or dried leaves boiled in water and poured on bites and skin ulcers.	NE	Th

Appendix 1. Contd.

<i>Tribulus terrestris</i> L.	Fruits	In North Africa fruit used as a tonic and to treat oral inflammations and bladder disorders.	LC	Th
<i>Typha domingensis</i> Pers.	Flowers	Dried crushed flowers applied to burns for cooling effect.	LC	He
<i>Vernonia cinerea</i> (L.) Less.	Leaves, roots and seeds.	Leaves used to treat scorpion bites, fevers and piles. Roots and seeds used as an anthelmintic.	LC	Ch
<i>Vicia sativa</i> L.	Whole plant	Dried and powdered plant applied to hair for scalp irritations (dandruff).	LC	Th
<i>Withania somnifera</i> (L.) Dunal	Leaves	Pounded leaves used as a poultice to treat burns and sunburns, to reduce swellings or mixed with garlic to treat stings and bites; powdered roots taken as a treatment for infertility and as a sedative; crushed leaves and berries in water, strained, given to ease difficult childbirth.	LC	Th
<i>Ziziphus spina christi</i> (L.) Desf.	Leaves, fruits, bark	Crushed leaves applied to skin sores and inflamed joints; ash of wood, mixed with vinegar applied to snake bites; tea made of fruits said to be a treatment for measles; fruit and kernels eaten to treat chest pains.	LC	Ph

VU, Vulnerable (applied to taxa that have a high risk of becoming endangered in the wild), NT, near threatened (applied to taxa that are likely to become endangered in the near future), LC, least concerned (lowest risk; taxa that do not qualify in threatened or near threatened categories. Widespread and abundant taxa are included in this category), NE, Not evaluated (applied to taxa that have not yet been evaluated against the Red List Criteria), NA, Not applicable (applied to taxa that are not eligible for assessment at a regional level) Ph, Phanerophyte, Ch, Chamaephyte, He, Hemicyptophytes, Ge, Geophytes, Li, Lianas and P, parasite).