Journal of Medicinal Plants Research Vol. 5(17), pp. 4287-4297, 9 September, 2011
Available online at http://www.academicjournals.org/JMPR
ISSN 1996-0875 ©2011 Academic Journals

Full Length Research Paper

Ethnobotanical study of medicinal plants in the Blue Nile State, South-eastern Sudan

Musa S. Musa[1,2], Fathelrhman E. Abdelrasool[2], Elsheikh A. Elsheikh[3], Lubna A. M. N. Ahmed[2], Abdel Latif E. Mahmoud[3] and Sakina M. Yagi[1]*

[1]Department of Botany, Faculty of Science, University of Khartoum, P. O. Box 321, Sudan.
[2] Forests National Corporation (Blue Nile), P. O. Box 658, Blue Nile State, Sudan.
[3]Forest Research Centre, Soba, P. O. Box 7089, Khartoum, Sudan.

Accepted 9 June, 2011

Ethnobotanical study of medicinal plants used by traditional healers was carried out in the Blue Nile State, South-eastern Sudan. Information was obtained through conversations with traditional healers with the aid of semi-structured questionnaires. Informant consensus, use value, and fidelity level for each species and use category were calculated. A total of 31 traditional healers participated in the study. Fifty three plant species distributed into 31 families and 47 genera were identified as being used to treat one or more ailments. The major source of remedies came from wild plants. The most frequently mentioned indications were digestive system disorders, infections/infestations, pain, evil eye and respiratory system disorders. The majority of remedies are administered orally and decoctions were the most frequently prepared formulation. The collected data may help to avoid the loss of traditional knowledge on the use of medicinal plants in this area. Considering the widespread use of these medicinal plants to treat various ailments, it therefore becomes crucial to scientifically validate the therapeutic uses and safety of these plants through phytochemical screening, different biological activity tests and toxicological studies.

Key words: Medicinal plants, ethnobotanical survey, Blue Nile State, Sudan.

INTRODUCTION

In recent years, the interest in folk medicine from different cultures, also known as Traditional medicine, has increased significantly in industrialised countries, due to the fact that many prescription drugs worldwide have originated from the tropical flora (Nelson-Harrison et al., 2002). A cooperative approach by ethnobotanists, ethnopharmacologists, physicians and phytochemists is thereby essential to spur the progress of medicinal plants research (Gilani and Rahman, 2005).

Medicinal plants have traditionally occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives in Sudan. Through its long history, the Sudan has witnessed the fusion of many cultures, Pharonic, Christian and Islamic along with the local indigenous cultures. With this unique history and vast variety of climate and flora, traditional medicine together with use of medicinal plants became an important part of the cultural heritage of the Sudan (El kalifa et al., 1999).

The abundance of information on the traditional medicinal uses of plants in Africa is in danger of disappearing since the knowledge of how to use medicinal plants is mostly passed down orally and even to date is poorly documented (Gurib-Fakim, 2006), although written information has been produced for some specific regions. Moreover, the most serious threat to local medicinal plant knowledge, however, appears to be cultural change, particularly the influence of modernization and the western worldview (Voeks and Leony, 2004) which has contributed to under mining traditional values among the young (Giday et al., 2003).

In this work, a field study of the medicinal plants used in a rural area of the South-East Region of the Sudan (Blue Nile State) was carried out, based on information gathered from interviews with traditional healers. Information regarding their traditional use, preparation, and administration was also collected. The study was

*Corresponding author. E-mail: sakinayagi@yahoo.com. Tel: 00 24 99 15 03 00 04.

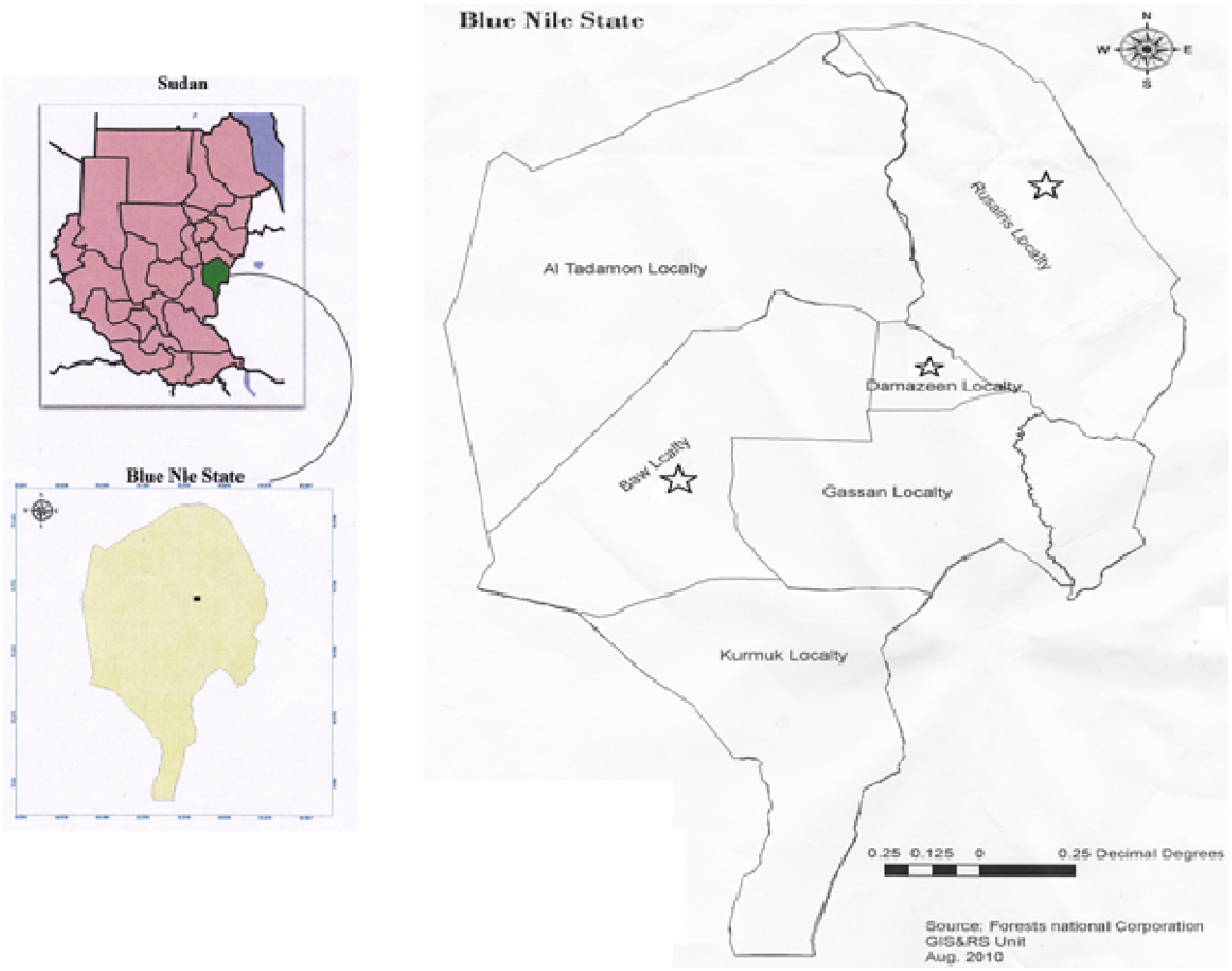

Figure 1. Map of the Blue Nile State showing study area.

carried out with the aim of preserving knowledge about the local use of medicinal plants in this area of the country, and provides preliminary information aimed at a more detailed investigation on the bioactive molecules.

METHODS

Study area and socio-economic setting

The study took place in Baw, Damazin and Roseiris communes, three rural areas located in the Blue Nile State in the South-Eastern of the Sudan (Figure 1). The study area lies in the savanna region between latitudes 10° and 12° 05´N and longitudes 3° and 3°E. The rainy season starts earlier in June and ends in September. The temperature ranges between 20 to 25°C during winter and between 32 to 40°C during summer.

Blue Nile State with an estimated area of 8,500.000 square kilometres, is considered to be one of the richest States in terms of the various economic resources, 80% of its land is arable and fertile. Mechanized agriculture prevails there together with traditional farming for crop production. The State is rich also in animal and forestry resources. Based on figures from the CSA (2009), the Blue Nile State has an estimated population of 842, 187. They form a social fabric made up of Arab tribes together with Fellata, Hausa, Barno and several local tribes, The various tribes are restricted to the following groups: (1) The Local tribal groups; (2) The Arab tribal groups; 3- The Western Sudan tribal groups and 4- The Southern Sudan tribal groups. The Ingessena tribe (group 1) represents one of the largest tribe in respect of population. It is an ancient original local Negroid tribe. Their capital is Baw. They speak Fung dialect. The rate of literacy is quite low until now. They were pagan but some of them had embraced Islam. They practice agriculture and animal rearing. The Fellata and Hausa tribes (group 3) come from western Africa, settled for sometime in Western Sudan then moved eastwards and settled on the Blue Nile banks in this region for about a hundred years. Their main villages include Roseiris, and Damazin. The Fellata are mostly farmers, nomads and government office workers due to their relatively high rate of literacy. The Hausa work in farming and fishing due to their low literacy rate. The two tribes are Muslims (Gadermary, 2006).

Data collection methods

Ethnobotanical data were collected during two different field trips

(August/2008 and January/2009) based on semi- structured interviews. A total of 31 traditional healers between the ages of 25 and 76 were involved from the three studies areas and were interviewed independently to avoid others influence. The questionnaire was designed to collect data on (i) local names of the plants, (ii) ailments treated by the plant (iii) plant parts used, (iv) condition of the plant material (dried or fresh) and (v) modes of preparation and administration. Some social factors like the name, age, occupation and education level of the interviewed person were also recorded. Also, the geographic locality and date of the interview were recorded. Plant specimens were collected for taxonomic identification using keys of written floras such as Broun and Massey (1929), Andrews (1948, 1952, 1952 and 1956), Ross (1975), Hutchinson and Dalziel (1968), Maydell (1990) and Elamin (1990). Voucher specimens were deposited at the Herbarium of Soba Forest Research Centre.

Data analysis

Use categories

The medicinal plant uses were classified into categories following the standard developed by Cook (1995). Each time a plant was mentioned as "used" was considered as one "use-report." If one informant used a plant to treat more than one disease in the same category, it was considered as a single use-report (Treyvaud et al., 2005).

Informant consensus factor (ICF)

To test homogeneity of knowledge, the informant consensus factor was used (Trotter and Logan, 1986):

$$ICF = \frac{N_{ur} - N_t}{(N_{ur} - 1)}$$

where N_{ur} refers to the number of use-reports for a particular use category and N_t refers to the number of taxa used for a particular use category by all informants. ICF values are low (near 0) if plants are chosen randomly or if there is no exchange of information about their use among informants, and approach one (1) when there is a well-defined selection criterion in the community and/or if information is exchanged between informants (Gazzaneo et al., 2005).

Use value

The relative importance was calculated employing the use value (Phillips et al., 1994), a quantitative measure for the relative importance of species known locally:

$$UV = \frac{\sum U_i}{n}$$

where U_i is the number of use-reports cited by each informant for a given species and n refers to the total number of informants. Use values are high when there are many use-reports for a plant, implying that the plant is important, and approach zero (0) when there are few reports related to its use. The use value, however, does not distinguish whether a plant is used for single or multiple purposes.

Fidelity level (FL)

Because many plant species may be used in the same use category, it is interesting to determine the most preferred species used in treatment of particular ailment, which can be done with the FL of Friedman et al. (1986):

$$FL(\%) = \frac{N_p}{N} \times 100$$

where N_p is the number of use-reports cited for a given species for a particular ailment and N is the total number of use-reports cited for any given species. High FLs (near 100%) are obtained for plants for which almost all use reports refer to the same way of using it, whereas low FLs are obtained for plants that are used for many different purposes.

RESULTS AND DISCUSSION

Distribution and diversity of medicinal plants in the study area

A total of 53 medicinal plants, which belong to 31 families and 47 genera were recorded in the study area. The results gathered during the survey are summarized in Table 1, which provide the following information for each species: scientific name, botanical family, local common name, use value, plant habitat, plant part used, disease treated and route of administration. The most represented families are Fabaceae and Caesalpiniaceae with 6 species each followed by Mimosaceae (5 species), Anacardiaceae (3 species), Bignoniaceae, Capparaceae, Combretaceae and Meliaceae, Moraceae and Sterculiaceae were represented with two species each. Other families were represented with one species each.

Plant use values, informant consensus factor and fidelity level

The most commonly used species is *Acacia oerfota* with a use value of 1.20, followed by *Tamarindus indica, Cassia arereh* and *Ziziphus spina-christi* which have use values from 1.07 to 1.00. The most rarely used plants are *Senna singueana* (use value 0.10), *Senna occidentalis* (use value 0.13) and *Strychnos innocua* (use value 0.13) (Table 1). The use categories with most use-reports are the categories of plants used for digestive system disorders (185 use-reports, 30 species), infections/ infestations (88 use-reports, 22 species), pain(38 use-reports, 6 species), evil eye (34 use-reports, 4 species) and respiratory system disorders (28 use-reports, 4 species) and these use categories all had a high degree of consensus with ICF values greater than 0.75. The highest degrees of consensus (ICF = 0.91, 0.89 and

Table 1. Ethnomedicinal plants used in the Blue Nile State, Sudan.

Plant species/ Family	Vernacular name	Use value	Habitat	Part used	Preparation	Ailment treated	Route of administration
Abutilon ramosum (Cav.) Guill. and Perr. (Malvaceae)	Fofo	0.68	Herb	Roots	Maceration	Stomach ache	Oral (potions)
Acacia nilotica (L.) Willd. Ex Delile (Mimosaceae)	Sunut	0.97	Tree	Fruits	Maceration	Malaria	Oral (potions)
					Powder	Furuncles	External (liniment/poultices)
					Smoke	Phlematic cough	External (inhalation)
Acacia oerfota (Forsk) Schweinf. (Mimosaceae)	Laot	1.20	Shrub	Roots	Paste	Teeth ache	External (filling tooth cavity)
					Smoke	Headache	External (inhalation)
					Decoction	Snake bite	Oral (potions)
				Stem	Smoke	Rheumatic pain	External (liniment/poultices)
Acacia polyacantha Wild subsp *campylacantha* (Hochst. ex A. Rich.) Brenan (Mimosaceae)	Kakamoat	0.87	Tree	Stem bark	Infusion	Dysentry	Oral (potions)
					Infusion	Sexual debility	Oral (potions)
					Decoction	Haemorrage	Oral (potions)
Acacia senegal (L.) Willd (Mimosaceae)	Hashab	0.57	Tree	Gum	Powder	Kidney problems	Oral (potions)
Acacia seyal Del. var. *seya*l (Mimosaceae)	Talh	0.60	Tree	Stem bark	Decoction	Diarrhea	Oral (potions)
					Decoction	Dysentry	Oral (potions)
Adansonia digitata L. (Bombacaceae)	Tabaldi	0.97	Tree	Fruits	Decoction	Diarrhea	Oral (potions)
					Decoction	Dysentry	Oral (potions)
					Decoction	Malaria	Oral (potions)
Anogeissus leiocarpus (DC.) Guill. & Perr. (Combretaceae)	Sahab	0.67	Tree	Stem bark	Decoction	Cough	Oral (potions)
					Decoction	Dysentry	Oral (potions)
					Decoction	Giardiasis	Oral (potions)
Aristolochia bracteata Retz. (Aristolochiaceae)	Umm Galagl	0.82	Herb	Roots	Maceration	Malaria	Oral (potions)
Azadirachta indica A. Juss. (Meliaceae)	Neem	0.80	Tree	Leaves	Infusion	Malaria	Oral (potions)
					Infusion	Fever	Oral (potions)
					Decoction	Jaundice	Oral (potions)
Balanites aegyptiaca (L.) Delile (Zygophyllaceae)	Heglig	0.83	Tree	Fruits	Maceration	Worms expulsion	Oral (potions)
					Maceration	Diabetes	Oral (potions)

Table 1. Contd.

Bauhinia rufescens Lam. (Caesalpiniaceae)	Kulkul	0.57	Shrub	Leaves	Powder	Dysentry	Oral (potions in youghrt)
Boscia senegalensis Per. (Capparaceae)	Mukheit	0.47	Shrub	Leaves	Paste	Rheumatic pain	External (liniment/poultices)
Boswellia papyrifera (Delile ex Caill.) Hochst. (Burseraceae)	Tarag Tarag	0.77	Tree	Stem bark	Powder Decoction Decoction	Balharsia Diarrhea Dysentry	Oral (potions) Oral (potions) Oral (potions)
Carissa edulis (Forssk.) Vahl (Apocynaceae)	Golo	0.79	Shrub	Roots	Maceration	Treating rashes	Oral (potions)
Cassia arereh Del. (Caesalpiniaceae)	Gaga	1.00	Tree	Roots Stem bark	Decoction Decoction Decoction Smoke	Stomach ache Diarrhea Malaria Evil eye	Oral (potions) Oral (potions) Oral (potions) External (inhalation)
Celosia trigyna L. (Amaranthaceae)	Mugum	0.70	Herb	Leaves	Maceration	Giardiasis	Oral (potions)
Cissus quadrangularis L. (Vitaceae)	Salala	0.50	Herb	Stem	Poultice Smoke	Acne Evil eye	External (liniment/poultices) External (inhalation)
Clematis hirsuta Guill. & Perr. (Ranunculaceae)	Fer	0.73	Herb	Whole plant	Maceration	Kidney problems	Oral (potions)
Clitoria ternatea L. (Fabaceae)	Sum	0.69	Shrub	Whole plant	Maceration	Constipation	Oral (potions)
Cynanchum acutum L. (Asclepiadaceae)	Irg Eldem	0.80	Herb	Roots	Maceration	Balharsia	Oral (potions)
Dalbergia melanoxylon Guill. Et Perr. (Fabaceae)	Abanus	0.43	Tree	Roots	Infusion	Stomach ache	Oral (potions)
Dichrostachys cinerea (L) Wight et Arn. (Fabaceae)	Kadad	0.53	Tree	Roots/ Leaves Leaves Leaves Roots Roots/ Leaves	Decoction Decoction Decoction Paste Powder	Stomach ache diarrhea. Jaundice Teeth ache Sexual debility	Oral (potions) Oral (potions) Oral (potions) External (filling tooth cavity) Oral (potions in milk)
Erythrina abyssinica Lam. Ex DC. (Fabaceae)	Hab El Arous	0.60	Tree	Stem bark Seeds	Decoction Powder Decoction	Jaundice Rheumatic pain Eye infection	Oral (potions) External (liniment/poultices) External (wash)

Table 1. Contd.

Ficus sycamorus L. (Moraceae)	Gumez	0.57	Tree	Stem bark	Powder	Stomach ache	Oral (potions)
				Fruits	Powder	Treating rashes	External (liniment/poultices)
Ficus ingens (Miquel) Miquel (Moraceae)	Gumez	0.30	Tree	Stem bark	Decoction	Dysentry	Oral (potions)
Grewia villosa Willd. (Tiliaceae)	Altiko	0.91	Shrub	Roots	Maceration	Cancer	Oral (potions)
Gyrocarpus jacquinii Gaertn.(Hernandiaceae)	Um Sabeba	0.77	Tree	Stem bark	Decoction	Constipation	Oral (potions)
Hydnora johannis Becc. (Hydnoraceae)	Tartous	0.77	Parasite	Roots	Maceration	Cholera	Oral (potions)
					Maceration	Diarrhea	Oral (potions)
					Maceration	Dysentry	Oral (potions)
					Powder	Evil eye	External (inhalation)
Jatropha curcas L. (Euphorbiaceae)	Habat El Muluk	0.53	Herb	Leaves	Decoction	Giardea	Oral (potions)
					Decoction	Jaundice	Oral (potions)
					Decoction	Malaria	Oral (potions)
					Decoction	Fever	Oral (potions)
Khaya senegalensis (Desr.) A. Juss (Meiaceae)	Mahogany	0.77	Tree	Stem bark	Decoction	Malaria	Oral (potions)
					Maceration	Diabetes	Oral (potions)
Kigelia africana (Lam.) Benth.(Bignoniaceae)	Um Shitour	0.67	Tree	Fruits	Paste	Breast tumor	External (liniment/poultices)
					Decoction	Hypertension	Oral (potions)
					Decoction	Diabetes	Oral (potions)
Lannea fruticosa Engl. (Anacardiaceae)	Lieon	0.73	Tree	Stem bark	Decoction	Dysentry	Oral (potions)
				Leaves	Poultice	Wounds	External (liniment/poultices)
Maerua angolensis DC. (Capparaceae)	Shager Elzaraf	0.33	Tree	Leaves	Paste	Breast tumor	External (liniment/poultices)
Momordica balsamina L. (Cucurbitaceae)	Abu Elefain	0.84	Herb	Whole plant	Maceration	Worms expulsion	Oral (potions)
Ozoroa insignis Delile (Anacardiaceae)	Tugul	0.33	Tree	Stem bark	Decoction	Stomach ache	Oral (potions)
Piliostigma reticulatum (DC.) Hochst. (Caesalpiniaceae)	Abu Khameira	0.53	Tree	Stem bark	Decoction	Snake bite	Oral (potions)
					Paste		External (liniment/poultices)
Plumbago zeylanica L. (Plumbaginaceae)	Sum Yanek	0.53	Herb	Whole Plant	Maceration	Epilepsy	Oral (potions)
Sclerocarya birrea ssp. *Caffra* (Sond.) J.O. Kokwaro. (Anacardiaceae)	Humeid	0.67	Tree	Stem bark	Powder	Diarrhea	Oral (potions)
					Powder	Dysentry	Oral (potions)

Table 1. Contd.

				Leaves	Powder	Treating rashes	External (liniment/poultices)
Securidaca longepedunculata Fres. (Polygalaceae)	Alali	0.67	Tree	Roots	Smoke	Evil eye	External (inhalation)
				Roots	Powder	Treating rashes	External (liniment/poultices)
Senna obtusifolia (L.) H. S. Irwin and Barneby (Caesalpiniaceae)	Kawal	0.67	Herb	Leaves	Decoction	Jaundice	Oral (potions)
Senna occidentalis (L.) Link (Caesalpiniaceae)	Soreib	0.13	Herb	Seeds	Powder	Jaundice	Oral (potions)
Senna singueana (Delile) Lock (Caesalpiniaceae)	Saba	0.10	Shrub	Roots	Decoction	Constipation	Oral (potions)
Sterculia setigera Delile (Sterculiaceae)	Tartar	0.90	Tree	Gum	Powder	Teeth ache	External (filling tooth cavity)
				Stem bark	Decoction	Hypertension	Oral (potions)
					Decoction	Haemorrage	Oral (potions)
					Powder	Headache	External (rubb with sesame oil)
				Stem bark	Decoction	Balharsia	Oral (potions)
Stereospermum kunthianum Cham. (Bignoniaceae)	Khash Khash Abiad	0.43	Tree	Stem bark	Powder	Syphilis	Oral (potions)
Strychnos innocua Del. (Loganiaceae)	Um Bikheisa	0.13	Tree	Roots	Decoction	Sexual debility	Oral (potions)
Tamarindus indica L. (Fabaceae)	Aradeib	1.07	Tree	Fruits	Infusion	Malaria	Oral (potions)
					Infusion	Fever	Oral (potions)
					Infusion	Stomach ache	Oral (potions)
				Stem bark	Powder	Wounds	External (sprinkle)
Tephrosia uniflora Pers. (Fabaceae)	Irg Altais	0.52	Herb	Roots	Maceration	Diarrhea	Oral (potions)
Terminalia laxiflora Engl. & Diels (Combretaceae)	Darout	0.47	Tree	Stem bark	Maceration	Cough	Oral (potions)
					Decoction	Tonic	Oral (potions)
Vangueria madagascariensis J. F. Gmel. (Rubiaceae)	Sum Alouyoun	0.57	Tree	Roots	Maceration	Diabetes	Oral (potions)
Waltheria indica L. (Sterculiaceae)	Irg Elmahal	0.66	Herb	Roots	Powder	Wounds	External (sprinkle)
Ximenia americana L. (Olacaceae)	Um Medika	0.53	Tree	Leaves	Decoction	Measles	Oral (potions)
				Roots	Paste	Teeth ache	External (filling tooth cavity)
Ziziphus spina-christi (L.) Desf. (Rhamnaceae)	Nabag	1.00	Tree	Roots	Infusion	Stomach ache	Oral (potions)
					Infusion	Urine retension	Oral (potions)
					Infusion	Diarrhea	Oral (potions)
					Infusion	Dysentry	Oral (potions)
					Infusion	Malaria	Oral (potions)

Table 2. Informant consensus factor (ICF) and fidelity level (FL) for ethnobotanical information given by the 31 informants.

Symptom and ailment categories	ICF	Preferred species	Application	FL (%)
Evil eye	0.91	*Securidaca longepedunculata*	Evil eye	57.1
Respiratory system	0.89	*Acacia nilotica*	Treating cough	83.1
Endocrinological system (diabetes)	0.88	*Balanites aegyptiaca*	Antdiabetic	54.3
Abnormalities	0.86	*Grewia villosa*	Cancer	100
		Maerua angolensis	Treating breast edema	60.0
Blood system disorders	0.86	*Sterculia setigera*	Hypertension	72.7
Injuries	0.86	*Tamarindus indica*	Treating wounds	85.0
Pain	0.86	*Acacia oerfota*	Treating teethache	90.1
		Acacia oerfota	Treating headache	67.8
Digestive system	0.84	*Senna singueana*	Constipation	88.4
		Sclerocarya birrea ssp. caffra	Treating diarrhea	66.7
		Hydnora johannis	Treating diarrhea	57.9
		Cassia arereh	Treating stomachache	75.0
		Ziziphus spina-christi	Treating stomachache	74.6
Snake bites	0.83	*Piliostigma reticulatum*	Snake bite	60.0
Infections/infestations	0.76	*Hydnora johannis*	Treating cholera	100
		Azadirachta indica	Treating malaria & fever	90.0
Skin and subcutaneous tissues diseases	0.67	*Carissa edulis*	Treating rashes	25.0
Genitourinary system disorders	0.58	*Acacia senegal*	Treating kidney problems	100
		Ziziphus spina-christi	Urine retension	100
		Strychnos innocua	Sexual debility	100
Muscolo-skeletical system	0.25	*Acacia oerfota*	Treating rheumatism	46.7
Nervous system	0.00	-	-	-
Nutritional disorders	0.00	-	-	-

Table 3. Habitat and proportion of cultivated and wild medicinal plants in the study area.

Plant habit	Number and % of species	Wild	Cultivated
Tree	32 (60)	32	12
Shrub	7 (13)	7	0
Herb	13 (25)	13	2
Parasite	1 (2)	1	0

0.88) are, however, for evil eye, respiratory system disorders and endocrinological system (diabetes), respectively (Table 2).

The category of plants used for treatment of nervous system and nutritional disorders has the lowest degree of consensus (ICF = 0); only One informant mentioned ailments in this category. Species with high use value appear to simultaneously be the preferred species in at least one use category (Tables 1 and 2). Still, some plants that are not widely used and did not show high use value are used for very specific therapeutic purposes, and we therefore found high FLs for these plants; e.g., *Grewia villosa, Acacia senegal, Ziziphus spina-christi* and *Strychnos innocua* all had FLs of 100% (Table 2). This finding suggested that there is a well-defined selection criterion for these use categories (Gazzaneo et al., 2005).

Because use values are dynamic and change through time, they may have decreased for some plants because of generational changes in pre-ferences or transformation of actual use patterns (Camou-Guerrero et al., 2008). Plants with low use values and/or FLs are not necessarily unimportant, but having low use values indicates that traditional knowledge about them is at risk of not being transmitted and that it may be gradually disappearing (Chaudhary et al., 2006).

Additionally, the low use value of some plant species could be related to their scarcity (Benz et al., 1994).

Habitat of the plants

Analysis of data based on their habitat showed that trees accounted highest proportion (60%) followed by herbs (25%), shrubs (13%) and parasites (2%). All medicinal plants are collected from the wild and only 26% of them are also cultivated in homegardens (Table 3). The cultivated plants are; *Acacia nilotica*, *Acacia senegal*, *Acacia seyal*, *Adansonia digitata*, *Azadirachta indica*, *Balanites aegyptiaca*, *Bauhinia rufescens*, *Boswellia papyrifera, Ficus sycamorus*, *Jatropha curcas, Kigelia africana*, *Senna occidentalis, Tamarindus indica* and *Ziziphus spina-christi*. There are traditional healers who

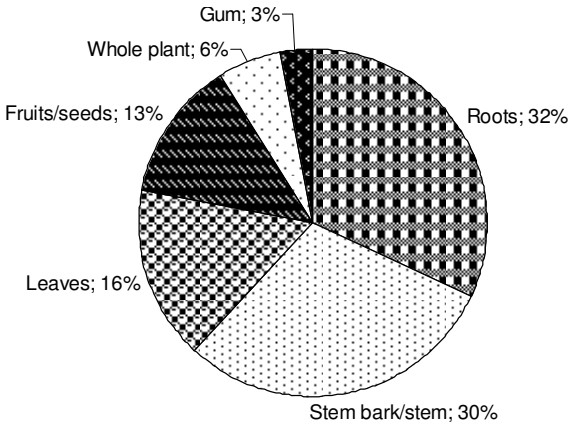

Figure 2. Parts of medicinal plants used in different preparations in the study area.

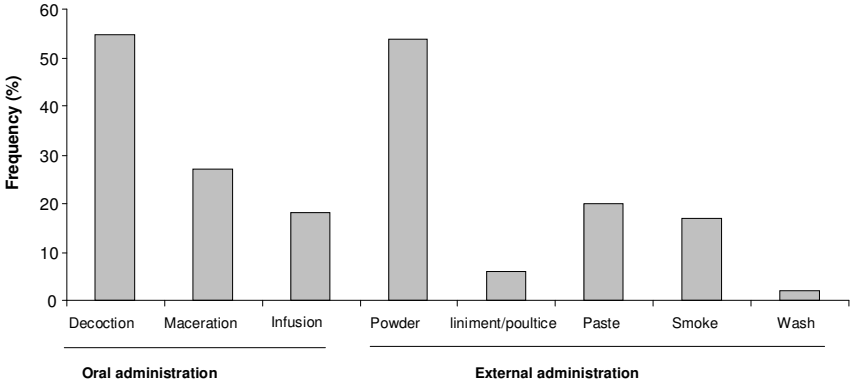

Figure 3. Mode of preparations of medicinal plants in the study area. Percentages were calculated as the ratio between the number of formulations in which a certain mode of application is used and the total number of formulations recorded.

believe that plants grown under agricultural conditions will not have the same medicinal properties as those harvested from the wild. Cultivated material is believed to lack the “power” of wild medicinal plants. This idea is shared by different healers in different African countries (Cunningham, 1993). However, the endangered plants reported by the traditional healers are; *Cassia arereh*, *Erythrina abyssinica* and *Dalbergia melanoxylon*.

Plant part used, method of preparation, and route of administration

Roots contribute about 32% of plant part used and followed by stem (30%) leaves (16%), fruits/seeds (13%), whole plant (6%) and gum (3%) (Figure 2). There are instances where different parts of the same plant being used for different purposes. There are also cases where more than one plant is used to treat a particular ailment. Some traditional healers for example, treated malaria with a combination of fruits of *Adansonia digitata*, *Tamarindus indica* and flower (calyx) of *Hibiscus sabdariffa*, or with a combination of fruits of *Acacia nilotica* and flower (calyx) of *Hibiscus sabdariffa*. Diabetes is treated by some healers with a combination of stem bark of *Swietenia mahagoni* with fruits of *Tamarindus indica* and roots of *Ziziphus spina-christi*.

According to the survey, the traditional healers administer their remedies in various forms. A majority of remedies are administered orally (75%) by consumption as potions, prepared in form of decoction (55%) or maceration (27%) or infusion (18%) from dried or freshly collected plant parts and some are used externally (25%) as liniment and poultices (6%) or paste (20%) or smoke (17%) or wash (decoction) (2%) or powder (54%) according to the disease and preparation method (Fig 3). Water served mainly as solvents and to improve the acceptability of certain oral remedies, yoghurt and milk are frequently used. The remedies prepared from *Senna occidentalis* seeds, and *Bauhinia rufescens* leaves for instance, are mixed with yoghurt so that the preparation can be swallowed without much difficulty. For most of

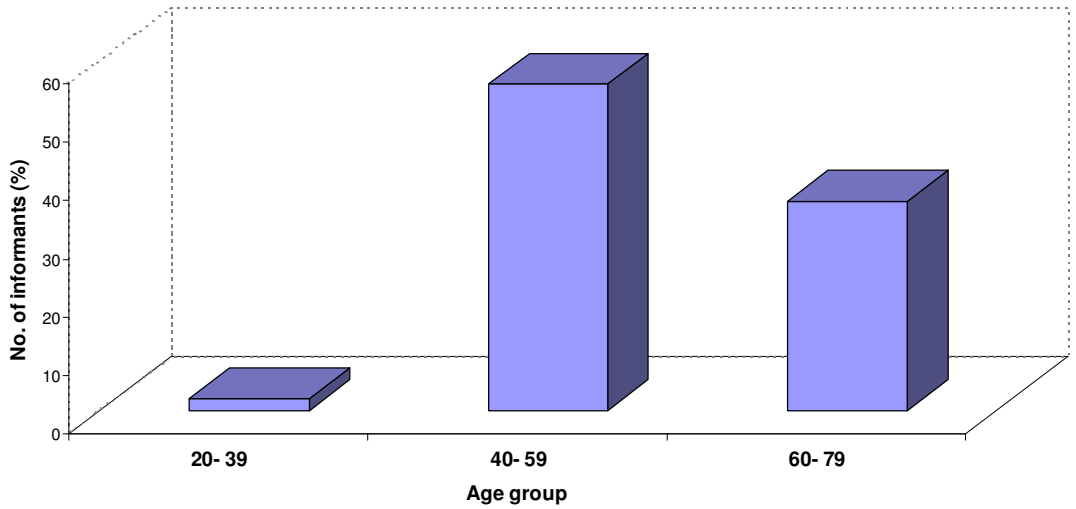

Figure 4. Age-group distribution of the traditional healers interviewed.

remedies, the dose given to the patient depends on age, physical and health conditions. Moreover, the traditional healers interviewed reported that for the remedy to have efficacy, certain rules have to be observed, such as the time for collecting the plant, the order in which different plants are added during the concoction, and the time of day at which preparations are made. During the survey, all traditional healers interviewed (Figure 4) emphasised the concept that a spiritual component is also involved in the use of plants for the treatment of particular symptoms, saying that it is the power, the "spirit" of the plant that is believed to have the therapeutic effect. This represents a common trait of traditional health practices (Herrick, 1995).

Medicinal plants and the associated knowledge

Analysis of the result on ages of informants reveals out there is a wide gap between generations (Figure 3). The majorities of the informants are elders and said that they had learned about medicinal plants during their childhoods and the knowledge had been orally passed down from family members, particularly grandparents and parents. Most of the adults reported that they learned about medicinal plants when trailing with their parents or grandparents to gather remedies in the forest when they were young. The lack of systematic documentation for medicinal plant knowledge may contribute to the loss of medicinal plant knowledge, particularly for plants that are neglected or non-preferred. This situation appears to occur in many parts of the world (Fekadu, 2001, Bussmann and Sharon, 2006).

Conclusion

This study confirms that wild plants are still a major source of medicine for the local people living in the Blue Nile State of the Sudan. Modern health care services in this area are not adequate, and most people have limited economic means to buy Western medicine from the market. Thus, traditional medicine remains the most popular medicine in solving health problems. As traditional medical knowledge is orally passed down via lifestyle, it is important to exhaustively document and publicize medicinal plant knowledge within the young generation to raise awareness of and appreciation for their traditional values and for the conservation and sustainable use of the plants as well as to keep the traditional medical knowledge left in their community alive.

The ongoing mass destruction of wild vegetation for different purposes may hasten the disappearance of medicinal plants. This in turn may become a threat for the traditional knowledge on medicinal plants and discourage the practice of traditional health care in the study area. It is very crucial that awareness creation be undertaken so that the community is actively involved in conservation and sustainable utilization of the traditional medicinal plants; as part of the entire plant biodiversity of the area.

ACKNOWLEDGEMENTS

The authors are thankful to all traditional healers for sharing their knowledge of medicinal plants with us and support.

REFRENCES

Andrews FW (1948). The Vegetation of the Sudan, in Tot till, J.D. (ed.). Agriculture in the Sudan, Oxford University Press.
Andrews FW (1950). The Flowering plants of the Anglo. Egyption Sudan, Vol. 1, Buncle Co. Ltd. Arbroath, Scotland.
Andrews FW (1952). The Flowering plants of the Anglo. Egyption Sudan. Vol. 2, Buncle Co. Ltd. Arbroath, Scotland.

Andrews FW (1956). The Flowering plants of the Anglo. Egyption Sudan, Vol. 3, Buncle Co. Ltd. Arbroath, Scotland.
Benz BF, Santana F, Pineda R, Cevallos J, Robles L, De ND (1994).
Broun AF, Massey RE (1929). Flora of the Sudan. Thomas Murby and Co 1. Fleet Lane, London, E.C. 4. El.
Bussmann RW, Sharon D (2006). Traditional medicinal plant use in Loja province, southern Ecuador. J. Ethnobiol. Ethnomed. 2, doi:10.1186/1746-4269-2-44.
Camou-Guerrero A, Reyes-García V, Martínez-Ramos M, Casas A (2008). Knowledge and use value of plant species in a Rarámuri Characterization of Mestizo plant use in the Sierra de Manantlán, Jalisco-Colima, Mexico. J. Ethnobiol., 14: 23-41.
Chaudhary MI, He Q, Cheng YY, Xiao PG (2006). Ethnobotany of medicinal plants from Tian Mu Shan Biosphere Reserve, Zhejiang-Province, China. Asian J. Plant Sci., 5: 646-653.
community: a gender perspective for conservation. Hum. Ecol., 36: 259-272.
Cook FEM (1995). Economic Botany Data Collection Standard. Royal Botanic Gardens, Kew, United Kingdom.
Cunningham AB (1993). African medicinal plants, setting priorities at the interface between conservation and primary health care. People and Plants Working Paper 1. UNESCO, Paris.
El Khalifa MY (1999). Home remedies in Khartoum State. Unpublished Research Data. MAPRI Reports.
Elamin HM (1990). Trees and Shrubs of the Sudan. Ithaca Press Exeter, U.K.
Fekadu F (2001). Ethiopian Traditional Medicine, Common medicinal plants in perspective, Sioux City, IA.
Friedman J, Yaniv Z, Dafni A, Palewitch D (1986). A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev desert, Israel. J. Ethnopharmacol., 16: 275-287.
Gadermary BH (2006). Tribal Structure in the Blue Nile State and the Issue of Belonging. Sudan vision. www.sudanvisiondaily.com/modules.php?name.
Gazzaneo LRS, Lucena RFP, Albuquerque UP (2005). Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). J. Ethnobiol. Ethnomed., 1, doi:10.1186/1746-4269-1-9.
Giday M, Asfaw Z, Elmqvist T, Woldu Z (2003). An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. J. Ethnopharmacol., 85: 43-52.
Gilani AH, Rahman AU (2005). Trends in ethnopharmacology. J. Ethnopharmacol., 100: 43-49.
Gurib-Fakim A (2006). Medicinal plants: Traditions of yesterday and drugs of tomorrow. Mol. Asp. Med., 27: 1-93.
Herrick JW (1995). Iroquois Medical Botany. Syracuse University Press, New York.
Hutchinson J, Dalziel JM (1968). Flora of west tropical Africa. 1st ed. Crown Agents for Overseas Governments and Administration, Millbank, London.
Maydell HJV (1990). Tress and shrubs of the Sahel, their characteristics and uses. GTZ, Germany.
Nelson-Harrison ST, King SR, Limbach C, Jackson C, Galiwango A, Kato SK, Kanyerezi BR (2002). Ethnobotanical research into the 21st century. In: Iwu MM, Wootton JC (Eds.), Ethnomed. Drug Discov. Elsevier, Amsterdam.
Phillips O, Gentry AH, Reynel C, Wilkin P, Galvez DBC (1994). Quantitative ethnobotany and Amazonian conservation. Conserv. Biol., 8: 225-248.
Ross JH (1975). Flora of South Africa, Vol. 16 Part I. The Government Printer Pretoria.
Treyvaud AV, Arnason JT, Maquin P, Cal V, Vindas PS, Poveda L (2005). A consensus ethnobotany of the Q'eqchi' Maya of southern Belize. Econ. Bot., 59: 29-42.
Trotter RT, Logan MH (1986). Informant consensus: a newapproach for identifying potentially effective medicinal plants. In: Etkin, N.L. (Ed.), Plants in Indigenous Medicine and Diet. Redgrave Publishing Company, Bedford Hills, New York.
Voeks RA, Leony A (2004). Forgetting the forest: assessing medicinal plant erosion in eastern Brazil. Econ. Bot., 58: 294-306.