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Medicinal value and ecotaxonomy of the flora of Blue Nile State-Sudan

[1]Haytham H. Gibreel, [2]Maha A. Y. Kordofani, [1]Essam I. Warrag and [2]Hoyam O. Ahmed

[1]Department of Silviculture, Faculty of Forestry, University of Khartoum, Sudan
[2]Department of Botany, Faculty of Science, University of Khartoum, Sudan

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ABSTRACT

The general objective of this study is to update the taxonomic identification, calculate ecological statistics and evaluate the medicinal values of the woody plant species (trees, shrubs & woody climbers) in El Nour Natural Forest Reserve, Blue Nile, which has high natural plant diversity, used as seed source and representative of the State. The study revealed 55 woody plant species that belong to 36 genera and 18 families (17 dicotyledonous and one monocotyledonous). Their vernacular names were presented .These plants were found to be of high medicinal uses in this area of study. Among the major findings, the subfamiy Mimosoideae used to treat stomach &rheumatic pains,colds, hypertension& scorpion bites; the family Combretaceae used as purgative, treat jaundice and wounds and the Capparaceae used to treat tuberculosis,bilharzias and opthalima. . The family Ochnaceae has been reported for the first time in the area and is represented by Ochna afzelii R.Brenan. ex Oliver (local name Lesan El Kalb). The updated families and subfamilies were: Capparaceae instead of Capparidaceae and Fabaceae instead of Leguminosae. At the subfamily level, Mimosoideae, Caesalpinioideae and Papilionoideae were used instead of Mimosaceae, Caesalpinaceae and Papilionaceae, respectively. The subfamily Mimosoideae showed the highest species and genera frequency. The identified families were alphabetically listed and the species grouped according to their habit into 19 species as large trees, 19 small trees, 15 shrubs and 2 woody climbers. Also, the study reported 12 species as endangered ones.

Key Words: Medicinal, Ecotaxonomy, Blue Nile, Sudan

INTRODUCTION

Identification and development of flora has a role in successful of management, whether for economic return and sustainability, or for ecosystem restoration. The vegetation cover and natural forests in the subtropical arid and semi-arid regions are changing and losing their capacities for natural regeneration [1]. Studies on general Sudan's flora were few, low intensity of sampling and outdated since they were started by the work of [2], followed by [3]; [4];[5] and [6].

The Blue Nile State is located within the vast savanna's areas in the central Sudan, characterized by considerable variation in micro and macro-habitats that resulted in high plant species diversity particularly forest trees and shrubs. The vegetation composition is dominated by acacias in the drier part and broad leaved deciduous trees in wetter parts, and additionally more annual grasses, perennials and a valuable proportion of herbs are always found [7]; [8]; [9]; [10] and [11].

El Nour Natural Forest Reserve (4667.17 hectare) is an important natural forest in the Blue Nile State. It extends

between latitudes 11˚ 52.5 33.4 & 11˚ 48 31.8 N and longitudes 34˚ 30 38.2 & 34˚ 29.5 23.05 E (Figure 1). The forest topography is locally known as "Karab", and characterized by the slight slope from south-west towards north-east with presence of some depressions in the middle and northern parts. Dark cracking clay soil, with some alluvial patches constitutes about 64.2% (2996.32 ha) of the forest and found in the north, northwest and northeast parts and around water courses. The remaining 35.8% (1670.85 ha) is sandy-loam to gravelly soil at the central and southeastern parts. The Blue Nile State is characterized by heavy rainfall from April to November with peak months being July and September. The average relative humidity (R.H) during the dry season is less than 50%, and increases to 80% in the wet season. August shows the highest mean relative humidity (69.57%).

The forest is a seed source for different valuable woody species that distributed in different areas within the state [12]. New studies regarding the taxonomic characteristic and species composition were taken before in consideration of the considerable changes in the environmental conditions, continuous introduction of exotic species and illegal human practices that may have affected its flora. These indicate the current need towards updating the taxonomic identification of the forest flora, to generate information that might help planners, pharmaceutical researchers, students and other related sectors as well as for sustainable management of the forest. The general objective of the study is to update the taxonomic identification, classification and evaluate the medicinal uses of woody plant species in EL Nour forest (Blue Nile state) and to estimate some ecological parameters.

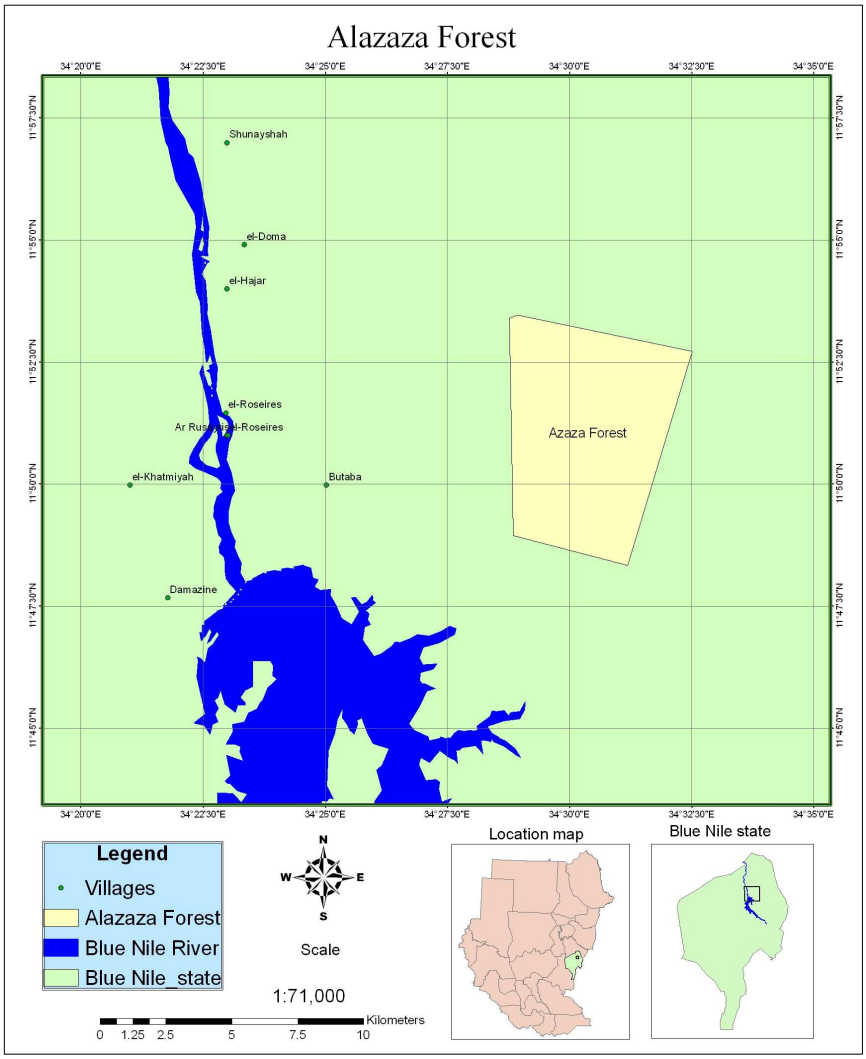

Figure 1: Location map of El Nour (Alazaza) Natural Forest Reserve within the Blue Nile State.

EXPERIMENTAL SECTION

1. Field work

Three reconnaissance surveys and four collection trips were made and resulted on stratification, mapping and demarcation of the forest area into working sites (site A and site B) based on soil type, by using handled GPS (Garmin GPSMAP-72).

A total of 231 sample plots (each of 1050 m2), were arranged in a grid (400 x 500 m) across the study sites (87 plots in site B and 144 plots in site A), then loaded onto the GPS to enable navigation to each plot while in the field (Figure 2).

The data collected in each sample plot were the number of each woody plant species, habit, ideal herbarium specimens (twigs, foliage, bark, inflorescence, and fruits), photographs and also the local names (vernacular) of the identified woody plant species.

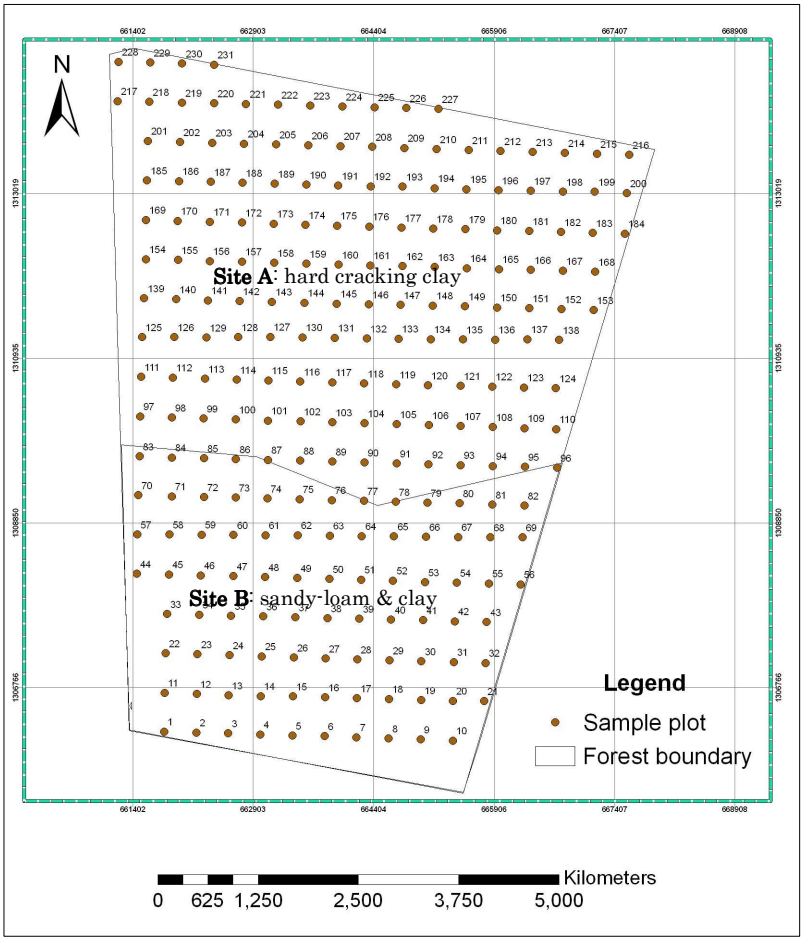

Figure 2: El Nour Natural Forest Reserve map, showing the boundaries and samples distribution within sites A and B.

2. Herbarium work and Identification

The collected woody plant specimens were examined, mounted, identified, labeled and deposited at the herbarium of the Department of Botany- Faculty of Science University of Khartoum, and Department of Silviculture- Faculty of Forestry University of Khartoum. For plant identification standard references for the Sudan were used e.g. [2]; [3]; [13] and selected publications such as [14] and [15]. Taxonomic information from [16] and [17] were also used.

Collected plant specimens were compared with material held in herbaria of the Forestry Research Centre, Soba; Faculty of Science, U. of Khartoum and Medicinal and Aromatic Plants Research Institute. Vernacular names (designated as Vern.) and medicinal values and uses were drawn from the knowledge of local inhabitants within the study area in the form of group discussion.

The family circumscriptions are realigned after the updated molecular phylogenetic data by [18]. The indentified families were ordered and listed alphabetically. Genera and species relative frequencies were calculated for each of the identified families according to [19] as follows:

- Genus Relative **Frequency** = (% occurrence of a genus) ÷ (% occurrence for all genus found)
- Species Relative **Frequency** = (% occurrence of a species) ÷ (% occurrence for all species found)

RESULTS AND DISCUSSION

The study identified 55 medicinal woody plant species that belong to 36 genera and 18 families of which the family Fabaceae includes three sub-families (Mimosoideae, Caesalpinioideae and Papilionoideae). They were grouped according to the variation in their natural habit and height into 19 as large tree, 19 small tree, 15 shrub and 2 woody climbers (Table 1). Sub-family Miomsoideae in the family Fabaceae, showed high genus and species frequency, followed by Combretaceae and Capparaceae (Figure 3). These plants were found to be of high medicinal uses in this area of study. Among the major findings, the subfamiy Mimosoideae used to treat stomach &rheumatic pains,colds, hypertension& scorpion bites; the family Combretaceae used as purgative, treat jaundice and wounds and the Capparaceae used to treat tuberculosis,bilharzias and opthalima. The family Ochnaceae has been reported for the first time and is represented by *Ochna afzelii* R.Brenan. ex Oliver (local name Lessan El Kalib). The species *Diospyros mespiliformis* Hochst. ex A.DC (Gugan) and *Cordia sinensis* Lam (Andrab) were not found in the study, although their presence was indicated by local people living within and around the forest and also [13] reported their presence in the Blue Nile State.

A number of species were recorded as endangered in the study area due to high exploitation by the local people within and around the forest area (Table 2).

Table 1: List of the woody plant species and their medicinal uses in El Nour Natural Forest Reserve, Blue Nile State- Sudan

No.	Family	Species, Scientific/ Local Names	Medicinal uses	Habit
1	Anacardiaceae	1.*Lannea fruticosa* (Hochst. ex A. Rich.) Engl. (Leyun-Ghallub)	Extract from the bark used for treating stomach diseases.	LT
		2.*Lannea schimperi* (A. Rich.) Engl. (Leyun-Amzag-Suda)	Bark, leaves &fruits used for diarrhea.	LT
		3.*Sclerocarya birrea* (A. Rich.) Hohst. (Humeid)	Extracts from bark &leaves used for diarrhea and the powder used for healing up wounds.	LT
2	Arecaceae (Palmae)	1.*Hyphaene thebaica* (L.) Mart. (Nakeel Al Dom)	Leaves used for wounds.	LT
3	Asclepiadaceae	1.*Calotropis procera* (Aiton.) Aiton (Usher)	Roots used for treating dysentery, dephantiasis, syphilis,jaundice; latex used for treating scorpion and snake bites.	SH
4	Balanitaceae	1.*Balanites aegyptiaca* (L.), Del. (Hegleeg (Laluob))	Fruits are eaten to cure diabetic, bilharzia; leaves used for healing wounds; decoction of roots used to treat malaria.	LT
5	Bombacaceae	1.*Adansonia digitata* Linn. (Tabaldi (Gonglize))	Juice used for stomach pain, bark boiled as cure for pain in body.	LT
6	Bignoniaceae	1.*Stereospermum kunthianum* Cham. (Khashkash Abiad)	Bark, root & fruits used for curing wounds, skin inflammation, sexual diseases & cough.	LT
7	Burseraceae	1.*Boswellia papyrifera* (Del.) Hochst. (Trag Trag)	Boiled extract of bark used for jaundice.	ST
8	Capparaceae	1.*Boscia angustifolia* A. Rich. (Irg Al Sraih)	Leaves used for wounds	WC
		2.*Boscia senegalensis* (Pers.) Lam. ex Poir. (Mokheit (Kursan))	Extract from root used for treating Bilharzia, leaves used as poultice for mascular pains; fruit extract used for treating tuberculosis.	SH
		3.*Cadaba rotundifolia* Forssk.	Leaves used for treating rheumatism.	SH

		(Kurmut)		
		4.*Capparis decidua* (Forssk.) Edgew. (Tundub)	Extract from stem used against jaundice & as poultice for swelling and joint paints; poultice of twigs used against head-ache, green branches used for cardiac problems, swelling &tooth-ache.	SH
		5.*Capparis tomentosa* Lam. (Irg Al Gulum)	Leaves used for opthalmia & against snake bites.	WC
		6.*Crateva adansonii* DC. (Dabker)	Leaves relieve pain.	ST
		7.*Maerua angolensis* DC. (Shagar ElZaraf (Shagar Eldoud Shehait))	Leaves used for treatment of rheumatism.	ST
9	Combretaceae	1.*A nogeissus leiocarpus* (DC.) Guill. & Perr. (Sabab – seilk)	Roots used as purgative.	LT
		2.*Combretum aculeatum* Vent., Choix. (Shehait)	Roots used as purgative.	SH
		3.*Combretum ghasalense* Engl. & Diels. (Habeel Um Ismaeel)	Bark used in treating stomach diseases.	ST
		4*Combretum glutinosum* Perr. ex DC. (Habeel Khrisha)	Roots & barks used for jaundice.	LT
		5.*Combretum hartmannianum* (Schweinf. (Habeel Al Gabal)	Boiled leaves used to cure asities; bark & leaves extract used for jaundice.	LT
		6.*Combretum lamprocarpum* Diels. (Habeel El Grouz)	Leaves & barks used for stomach & wounds.	ST
		7.*Combretum molle* R. Br. Ex G. Don. (Habeel Kriusha)	Burnt leaves used as aromatic smoke.	LT
		8.*Terminalia brownii* Fresen. (Subagh – Subaraya)	Bark used for cough ; rheumatism &bronchitis	LT
10	Fabaceae	9.*Terminalia laxiflora* Engl. & Diels. (Subagh – Darut)	Leaves used for stomach pains &wounds	LT
	Caesalpinioideae	1.*Cassia arereh* Del. (Gaga)	Fish-poisons extracted from roots & pods; bark used against cutaneous & subcutaneous parasitic infection; leaves extract used for stomach pain.	ST
		2.*Piliostigma reticulatum* (DC.) Hochst. (Kharub)	Leaves used for cold; bark used against diarrhea & dysentery & for wounds & syphilitic cancer.	SH
		3.*Tamarindus indica* L. (Aradaib (Abu Khmeira))	Roots used for chest complains.	ST
	Mimosoideae	1.*Acacia polyacantha* Willd. (Kakamoot (Um Sinina))	Gum used for treating stomach complains.	ST
		2.*Acacia senegal* (L.) Willd. (Hashab)	Roots & leaves used to treat cold, stomachaches, diarrhea & hemorrhages.	SH
		3.*Acacia seyal* var. *fistulal*. Schwinf.Oliv. (Sufar Abiad)	Gum effective against rheumatic & inflammations of respiratory system.	ST
		4.*Acacia seyal* var. *seyal* Del. (Talih Ahmer)	The tree is used for rheumatic pains &colds & bark &leaves used in treating gastric ulcers.	ST
		5.*Acacia sieberiana* DC. var. *sieberiana* (Talih)	Crushed pods used for hypertention.	ST
		6.*Acacia mellifera* (Vahl.) Benth. Kitir	Bark extract used as remedy for stomach trouble, as treatment for malaria & pneumonia.	SH
		7.*Acacia oerfota* (Forssk.) Schweinf var. *oerfota* (laut)	Leaves used as poultice for swelling; root juice for scorpion bites; smoke of stem & branches used to cure rheumatism & backpain.	SH
		8.*Albizia lebbeck* (L.) Benth. (Degn El basha)	Bark used for rheumatism.	LT
		9.*Dichrostachys cinerea* (L.) White & Arn. (Kadad)	Bark used for treatment of snakebites, toothache & coughs.	SH
		10. *Entada africana* Guill. & Perr. (Al Lauok))	Bark & seeds used to treat cold & throat complains.	ST
		11. *Pithecellobium dulce* (Roxb.) Benth. (Tamer hindi)	Leaves used for cold.	ST
	Papilionoideae	1.*Dalbergia melanoxylon* Guill. & Perr.	Root & stem bark are antidiarrhetic; smoke from roots inhaled to treat headache, bronchitis &	ST

		(Abnos – Babanos)	abdominal pains & hernia.	
		2.*Lonchocarpus laxiflorus* Guill. & Perr. (Khashkash Azrag (Al Afna))	Infusion of roots used as tonic.	LT
		3.*Pterocarpus lucens* GuilL. & Perr. (Taraya)	Leaves used for diarrhea.	LT
11	Loganiaceae	1.*Strychons innocua* Del. (Um Bukheisa)	Extracts from leaves&bark used in curing stomach problems.	ST
12	Meliaceae	1.*Azadirachta indica* A. Juss. (Neem Baladi)	Leaves, bark & fruit used for treating malaria & skin diseases & rheumatism.	LT
13	Moringacea	1.*Moringa olifera* Lam. (Moringa (Al Rawag))	Seeds used to clean water for drinking.	ST
14	Ochnaceae	1.*Ochna afzelii* R.Br. ex Oliv. (Lessan El kalib)	Leaves used for body pains.	ST
15	Rhamnaceae	1.*Ziziphus abyssinica* Hochst., A. Rich (Siddir Al Feel)	Fruits used to treat stomach pains.	SH
		2.*Ziziphus spina-christi* (L.) Desf. (Siddir – Nabag)	Fruits used for treatment of dysentery.	SH
16	Rubiaceae	1.*Gardenia lutea* (Abu Gawi (Al Gardenia))	Leaves & roots used for curing stomach diseases.	ST
		2.*Xeromphis nilotica* Stapf. (Shidr el Marfein)	Leaves & roots used for curing stomach diseases.	ST
17	Sterculiaceae	1.*Sterculia africana* Fiori. (Al Tartar Al Ahmer)	Leaves used for fever.	LT
	"	2.*Sterculia setigera* Del. (Al Tartar Al Abied)	Fruit used for fever and pains.	LT
18	Tiliaceae	1.*Grewia flavescens* Juss. (Guddeim Abou Dlouae)	Leaves used for smoking.	SH
		2.*Grewia mollis* Juss. (Guddeim Basham)	Leaves used to cure fever.	SH
		3.*Grewia tenax* Ascher & Schweinf (Guddeim)	Leaves & fruits used to cure stomach complain.	SH

LT, ST, SH and CW refer to large tree, small tree, shrub and woody climbers, respectively

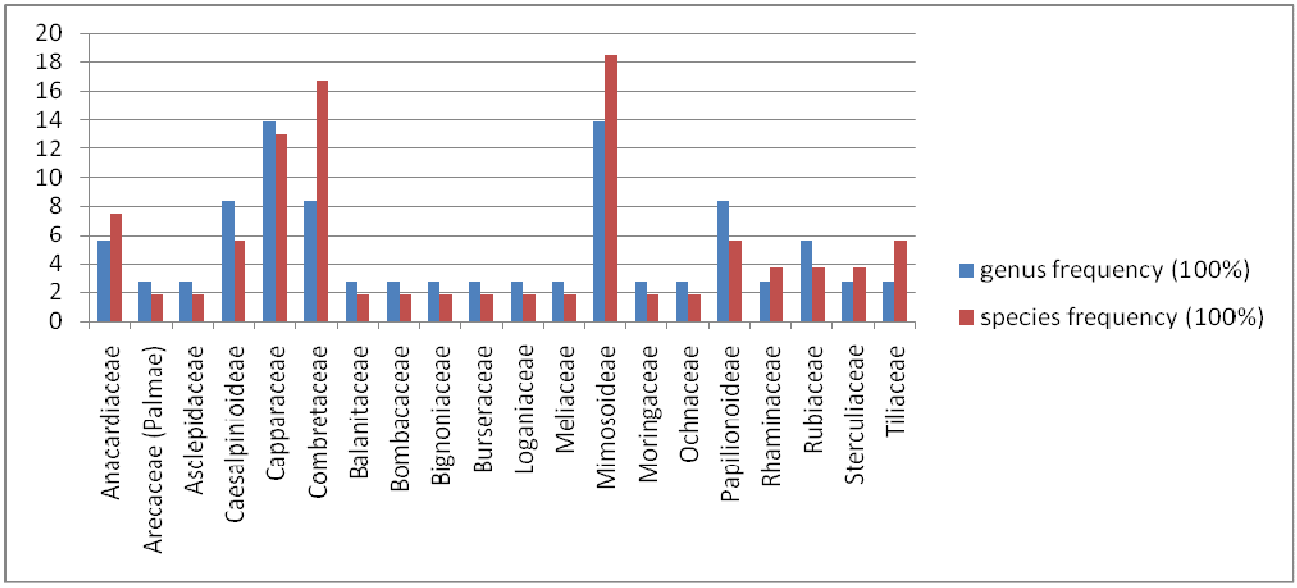

Figure3: Genera and Species relative frequency by identified families

Table 2: Endangered woody plant species in El Nour Natural Forest Reserve, Blue Nile State - Sudan.

No	Species	Family	Vern. Names	Habit
1	*Adansonia digitata* Linn.	Bombacaceae	Tabaldi	LT
2	*Balanites aegyptiaca* (L.), Del.	Balanitaceae	Hegleeg	LT
3	*Boswellia papyrifera* (Del.) Hochst.	Burseraceae	Tarag Tarag	ST
4	*Cadaba rotundifolia* Forsk.	Capparaceae	Kurmut	SH
5	*Dalbergia melanoxylon* Guill. & Perr.	Papilionoideae	Abnos (Babanos)	ST
6	*Grewia flavescens* Juss.	Tiliaceae	Abou Dlouae	SH
7	*Grewia mollis* Juss.	Tiliaceae	Guddeim Basham	SH
8	*Grewia tenax* Ascher & Schweinf.	Tiliaceae	Guddeim	SH
9	*Lonchocarpus laxiflorus* Guill. & Perr.	Papilionoideae	Khashkash Azrag	ST
10	*Ochna afzelii* R.Br.ex Oliver	Ochnaceae	Lessan El Kalib	ST
11	*Piliostigma reticulatum* (DC.) Hochst	Caesalpinioideae	Kharub	SH
12	*Xeromphis nilotica* Stapf.	Rubiaceae	Shidr el Marfein	SH

CONCLUSION

The study reported for the first time the presence of the family Ochnaceae which is represented by one species in the forest area which is *Ochna afzelii* R.Br. ex Oliver. The species *Diospyrous mespiliformis* (Gugan) and *Cordia sinensis* (Andrab) were not found in the study, although their presence was indicated by local people and previous reports. The updated names for the families Capparidaceae to Capparaceae and leguminaceae to Fabaceae were used in this study. Also, the updated subfamilies Mimosoideae, Caesalpinioideae and Papilionoideae were used instead of Mimosaceae, Caesalpinaceae and Papilionaceae, respectively. According to [13] there are 106 woody plant species distributed in the Blue Nile State of which 55 woody species (53%) were found to constitute the forest flora. About 12 species were recorded as endangered in the study area due to high exploitation by the local people within and around the forest area.

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