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Ethnobotanical study of some medicinal plants from Hoggar, Algeria

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Study was conducted from July, 2011 to March, 2012 to explore and enumerate the medicinal uses of some plants in folkloric medicine of Hoggar (Algerian Sahara). Semi-structured questionnaires were used to conduct interviews with traditional healers, herb sellers and other knowledgeable individuals on use of medicinal plants. The informants (100) consist of 63% females and 37% males of which 6% were traditional healers, 6% herb sellers, and 7% tourist guides while the others were knowledgeable individuals on medicinal plant utilization. A total of 31 plant genera belonging to 15 different families were recorded where Lamiaceae 19 (35%), Astéraceae 16 (12%), and Zygophylaceae 12 (90%) were the important families. This study provides preliminary data for further phytochemical investigation of wild plants with therapeutic potentials. Little data presented on the common usage of plants in Algeria Sahara, not only those elements of credibility to be attributed to the plants cited, also illustrated some endemic interesting plants were traditionally used for curing various health disorders in Tamanrasset (Hoggar).

Key words: Algeria, Hoggar, ethnomedicinal use, medicinal plants, Tamanrasset.

INTRODUCTION

Medicinal plants have provided modern medicine with numerous plant derived therapeutic agents. Most of these plant derived drugs were originally discovered through the study of traditional cures and folk knowledge of native population. Some of these could not be substituted despite the enormous advancement in synthetic chemistry (Hudaib et al., 2008). The World Health Organization (WHO) has reported that about 80% of the world's population mainly depend on traditional medicine, and the use of plant extracts is mainly involved in the traditional treatment (Beverly and Sudarsanam, 2011). Plants have been used as a medicinal agent since ancient times, first only on a folkloric basis and later developed on a scientific way into a single agent drug

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(Shuvasish et al., 2012). Identifying the marker compounds and the biological activities are some of the important parameters of quality assessment. Since some of the polyherbal formulations contain as much as 108 ingredients, assessing and monitoring their quality including the identification of the marker compounds and the biological activities becomes complex, difficult to achieve and is an expensive process.

An ethnobotanical identification is the first stage in the quality assurance of traditional medicine and further in discovering new drug leads from the medicinal plants (Phurpa et al., 2011). Documentation of the indigenous knowledge through ethnobotanical studies is important for the conservation and utilization of biological resources. Therefore, establishment of the local names and indigenous uses of plants has significant potential societal benefits (Ugur, 2011). Plant use for medicine varies among different ethnic and cultural groups (Elufioye et al., 2012). The present work was carried out to explore the medical remedies of some medicinal plants used by the rural people of Algeria, to ascertain the detailed information on plants used by Saharan people and their usage based on ethnobotanical knowledge.

MATERIALS AND METHODS

Study area

Study area was located in the south arid zones of Algeria (2000 km from Algiers), Hoggar, with Tamanrasset town as its administrative headquarter. Ethnobotanic enquiry was performed in different areas of Hoggar region including the following: Tamanrasset, In Salah, Ablasta, Tazrouk, In Mguel, Idless, Tit, Outoul, Silta and In Gazem (Figure 1). Hoggar is divided into several natural regions, the mountainous massifs divided into two main regions: the Tefedest to the North and the Atakor in the center of the massif where it culminates the highest summits of Algeria (Tahat: 3003 m; Ilaman: 2739 m; Assekrem: 2726 m) and surrounding wall tassilian to the periphery. Crossed by the tropic of cancer (22° 33'N), the Hoggar submitted to an influence of two climatic regimes: The Mediterranean regime (moderate) and the tropical regime (Sudanese). With its exceptional geographical situation; Hoggar is between a real ecological shelter of strong floristic and faunistic diversity. Several types of floras were different according to their biogeographic origins: A Mediterranean flora, a flora saharo-sindian; a flora soudano-décanian; a cosmopolitan flora; and an endemic flora (Sahki and Sahki-Boutamine, 2004; Chenoune, 2005).

Ethnobotanical survey

Ethnobotanical data were collected between July, 2011 to March, 2012. The information was mainly gathered through semi-structured interviews (Eddouks et al., 2002) that were held with selected knowledgeable individuals. Few were carried out in Arabic language and some times in Tamahaq with the help of local people (Touaregs). Information regarding gathering, preparation, use, and practice of medicinal plants were also collected. In this study, 100 knowledgeable elders between the ages of 20 and 80 were randomly selected. 22% were above 61 years, 43% were aged between 41 and 60 and 36% were between the ages of 20 and 40, both rural and urban communities were visited to collect varying information on local remedies. For each medicinal plant, its use against a particular disease was assessed. Plants were collected and identified by National Institute of Forest Research (Algeria) and by the use of the flora of Ozenda (1983); as well as by the use of other publication on medicinal plants (Benchalah et al., 2004).

RESULTS

In the present study, a total of 31 plant genera belonging to 15 families were reported of which Lamiaceae 19 (35%), Astéraceae 16 (12%), and Zygophylaceae 12 (90%) were the most important. The detailed information about the local name, parts of the plants used and medicinal uses were documented from the local people of Hoggar. The 31 species were used to threat different types of diseases such as wound and related injuries, body sickness, diarrhoea, skin problems, cephalic pains, bronchitis, cough, cold, fever, kidney problem, stomach problems, ulcer, sore throat, urinary bladder and rheumatism. The results revealed that a major proportion of medicinal knowledge comes from people living in Tamanrasset (17%), Tazrouk (14%), Idless and Ablasta (12%).

In terms of the number of important plant cited, Lamiaceae is the most predominant family of ethnomedicinal importance with six species (*Salvia aegyptiaca, Teucrium polium, Salvia chudaei, Mentha longifolia, Marrubium deserti, Lavandula pubescens*). It was followed by Astéraceae with five medicinal plants (*Atractylis aristata*, *Matricaria pubescens, Asteriscus graveolens, Artemisia judaica, Artemisia campestris*) and Fabaceae, Apiaceae, Caparidaceae with two medicinal plants each. Other families (Chenopodiacea Salvadoraceae, Solanaceae, Resedaceae, Polygonaceae, Myrtaceae, Axlepiaceae, Ramnaceae, Rutaceae, Poaceae) were represented with one species of ethnomedicinal importance to cure various ailments among Hoggar people. Whereas, Hammiche and Maisa (2006) have reported Asteraceae family as the dominant family in their investigation with 12 endemic species in Tassili N'ajjer. Persons interviewed mentioned that they collected plant parts mostly in spring or summer, as Hudaib et al. (2008) have recorded that medicinal plants are collected in spring and used all year long. Mostly, plant parts were used for herbal preparations in dried form rather than in fresh form (Lone et al., 2014). Preparation of medicinal plants is varied such as: poultice, powder, and inhalation. However decoction, powder and infusion were the most form of preparation. These results were in agreement with the literature of Kola et al. (2008), Zheng and Xing (2009) and Pascal et al. (2011), wherein preparations were made with water as a solvent. The parts of the plant primarily used are the aerial parts, leaves, while roots and seeds are sometimes used. Some plants are cited in the survey as endemic and have little data or have never been studied, and are

Figure 1. Geographical situation of Tamanrasset (Hoggar) in Algearia.

taken for their phytochemical screening as has been described by Chew et al. (2011). For exemple: *A. graveolens*, *Lavandula antineae* and *Artemisia judaica* (Table 2). Women (63%) use medicinal plants more frequently than men (37%); these results are in agreement with Jouad et al. (2001) and Tahraoui et al. (2007). This could be explained by: women are more attached than men to everything traditional; the relative frequency of analphabetism of women in our society could be behind at the credulity toward information and particularly toward indication on the use of medicinal plants and the easiness of transmission of this information between women. This may explain their relative knowledge in this area (Jouad et al., 2001). Likewise the following plants are reported to have different types of uses by the various local communities and according to the literature elsewhere.

Cymbopogon schonenthus is reported to have sedative, digestive and aromatic properties (Katiki et al., 2012). In the South of Tunisia, this plant is also used for the treatment of rheumatism, and to diminish fever, which is in agreement with our study (Khadri et al., 2008). *Solenstema argel* was used in folk medicine as a remedy for bronchitis, gastrointestinal cramps, stomachache, colic, cold and urinary tract infections. In Libya and Chad, a decoction of leaves is used to treat neuralgia and sciatica (Innocenti et al., 2006). It is commonly used for the treatment of cough and as a purgative (Hassana et al., 2001; Plaza et al., 2005). *Capparis spinosa* flowers, buds, fruits, seeds, shoots and bark of roots were traditionally used for pharmacological purposes, especially for rheumatism (Jiang et al., 2007; Fu et al., 2008), their floral buttons were employed as a flavouring in cooking and are also used in traditional medicine for their diuretic, antihypertensive, poultice and tonic properties (Panico et al., 2004). Dried seed of *Zizyphus jujuba* has been used as a tranquilizer, an analgesic and an anticonvulsant in oriental countries such as Korea and China for centuries (Ma et al., 2007). Some of the plants reported in the present study are interrelated with the study of Benchallah et al. (2004) and Hamich and Maisa (2006).

Similarities in the use of a Saharan species between local people may support the presence of specific active compounds in these plants, which may be useful for finding cures for specific ailments. *Salvia chaidaei* is used in the treatment of digestive diseases (diarrhoea, ulcer) rheumatisms, kidney diseases, by the studied local people. In the literature the plant is reported to dysmenorrhea, abdominal pains, spasms sun stroke, gonorrhoea (Hamiche and Maisa, 2006). Sahki and Boutamine (2004) reported that there are more than 292 plants which have been reported to have medicinal uses among the various region in the Hoggar, and these plants were frequently used to treat stomach problems, poisonous bites, nervous disorders, cough, fever, asthma

and diabetes but some of them were exotic for example: *Argania spinosa, Moringa oleifera, Eucalyptus bosistonana* and *Populus nigra*. But there is not much information available in the literature about the composition or biological activities of these plants used in this region with an exception to the study of Chentoufe at al. (2012), Roukia et al. (2013), Hammoudi et al., 2013 and Bouzabatta el al. (2013).

DISCUSSION

In Hoggar, the traditional pharmacopoeia exposes a wide arsenal of plant remedies, because it represents a key biodiversity site in the central Saharan ecosystem in Algeria; and it potentially constitutes one of the prime sites in the world for phytochemical investigation. Floristic diversity is presently estimated at about more than 292 species with high levels of endemism (Sahki and Sahki-Boutamine, 2004). This study revealed that about 31 threatened plant species are being used as medicine by local people in Hoggar especially in rural. So we can observe that phytotherapy is frequently practiced by Sahara population in this region. The reasons of the use of medicinal plants are that these natural remedies are less cheap and more efficient than modern medicines. Digestive disease is the most important ailment treated on the basis of number of citations for medicinal uses (Table 1). This is followed by fever, rheumatisms and diabetes. *Teucrium polium*, *Myrtus nivellie* and *Cymbopogon schonenthus* are the three leading species being used as remedies against a variety of complaints in the area. The high diversity of use of these three species could be attributed to their relative abundance in the area. The high consensus of the informants on the medicinal use of these species shows the importance of these plants to the Sahara people. Some plants that were cited during the course of this study were also reported by authors elsewhere in other parts of Algeria (Hammiche and Maisa, 2006; Rebbas et al., 2012; Miara et al., 2013) and in Morocco (Jouad et al., 2011; Tahraoui et al., 2007). It is tempting to speculate that a high frequency of use of plant is related to high efficacy and safety of the plant material (Tahraoui et al., 2007). The biological activities of some of Algeria medicinal plants are known already from other studies that were carried out elsewhere (Djeridane et al., 2006; Atmani et al., 2009, 2011; Chelli-Chentouf et al., 2012; Bakchiche et al., 2013; Benariba et al., 2013; Bouzabata et al., 2013). Most preparations are made with water as a solvent and the majority of the remedies are taken orally from a single plant; mixtures are used rarely. Some people have told us that *Artemisia judaica* is recognised in mixture in multiple prescriptions mainly for wounds. The reason for the dominance of herbaceous medicinal plants could be because of their abundance and year round availability in the study area. The phytochemical investigations (Table 2) revealed the presence of several secondary metabolites, alkaloids, tannins, saponins, flavonoids and terpenoids, hence signifying the therapeutic effect which strongly supports the conventional use of this plant against various diseases.

A. judaica susp sahariensis Chev (Astéracea) known under the names of “Tehereglet” in Tamahaq and “Chih” in Arabic is an endemic species, mainly used as powder (43, 18%) or infusion (27, 84%) preparation by the local people in Hoggar to treat digestive diseases (42, 99%). Studies on the chemical constituents of *A. judaica* have been carried out by many investigators and have shown the presence of various compounds, for exampe flavonoids and sesquiterpene lactones. The essential oil of *A. judaica* contains piperitone (61, 9%) terpine-4-ol (4, 6%) and bornyl acetate (3, 0%) (Dob and Chelghoum, 2006). The water and alcoholic extracts of *A. judaica* from Egypt significantly reduced the blood glucose level in experimentally diabetic rats (Nofal et al., 2009).

Asteriscus graveolens Forsk (Astéracea) known under the names of “Tamayu” in Tamahaqand “Tafss” or “Nougd” in Arabic was frequently (leaves and stems 60, 34%) used for diabetes (27, 91%) and rheumatism (26, 36%). According to literature *Asteriscus* genus was characterized by the presence of sesquiterpenes (Rauter et al., 2001), but flavonnoids, bisabolone hydroperoxides were also described as constituents in their extracts (Akssira et al., 2006). The essential oil of *A. graveolens* from Bechar in Algeria is characterized by the main constituents: 1, 8 cinéol 21, 5% in leaves, 16, 5% in flowers and δ cadinol 19, 1% in leaves, 13, 9% in flowers (Cheriti et al., 2007). Oxygenated sesquiterpenes with 6-oxocyclonerolidol (74.9%) and 6-hydroxycyclonerolidol (11.8%) are the major components to this oil from Morocco. The inhibition of the corrosion of mild steel in sulphuric acid solution by *A. graveolens* essential oil has been studied. Inhibition was found to increase with increasing concentration of the essential oil to attain 82, 89% at 3 g/L (Znini et al., 2012).

Myrtus niveili Batt and Trab (Myrtace) known under the names of “Tafaltasset” in Tamahaqand “Raihane Essahara El Wousta” in Arabic was reported by local people for diabetes (34,15%) and digestives diseases (25, 20%). The chemical composition of essential oil from central Sahara of Algeria is largely dominated by1,8-cineole (33.6 to 50.4%) and limonene (17.5 to 25.0%). The structure of two new compounds bearing the isoamylcyclopentane skeleton has been elucidated. The oil was more active against Cryptococcus neoformans with MIC of 0.16 µl/ml followed by dermatophytes, with MICs of 0.64 and1.25 µl/ml. Furthermore, evaluation of cell viability showed no cytotoxicity in HaCaT keratinocytes at concentrations upto1.25 ml/ml. Rached et al. (2013) have been reported the phenolic compounds and its antioxidant activity to this species.

Cymbopogon schoenanthus Spreng known under the names of “Teberint” or “Teberimt” in Tamahaqand “El

Table 1. Medicinal plants used in Hoggar, Algeria.

Scientific name And familly	Tamahaq name	Plant part used	Preparation	Therapeutic uses
Salvia aegyptiacia L	Sassaf	Seeds, aerial parts	Infusion, powder, decoction	Fever, chills,Eye wash ,digestive, diseases
*Teucrium polium susp*L Lamiceae	Takmezout	Leaves, aerial parts	Decoction, infusion, powder, poultice,	Fever, diabetes, digestive diseases, Women infertility,arterial, Hypertension,Wounds
Salvia chudaei batt andTrab	Aouit	Leaves, aerial parts	Decoction, powder	Digestive diseases (diarrhoea, ulcer) Rheumatisms, kidney diseases
Mentha longifolia L Lamiceae	Taihart	Leaves, aerial parts powder	Décoction, infusion,	Diabète. Fever Arterial hypertension Jaundice
Marrubium deserti De Noë Lamiceae	Telheret	Leaves, aerial parts	Décoction, infusion	Fever, arterial Hypertension
Lavandula pubescens(Maire) susp antineae Lamiceae	Adjoua	Aerial parts, leaves, leaves+ stems	Infusion	Diabetes Cough, chills Rhematisms
Atractylis aristata batt andTrab Astéracea	Ameskekk	Aerial parts, leaves	Décoction, infusion,	Fever, Digestive diseases, Allergies
Matricaria pubescens Scultz Astéraceae	aynasnis	Aerial parts	Décoction, infusion powder	Allergies, digestive diseases, fever Spasms
Asteriscus graveolens Forsk Astéraceae	Tamayu	Leaves aerial parts, (leaves+stems)	Décoction, oitment	Diabetes, Rheumatisms Migraines, Dermatosis Respiratory diseases
Artemisia judaica susp sahariensis (Chev) Astéraceae	Teheregle	Leaves+ flowers, Aerial parts	Decoction, infusion, Poultice, powder, Inhalation	Digestive diseases: (vomits), fever, Respiratory diseases, Wounds
Artemisia campestris L Astéraceae	tedjok	Leaves, aerial parts	Decoction, infusion, powder	Digestive diseases, Fever, after childbirth Hair loss
Fagonia bruguieri DC *zygophylaceae*	afessour	Leaves, aerial parts	Décoction, infusion, Powder	Jaundice, Digestive diseases, anemia kidney diseases
Tribulus terrester L zygophylaceae	tadjaroft	Leaves, aerial parts,	Décoction, infusion, powder	Diabetes, Digestive diseases Fever, kidney diseases
Balanites aegyptiaca Del *zygophylaceae*	tabourak	Roots, Leaves, aerial parts, cortex, fruit	Decoction, infusion	Diarrhoea , fever, Migraine, pain of the stuffs Cough
Zygphyllum album L Zygophylaceae	abelkozt	Leave, aerial parts	Decoction, powder	Fever, diabetes, Digestive diseases Hypertension,Wounds
Acacia nilotica L Fabaceae	Taggart	Root, leaves, aerial parts, cortex	Decoction, Infusion, Powder	Diabetes, Digestive diseases,Anemia, fever, Arterial hypertension,
Acacia tortilis (Forsk) Fabaceae	Abser	Leaves, aerial parts, cortex, latex	Infusion, powder Décoction,	Ulcer stomach Fever, arterial hypertension, wounds
Deverra scoparia Coss and Dur Apiaceae	Tattait	Leave, aerial parts	Décoction, infusion, Powder	Digestive diseases Rheumatisms, Rheumatisms Diabetes
Ammondaucus C and D leucotrichus Apiaceae	akamman	Seeds, aerial parts	Décoction, infusion, Powder	Digestive diseases, vomiting, fever Appetite
Cleome arabica subsp *amblyocarpa (Barrate and Murb) Caparidaceae*	ahouya r	Leaves, aerial parts	Decoction, infusion, powder, poultice	Digestive diseases, Cough, Rheumatisms,Respiratory diseases,
Capparis spinosa L Caparidaceae	taloulout	Leaves, aerial parts,	Decoction, poultice, Infusion	kidney diseases, Articular pains
Atriplex halimus L Chenopodiaceae	aramas	Leaves, aerial parts, roots	Decoction, infusion, powder	Cysts

Table 1. Cont'd.

Salvadora persica L Salvadoraceae	tehak	Leaves, aerial parts, Cortex	Decoction, infusion, Powder, oitement	Fever, Rheumatisms, Digestive diseases Allergies, Wounds
Hyoscyamas muticus L Solanaceae	afalahlah	Leave, aerial parts	Decoction, powder	Articular pains, kidney diseases
Reseda villosa Coss Resedaceae	abellendjad	Seeds, aerial parts,	Decoction, infusion, powder	Rheumatisms, cough Fever, digestive diseases
Colligonum comosum L'Her Polygonaceae	aressou	Aerial parts	Decoction	Diarrhoea
Myrtus niveili Batt and Trab Myrtaceae	tafeltest	Leaves, aerial parts, flowers, whole plant	Decoction, ointment, poultice	Diabetes, fever, Digestive Diseases, Rheumatisms Respiratory diseases, Allergies
Solenostemma oleifolium Bull and Bruce Axlepiaceae	arellachem	Leave, aerial parts powder	Decoction, infusion	Diabetes, Respiratory diseases, Rheumatisms Fever, sores
Zizyphus lotus L *Ramnaceae*	tabakat	Leaves, fruit	Decoction, powder	Digestive diseases Diarrhoea, diabetes
Haplophyllum tuberculatum L Rutaceae	toufichkane	Leaves, aerial parts	Decoction, infusion	Muscular pains, Digestive diseases Menstruation calms pain
Cymbopogon schoenanthus L Spreng Poaceae	tiberimt	Leaves, aerial parts, Whole plant	Decoction	Kidney and, urinary diseases Digestive diseases, Rheumatisms Fever, food poisoning

Table 2. Preliminary phytochemical screening of selected plant from Hoggar

Class	*Asteriscus graveolens*	*Artemisia judaica*	*Myrtus nivellie*	*Lavandula antineae*	*Cymbopogon shonenthus*
Alcaloids	++	+++	++	++	++
Tanins	++	+++	+++	++	++
Flavonois	++	+++	+++	++	+
Saponins	+	+++	+++	++	+
Terpenoids	++	+++	+++	++	++

+ = Present, ++ = Present appreciable, +++ = Present very appreciable.

Lamad" in Arabic was mentioned for the treatment of digestives (32, 39%) and renal (38, 06%) diseases. Essential oils of *C. schoenanthus* of Borkina Faso were determined. Among the identified compounds, two monoterpenes (peperitone and δ2 carene) remain the principal components in the oil (Onajah et al., 2007). The insecticidal effect of essential oil of this species from Togo has been studied (Ketoh et al., 2004). Aqueous extract, proanthocyanidin rich extract, and organic extracts of *C. schoenanthus* shoots from three different locations in South Tunisia were screened for their antioxidant, acetylcholinesterase and antimicrobial activities (Khadri et al., 2010).

Lavandula pubescens susp (Maire) is known under the names of "Ajoua" or "Ttehenok" in Tamahaq. The Arabic name was not found. It was widely used in infusion form for cough, chills and rheumatisms by nomads, is an endemic species from central Sahara of Algeria. No data has been published on the constituents of this plant. These are probably similar to those in other Lavender species camphor, linalool and linalyl acetate

(Hassiotis et al., 2010; Djenane et al., 2012; Zheljazkov et al., 2013).

CONCLUSION

Plants constitute an unlimited source of medicine for the local people living in Hoggar and phytochemicals available for improving human health. Knowledge on utilization of plant resources for health care delivery varies with cultural background globally. This study presents a useful documentation which can contribute to preserving knowledge on the use of medicinal plants in this region, yielded 31 candidate plants with important compounds that can be researched further in areas of Phytochemistry for possible leads in the development of novel drugs with little or no side effects and transferring it to future generation.

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Conflict of interest

The authors declare that they have no conflict of interest.

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