

Traditional medicine in Central Sahara: Pharmacopoeia of Tassili N'ajjer

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Abstract

Further to the previously reported ethnobotanical surveys of North-Sahara and Ahaggar [Maiza, K., Brac de la Perrière, R.A., Bounaga, N., Hammiche, V., 1990. Usages traditionnels des plantes spontanées d'El Goléa. Actes du Colloque de l'Association Française pour la Conservation des Espèces Végétales, Mulhouse; Maiza, K., Hammiche, V., Bounaga, N., Brac de la Perrière, R.A., 1992. Inventaire des plantes médicinales de trois régions d'Algérie. Actes du Colloque International hommage à Jean Pernès: Complexes d'espèces, flux de gènes, ressources génétiques des plantes. Paris, pp. 631–633; Maiza, K., Brac de la Perrière, R.A., Hammiche, V., 1993a. Traditional Saharian pharmacopoeia. Acta Horticulturae, I.S.H.S. 332, 37–42; Maiza, K., Brac de la Perrière, R.A., Hammiche, V., 1993b. Récents apports à l'ethnopharmacologie du Sahara algérien: Actes du 2ème Colloque Européen d'Ethnopharmacologie & 11ème Conférence Internationale d'Ethnomédecine. Heidelberg, pp. 169–171; Maiza, K., Brac de la Perrière, R.A., Hammiche, V., 1995. Pharmacopée traditionnelle saharienne. Revue de Médecines et Pharmacopées Africaines, 9 (No. 1), 71–75; Maiza, K., Smati, D., Brac de la Perrière, R.A., et Hammiche, V., 2005. Pharmacopée traditionnelle au Sahara Central: Pharmacopée de l'Ahaggar. Retenu pour publication. Revue de Médecines et Pharmacopées Africaines.], we have now moved our investigations on Tassili N'ajjer, another distinct region of the Southern Algerian Sahara. Ethnobotanic research has been carried out through interviews with nomad populations and the traditional practitioners of recognised competence. To date, 80 wild indigenous medicinal plants have been identified and are currently used by the local population for various illnesses. Information on their vernacular *Tamahaq* and Arabic names, their flowering distribution, the parts used, the modes of preparation and routes of administration are reported and discussed in this paper. This work completes our investigation in Central Sahara.

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1. Introduction

Tassili N'ajjer, an important part of Central Sahara (Fig. 1), is rugged terrain and not easily accessible; it is famous for its prehistoric art, and its archaeological vestiges on account of which UNESCO classified it as a heritage site in 1982. However, located 2000 km from Algiers, it remains the least known region of the Sahara. This large wilaya (administrative region) of 285,000 km² constitutes the South Eastern part of the Algerian Sahara. It is characterised by a contrasted landscape of rugged mountainous terrain and desertic plateaux of black rocks which form the *Reg* or white sands which constitute the *Erg* where the green oasis are located. The central barrier of 1500–2000 m in altitude extends over 800 km and covers 80,000 km². This

forms a rugged plateau known by its Touareg name of *Tassili*. Canyons cut across this plateau forming 1400 m high impressive cliffs above the many rivers or wadi.

There are two main seasons: the temperate season, from October to April (−1° to +35°) and the dry season (+15° to 47°). It is modified by altitude; the Tassilian plateau is colder in winter and cooler in summer. Extremely violent winds dry the atmosphere. The average annual rainfall varies from 5 to 15 mm. The growth of annual plants is closely linked to the amount of rainfall.

There is a population of 34,000 inhabitants, mainly Touaregs who are of Berber origin, and speak *Tamahaq*, which is transcribed in its own characters: *Tifinar*. Several severe droughts have forced them to have a sedentary life style. The main towns are Illizi, with a population of 10,000, Djanet, In Amenas and Bordj Omar Driss. Only Illizi and Djanet are linked by a 412-km asphalt road.

The rural populations live in small hamlets constituted of “Ikebran” or “zeriba”, huts typical of this region, which are

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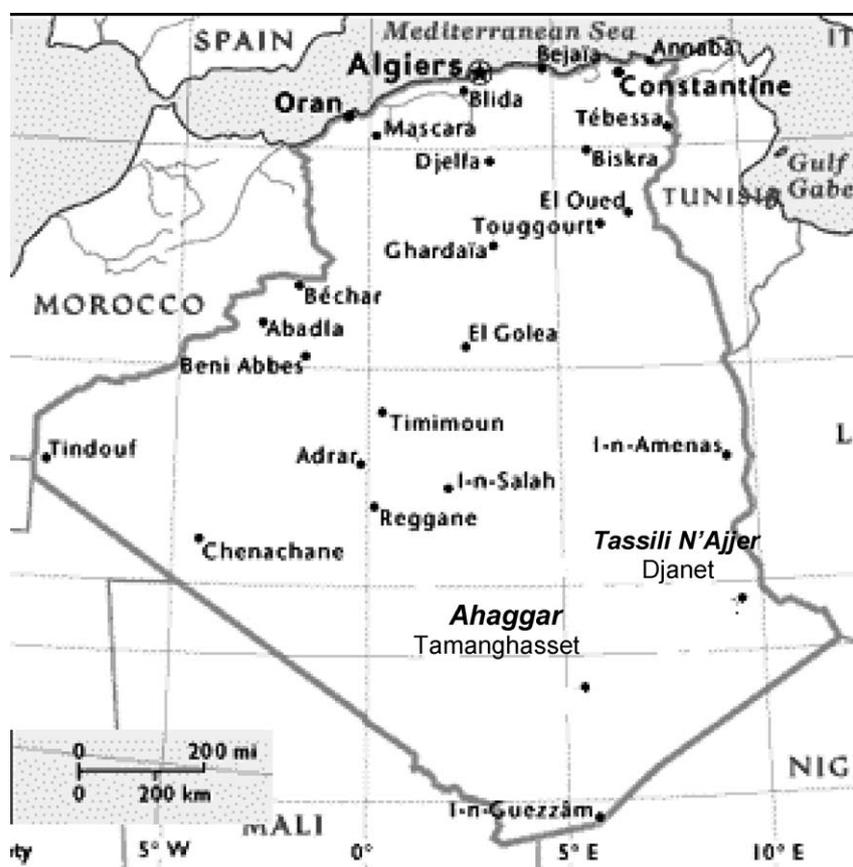


Fig. 1. Situation map. Tamanghasset in Ahaggar and Djanet in Tassili N'Ajjer are the biggest towns of Central Sahara.

characterised by their circular of dry stone base and conic roofs of typha and reed. The people living in the oasis raise camels and goats, and agriculture enables them to be self sufficient as regards food. The young generation are attracted to the petroleum industry in the north of the region.

There are two 60-bed hospitals located in Djanet and Illizi. Even if they have enough nursing personnel, there is an alarming lack of doctors and surgeons. Due to the fact that the population is scattered, and part of it remains nomadic, the healthcare structures are not very effective. Accessibility is the main problem due to limited means of transport as well as extreme weather conditions, vastness of the region, dangerous terrain and the lack of roads. Therefore, the population has fallen back on its ancestral knowledge of everyday remedies. The popular knowledge has been enhanced by the melting of populations of different native origins but has evolved and been adapted due to contact with other practices. It is for this reason that it became urgent to evaluate this knowledge.

2. Methodology

The 1993 investigation was restarted in 2004 and concerns the region accessible only by all terrain vehicles. We travelled from Djanet to Illizi through the Fadnoun plateau paved with fabulous carved stones and cave paintings. To gather data we used standardized list of questions: PHARMEL file (Adjanohoun et al.,

1989) which adapted according to the region and that we had already used in our previous investigations.

We chose to investigate traditional healers whose notoriety goes beyond their families and friends and whose practice is passed from father to son. They are considered as professionals and are local healers, semi nomads and tourist guides who were former nomads (track-showing, guides, and camel-drivers) converted tourism because of their knowledge of the terrain. Most of them are old. Each participant had to identify the plant, indicate the place where it was found, the frequency, and give major indications. The information was given to us mainly in *Tamahaq* and sometimes in Arabic. The guide's knowledge of the two languages helped us to avoid any confusion. Sometimes, Arabic name is not found.

We identified the species using Ozenda's identification keys for Sahara flora (Ozenda, 2004) and the work of Maire from Central Sahara (1933). The plant material was directly compared to the samples of the herbarium of the Office du Parc National du Tassili located in Djanet. Voucher herbarium specimens and reference samples were recorded in our laboratory.

They are classified in Table 1, with their scientific names in alphabetical order and reference samples. Also are noted their vernacular names *Tamahaq* and Arabic-used in N'Ajjer Tassili, the geographical area which indicates precisely their endemism, the part of plant used, the methods of preparation, the routes of administration and the therapeutic indications.

Table 1
Wild indigenous species of Tassili N' Ajjer's pharmacopoeia

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
<i>Acacia albida</i> Del. subsp. <i>raddiana</i> (Savi) Brennan Fabaceae/Hv638	Tropical Africa	<i>ahetes</i>	haras	Bk/D/Iu	Chills: bronchitis, cough Fever
Fabaceae/Hv639	Tropical Africa and Arabia	<i>tadjart</i>	selam	Fr, Sd/Pd/Iu Fr/Pd/Eu	Chills, diabetes Haemostatic, healing
<i>Acacia tortilis</i> (Forsk.) Hayne. Fabaceae/Hv640	Tropical Africa and Arabia	<i>abser</i>	thalah	Fr, Sd/Pd/ + water Gm/water/Iu Gm/water/Eu Bk/Pd/Eu	Stomach diseases: diarrhoea, aches Pulmonary infections: pleurisy (mixture with <i>Solenostemma arghel</i>) Jaundice Infected wounds, eye inflammation Bandages: antiseptic, healing
<i>Acacia seyal</i> Del. Fabaceae/Hv 641	Soudano-deccanian	<i>tamat</i>	seyal	Bk, Lf/D/Iu Bk, Lf/D/Eu Sd/D/Iu Sd/D/Eu Sd/Pd/Eu	Stomach diseases: ulcer Rheumatism Fever, dysmenorrhoea Eye inflammation Infected wounds
<i>Aerva javanica</i> (Burn.) Juss. Amaranthaceae/Hv645	Soudano-deccanian	<i>temkerkezt</i>	makhmila	Ap/D/Iu Ap/D/Iu Ap/D/Eu	Jaundice, Diabetes, cough, headaches Kidney diseases: lithiasis, urinary decrease Abdominal pains Helminthiasis Skin diseases: dermatosis, boils, aphthae (* soap * scorpion sting)
<i>Ammodaucus leucotrichus</i> C. and D. Apiaceae/Hv 684	Endemic saharian	<i>akamman</i>	oum draiga	Sd/I/Pd/Iu	Stomach diseases: vomiting, pains Allergies Emmenagogue, abortive, aphrodisiac (* aromate and mixtures)
<i>Anabasis articulata</i> Moq. Chenopodiaceae/Hv 679	Saharo-arabic	<i>bender</i>	ajrem	Ap/D/Eu	Skin diseases: eczema, ichingit Fever, headache Lice (head and pubis) (* soap)
<i>Anastatica hierochuntica</i> L. Brassicaceae/Hv682	Saharo-arabic	<i>akaraba</i>	komchet en nebbi	Wp/D/Iu Sd in situ	Easing childbirth, calm pains and aids to menstruation , epilepsy, constipation Foreign body in eye (* contraceptive for cattle, * magic)
<i>Anvillea radiata</i> C. and D. var. <i>australis</i> Chev. Asteraceae/Hv708	Endemic saharian	<i>tehetit</i>	nougd l' hoor	Ap/I/Iu	Stomach and liver diseases; Diabetes Post partum care: analeptic
<i>Artemisia campestris</i> L. Asteraceae/Hv650	Mediterranean	<i>tedjok</i>	degoufet	Ap, Fl/D/Iu Ap/I/Iu Ap/D/Pit	Post partum care: analeptic, spasms and aid to menstruation Helminthiasis Stomach and liver diseases Healing, vulnery Mycosis, dandruff (* plant for mixtures)
<i>Artemisia judaica</i> L. Asteraceae/Hv651	Saharo-arabic	<i>tiherdjeli</i>	Not found	Ap, Fl/I/D/Iu Ap/Pd/Eu	Helminthiasis Stomach diseases: constipation, colics Fever, nervous sedative Jaundice, dysmenorrhoea Skin diseases: healing, vulnery, allergies Mycosis, dandruff (* aromate)
<i>Asphodelus tenuifolius</i> Cavan. Fabaceae/Hv638	Mediterranean	<i>izean</i>	achb l' ibel	Ap/I/Iu	Stomach diseases: constipation Pediatry: measles, anemia

Table 1 (Continued)

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
Liliaceae/Hv660				Ap/Pd/Iu	Myalgia, muscle contraction, fever (* plant for mixtures, * condiment) (local butter)
<i>Astericus graveolens</i> (Forsk.) DC. Asteraceae/Hv693	Saharo-arabic	amayou	nouged	Ap/D/Iu Ap/D/Iu Ap/M/Iu Ap/Pd/Eu	Rheumatism, muscle contraction, fatigue New born pathology: colics, vomiting Diabetes , palpitations, headache Female sterility Infected wounds
<i>Atractylis aristata</i> Batt. and Trab. Asteraceae/HV676	Endemic of central Sahara	ameskeki	Not found	Ap/I/Iu Ap/I/Eu	Stomach diseases: colics, spasms , fever Skin complaints: infected sores
<i>Balanites aegyptiaca</i> Del. Zygophyllaceae/Hv667	Tropical Africa	taboûrak	zekkoum	Lf/D/Iu Lf, Bk/D/Plt Bk/M/clyster	Stomach diseases: constipation, indigestion Jaundice, diabetes, enlarged spleen Helminthiases Skin disease: dermatosis, herpes, vitiligo, malignant wounds, gonorrhoea, syphilis, lice Strong constipation (* snake bite)
<i>Bassia muricata</i> (L.) Asch. Chenopodiaceae/Hv691	Saharo-arabic	ouhas	rebir	Lf/Plt Ap/I/Iu	Skin diseases: dermatosis, pustules, boils and infected wounds Diarrhoea
<i>Boscia octandra</i> Hochst. Capparaceae/Hv692	Dry tropical-Africa	tadant	Not found	Lf/D/Iu	Diarrhoea with blood Fever, aching bones and joints
<i>Brocchia cinerea</i> Viss. Asteraceae/Hv643	Saharo-arabic	takkelt	gertoufa	Ap/I/Iu Ap chewed + Eu (Plt)	Digestive diseases: constipation, colics Respiratory diseases, cold, rheumatism Tonic Female sterility (* snake bite and scorpion sting) (* plant for mixtures, * aromate/condiment)
<i>Calligonum comosum</i> L'Hér. Polygonaceae/Hv807	Saharo-arabic	aressou	arta	Ap/D/Iu Ap/Pd Ap/Tar/Eu	Diarrhoea, aphthae Deodorant for body Tinea, eczema
<i>Calotropis procera</i> Ait. Asclepiadaceae/Hv800	Saharo-arabic	tourha	kranka	R/D/Eu R/D/Iu R (Bk)/D/Iu Lf, fresh/I/Iu Lf, fresh/Plt Lf, dried/inhaling Fl/I/Iu Ltx/Pd/Iu Ltx/Pd/Eu	Skin diseases, dermatosis, infected sores Syphilis Respiratory diseases: cough, tonsillitis Jaundice Helminthiases, bilharziose, dysentery Helminthiases, constipation, fever Rheumatism, syphilis Asthme, epilepsy, pains Tonic Abortive Piles, infected wounds (* camel's scabies)
<i>Capparis spinosa</i> L. Capparaceae/Hv803	Mediterranean and Saharo-arabic	taloulout	kabar	Lf, fresh/Plt Lf, dried/Pd/Iu Ap/D/Iu Lf, bud/D/Iu Lf, bud/D/Eu R/D/Iu R (Bk)/D/Iu	Rheumatismic pains, headache Rheumatism, toothache Helminthiases Kidney diseases: stones, urinary decrease Respiratory problems. Headache, diabetes Eye diseases Dysmenorrhea, sterility, aphrodisiac Jaundice, enlarged spleen (* camel's scabies)
<i>Cassia italica</i> (Mill.) Lam Fabaceae/Hv642	Saharo-arabic	adjardjar	senna	Lf, Fr/D (milk)/Iu	Constipation Pulmonary chills: asthma, fever

Table 1 (Continued)

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
				Lf, Fr/M/Eu Fr/Pd/M	Bronchitis, cough, mycosis, aphthae Shampoo Eye wash
<i>Cistanche tinctoria</i> (Desf.) Beck. Orobanchaceae/Hv680	Saharo-Mediterranean	ahlewan	danoun	Ap/D/Iu	Diabetes, diarrhoea, abdominal pains
				Ap/D/Eu Ap/Pd/Iu	Aphrodisiac Muscle contractions, bruises Analeptic (paps), stimulant of lactation
<i>Citrullus colocynthis</i> (L.) Schrad. Cucurbitaceae/Hv664	Mediterranean and Saharo-arabic	tadjalt,alkad	lahdedj	Ap, fresh/Plt	Vitiligo, tinea, headaches
				Fr, Pulp/Plt Fr, Pulp/I/Iu Fr, Pulp/I/Iu Fr, Pulp/D/Eu Fr, Pulp/M (milk) Sd/Iu Sd, M in oil/Eu R/D/Iu	Muscular and rheumatic pains Diabetes , fever, Diuretic Epilepsy, helminthiases Dermatosis, sores, piles Syphilis (fasting) Helminthiases, abortive, jaundice Eczema Boils
				R/in situ	Abortive (* camel's scabies) (* snake bite and scorpion sting)
<i>Cleome africana</i> DC. Capparaceae/Hv687	Saharo-arabic	ahoya	mekheinza	Ap,crush./D/ Rubing and Iu Ap, crush./D/Iu	Respiratory diseases: chills, fever Sudorific Digestive diseases: abdominal pains Muscular and rheumatic pains Diuretic, emmenagogue, abortive (* camel's scabies)
				Ap, crush./D/Iu Ap, crush./D/Plt	
<i>Cornulaca monacantha</i> Del. Chenopodiaceae/Hv704	Saharo-arabic	tahara	had	Ap/D/Iu	Liver pains: jaundice
				Ap/D/Eu Ap/I/Iu	Skin diseases: dermatosis, abscesses Emetic (fresh plant)
<i>Cupressus dupreziana</i> A.C. Cupressaceae/Hv808	Endemic of central Sahara	tarout	Not found	Lf/I/Iu	Fever
				resin/D/Iu	Respiratory diseases: cough
<i>Cymbopogon schoenanthus</i> (L.) Spreng. Poaceae/Hv677	Tropical-afro-Asiatic	tibérint	lemmad	Wp/I/Iu	Aching bones and joints, rheumatism
				Wp/I/Iu	Fever Digestive diseases: aerophagia, flatulence Post partum care: urinary decrease, analeptic drink for new mother after childbirth Bad breath, gumboils Urinary incontinence (* plant for mixtures)
<i>Echinops bovei</i> (Boiss.) Maire. Asteraceae/Hv703	Saharo-arabic	tefaryast	tasegra	Ap/I/Iu	Eye complaints, trachoma Sores inflammation Digestive diseases: spasms, colics, fever
<i>Ephedra altissima</i> Desf. Ephedraceae/Hv689	Endemic of central Sahara	amateltel	abassi	Ap/I/Iu	Respiratory diseases: asthma, bronchitis Vascular hypertension
<i>Euphorbia calyprata</i> C. and D. Euphorbiaceae/Hv694	Endemic saharian	tanakkat	ammaya	Ltx/Eu	Skin diseases: warts, pustules
				Ltx diluted/Plt	Eczema (* mixtures for snake bite and scorpion sting)
<i>Euphorbia cornuta</i> Pers. Euphorbiaceae/Hv695	Endemic saharian	tahout	garraba	Ltx/Eu	Dermatoses: eczema, warts Trichiasis (* scorpion sting, * magic)
<i>Euphorbia granulata</i> Forsk. Euphorbiaceae/Hv696	Endemic saharian	tellak	redaha	Ltx diluted/Iu	Helminthiases
				Ap, Ltx/Plt	(* snake bite and scorpion sting)
<i>Fagonia arabica</i> L. Zygophyllaceae/Hv685	Saharo-arabic	ambaroudj	Not found	Ap/Pd/Iu Ap/M/Eu	Jaundice Fever, abscesses, aphthae

Table 1 (Continued)

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
<i>Fagonia bruguieri</i> DC. Zygophyllaceae/Hv686	Saharo-arabic	<i>afessoûr</i>	telihia	Ap/Pd/Iu	Jaundice , liver insufficiency Palpitations, anxiety
<i>Ficus salicifolia</i> Vahl. Moraceae/Hv699	Endemic of central Sahara	<i>teloukat</i>	Not found	Lf, Bk/Pd/Eu Lf, Bk/Pd/Iu Lf, Bk/D/Eu	Healing Digestive diseases: ulcer, diarrhoea Eczema
<i>Forskahlea tenacissima</i> L. Urticaceae/Hv654	Saharo-arabic	<i>talltaq</i>	hamched	Wp/Pd/Eu	Haemostatic, healing
<i>Globularia alypum</i> L. Globulariaceae/HV643	Mediterranean	<i>tide n' tnet</i>	tasselgha	Ap/D/Iu	Constipation Diabetes, fever, mycosis (* plant for mixtures)
<i>Heliotropium bacciferum</i> Forsk. Borraginaceae/Hv801	Saharo-arabic	<i>tahenna</i>	medeb	Lf/Pd/Eu Ap/D/Iu + Eu	Skin diseases: abscesses, boils, tinea Tonsillitis (gargle) (* snake bite, * camel's scabies)
<i>Hyoscyamus muticus</i> L. ssp. <i>falezlez</i> (Coss.) Maire Solanaceae/Hv809	Endemic saharian	<i>afalahlah</i>	bettima	Lf/M (oil)/Plt Lf/D/Iu	Backache, muscular cramps Eye inflammation, lice Spasms, palpitations, anxiety (* magic)
<i>Ifloga spicata</i> (Vahl) Schultz Asteraceae/Hv705	Saharo-arabic	<i>ahiyouf n'ekli</i>	tasakrout	Wp/D/Iu	Skin diseases: dermatosis, allergies Cardiac disorders
<i>Lavandula antineae</i> Maire. Lamiaceae/Hv706	Endemic of central Sahara	<i>tehenok</i>	Not found	Ap, Fl/I/Iu Ap, Fl/I/Eu	Chills Bruises, oedema (* aromatic, * plant for mixtures)
<i>Leptadenia pyrotechnica</i> (Forsk.) Dec. Asclepiadaceae/Hv 697	Soudano-deccanian	<i>enag</i>	assabay	Ap/I or M/Iu Ap/I or M/Eu	Fever, cough Kidney disorders, stones, urinary decrease Dermatosis
<i>Maerua crassifolia</i> Forsk. Capparaceae/Hv690	Saharo-arabic	<i>tadjart</i>	atil	St/R Bk/D/Iu Lf/D/Iu Lf (fresh)/Plt	Tooth pick Fever, headache Gastro intestinal diseases: vomits Toothache, fever
<i>Marrubium deserti</i> De Noë. Lamiaceae/Hv709	Endemic	<i>telheret</i>	meriout	Lf/I/Iu	Respiratory diseases, fever Diabetes, jaundice, vascular hypertension
<i>Matricaria pubescens</i> (Desf.) Schultz. Asteraceae/Hv644	Endemic of Nord-Africa	<i>aynasnis</i>	ouazouaza/guertoufa	Ap, Fl/I/Iu Fl/Eu	Pediatry: measles, dental exit, fever Dysmenorrhoea, muscle contraction Sore inflammation, itching Conjunctivitis (tiny globose flower soaked in water, and applied in situ) (* scorpion sting, * condiment) (local butter)
<i>Myrtus nivellei</i> Batt. and Trab. Myrtaaceae/Hv681	Endemic central Sahara	<i>tafeltest</i>	rihan	Lf/I/Iu Lf/I/Plt	Intestinal diseases: diarrhoea , fever, diabetes Dermatosis: mycosis, hair care (leaf crushed + oil or butter = ointment)
<i>Nerium oleander</i> L. Apocynaceae/Hv646	Mediterranean	<i>el el</i>	defla	Lf/D/Eu Lf/D/Iu Ltx/Eu	Skin diseases: dermatosis, itching Diabetes, hair loss, fever, headaches Syphilis, abortive Eczema, toothache
<i>Panicum turgidum</i> Forsk. Poaceae/Hv698	Saharo-arabic and Soudano-deccanian	<i>afezou</i>	mrokba	R/D/Iu Wp/D/Eu Wp, Pd/Eu	Strong constipation Skin diseases: bruises, oedema Bandage for wounds and sores
<i>Paronychia arabica</i> L. Caryophyllaceae/Hv674	Saharo-arabic	<i>ahiyouf mkhalkhal</i>	souifa	Ap/I/Iu Ap/D/Iu Ap/CD/Eu	Diabetes Kidney diseases: failure, stones Cardiac disorders Skin diseases: whitlow , boils, pustules

Table 1 (Continued)

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
<i>Peganum harmala</i> L. Zygophyllaceae/Hv649	Cosmopolite	<i>alora</i>	harmel	Sd/D/Iu	Rheumatisms, back pains Fever, lips sore, herpes, emmenagogue
				Sd/D/Iu	Diabetes , jaundice, helminthiasis Nervous disorders: break down Anxiety, just married sexual weakness
				Sd/D/Eu	Eczema, tumours
				Sd (crushed)+oil (M10 days)/Plt	Lice (* blooming = mascot) (* plant for mixtures, * magic)
<i>Pergularia tomentosa</i> L. Asclepiadaceae/Hv661	Saharo-arabic	<i>tachkat</i>	relka	R (pounded)/Iu	Chills, bronchitis, constipation
				Ap/D/Iu	Helminthiasis Abortive
				Ap/D/Plt	Skin diseases:dermatosis, boils, allergies depilatory
<i>Periploca laevigata</i> Ait. Asclepiadaceae/Hv702	Saharo-mediterranean	<i>sellouf</i>	hallaba	Ap, Sd/D/Eu	Rheumatisms, various pains
				Ap, Sd/D/Iu	Diabetes Abortive
<i>Pituranthos chloranthus</i> Benth. and Hook. Apiaceae/Hv655	Endemic of	<i>atta</i>	Not found	Ap/I/Iu	Fever, diabetes
	Nord-Africa			Ap, Pd/Eu	Lice (head and pubis)
<i>Pituranthos scoparius</i> Benth. and Hook. Apiaceae/Hv 656	Endemic of	<i>tattayt</i>	guezazah	Ap/I/Iu	Post partum care: spasms, pains Diabetes, hepatitis, digestive difficulties Urinary infections (* aromate)
	Nord-Africa				
<i>Pulicaria crispa</i> Schultz. Asteraceae/Hv712	Saharo-arabic	<i>tanefest</i>	arfedj	Ap/I/Iu	New born pathology: colics, vomits, urinary Decrease
				Ap/D/Iu	Diabetes, palpitations, diuretic
<i>Pulicaria undulata</i> (L.) DC. Asteraceae/Hv713	Saharo-arabic	<i>tamayout</i>	Not found	Ap/D/Iu	Chills
				Ap/D/Eu	Diabetes, cardiac disorders Skin diseases: abscesses, boils (* aromatic, * tea)
<i>Reseda villosa</i> Coss. Resedaceae/Hv714	Endemic saharian	<i>abellendjad</i>	sbib es sena	Ap/I/Iu Ap/D/Eu	Digestive diseases, diarrhoea Rheumatisms, aching joints
<i>Rhus triaprtitus</i> R. Sch. Anacardiaceae/Hv647	Mediterranean	<i>tahouneck</i>	djedari	Fr/D/Iu	Digestive diseases: colics, diarrhoea
				Lf/D/Iu	Rheumatisms, muscle contraction, myalgia Toothache (* snake bite and scorpion sting)
<i>Ricinus communis</i> L. Euphorbiaceae/Hv648	Tropical	<i>tafenit</i>	kiroua	Ap/CD/Iu + Eu	Skin diseases: sores, boils, bruises Post partum care: emmenagogue, dryant of lactation
				Lf, fresh/Plt or rubbing Lf, fresh/Plt or rubbing	Aching joints, lumbago, sciatica Amenorrhoea, helminthiasis Jaundice, diabetes, kidney disease, male sterility
				Lf, fresh/D/Iu R/D/Iu	Lumbago, sciatica , aching joints Fever, headaches
				R/D/Eu Sd/D/Iu	Nervous diseases: vertigo, epilepsy Trachoma, aphthae, hair loss (* camel's scabies)
				Sd/D/Eu	
<i>Ruta tuberculata</i> Forsk. Rutaceae/Hv666	Saharo-arabic	<i>touf ichkan</i>	fidjel	Ap/D (milk)/Iu	Aching bones and joints Dysmenorrhoea, female sterility, difficult delivery, post partum care, anemia Liver and bowels complaints Fever
				Ap/D (milk)/Plt Ap/I (milk)/Iu	Headache Child convulsions (* plant for mixtures)
					Vascular hypertension
<i>Salsola baryosma</i> (Schul.) Dandy. Chenopodiaceae/Hv653	Saharo-arabic and Soudano-deccanian	<i>issin</i>	ressal	Wp/I/Iu Wp/Pd/Eu	Vascular hypertension Vulnerary: bruises, oedema

Table 1 (Continued)

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
<i>Salvadora persica</i> Garcin.	Soudano-deccanian	têhak	missouâk	St	Tooth-pick
Salvadoraceae/Hv715				Lf/D/Iu inhaling Lf/Pd/Eu Bk/D/Iu Bk/D/Plt	Jaundice, aphthae, amenorrhea, gonorrhoea, syphilis Bilharziose Tuberculosis (wash cloth, two times/day/40days) Fever, spleen diseases, contraceptive Pulmonary problems: cough, asthma Diabetes Rheumatism, boils (* snake bite)
<i>Salvia aegyptiaca</i> L. Lamiaceae/Hv668	Saharo-arabic	sassaf	bou fettâch	Sd/in situ Ap/I/Iu	Eye antiseptic Fever, digestive diseases: pains, spasms Piles, infected wounds
<i>Salvia chudaei</i> Batt. and Trab. Lamiaceae/Hv667	Endemic of central Sahara	aouit	tagrouft	Ap/D/Iu Ap/D/Iu + Plt Ap/Pd/Eu	Dysmenorrhea, abdominal pains, spasms Sun stroke Gonorrhoea
<i>Solenostemma oleifolium</i> Bull. and Bruce Asclepiadaceae/Hv652	Saharo-arabic	arellachem	ardjel	Ap, Lf, Fr/D/Iu Ap/Pd/Plt Ap/D/Iu + Plt	Respiratory illness: pleurisy, cough Fever, measles Kidney and gastro-intestinal diseases Jaundice Diabetes Skin diseases (soap), wounds, sores Rheumatism, sciatica Gonorrhoea, syphilis, oedema
<i>Stiagrostis pungens</i> Desf. Poaceae/Hv683	Sahara and sout-Africa	toulloult	drin	Sd/Pd/Iu St/D/Plt stubble	Post partum care: reconstituant, tonic Rhumatismal and joint pains Drain for wounds with pus
<i>Tamarix aphylla</i> (L.) Karst. Tamaricaceae/Hv662	Saharo-arabic	tabarkkat	ethel	Ap/D/Iu Ap/D/Plt Gall/I/Iu	Post partum care: aid to menstruation, fever Jaundice, kidney and spleen diseases Eye inflammation Diarrhoea (* camel's scabies)
<i>Tamarix gallica</i> L. Tamaricaceae/Hv663	Mediterranean and saharo-arabic	tarfa	fersig	Ap/D/Iu Ap/D/Plt Gall/I/Iu	Chills, cold, tonsillitis, sudorific Eye diseases, boils Diarrhoea
<i>Teucrium polium</i> L. Lamiaceae/Hv665	Endemic of central Sahara	takmezout	djaida	Ap/D/Iu Ap, fresh./Plt	Chills, fever Diabetes Helminthiasis, tonic, blood-cleansing Skin diseases: open sores, eczema Piles (* aromatic, * plant for mixtures)
<i>Traganum nudatum</i> Del. Chenopodiaceae/Hv659	Saharo-arabic	térahit	domran	Ap, fresh./Iu	Constipation
<i>Tribulus terrester</i> L. Zygophyllaceae/Hv670	Cosmopolite	tadjaroft	atras el klab	Wp/I/Iu Wp/I/Eu Fr/I/Iu Sd/Pd/Iu	Kidney diseases: stones, urinary decrease Intercostal pains, rheumatism (rubbing) Aphthae, mycosis Palpitations, Helminthiasis Dysmenorrhea, aphrodisiac Spleen, moral fall (paps and local bread)
<i>Trichodesma africanum</i> (L.) R.Br. Borraginaceae/Hv716	Saharo-tropical	alka	bedjig	Wp, roasted/Eu	Skin diseases: desinfectant Haemostatic for sores and wounds

Table 1 (Continued)

Species/herbarium number	Floristic area	Tamahaq	Arabic	Part/Prp/Way	Traditional uses
<i>Trigonella foenum graecum</i> L. Fabaceae/Hv669	Saharo-arabic	<i>ibediouen</i>	helba	Ap, Sd/D/Iu Sd + oil/Plt	Diabetes, tonic, analeptic , blood cleaning Palpitations Hair loss
<i>Typha elephantina</i> Roxb. Typhaceae/Hv682	Tropical	<i>taheli</i>	berdi	ashes of rhizoma	Haemostatic, healing
<i>Varthemia sericea</i> (B and T) Diels Asteraceae/Hv701	Endemic of Tassili N'Ajjers	<i>tagart n'esali</i>	Not found	Lf/I/Iu Lf, fresh/Plt	Digestive diseases: stomachaches, headache Healing: wounds and sores
<i>Zilla spinosa</i> L. Brassicaceae/Hv683	Saharo-arabic	<i>aftazzen</i>	chebreg	Ap/D/Iu	Jaundice , asthma Kidney diseases: stones
<i>Zizyphus lotus</i> (L.) Desf. Rhamnaceae/Hv681	Saharo-mediterranean	<i>tabakat</i>	sedra	Fr/Iu Lf, hashed/Plt R/D/Iu	Abdominal pains, diarrhoea Lips herpes, fever Diabetes Sores and burns, boils, tumours Constipation
<i>Zygophyllum album</i> L. Zygophyllaceae/Hv722	Saharo-mediterranean	<i>abelkozt</i>	aggaia	Ap, Lf/D/Iu Ap, Lf/D/Iu Ap/Pd/Eu or bath	Diabetes (fasting), myalgia, rheumatism Gastric aches, liver attack, colics Dysmenorrhae Body care for the new born, eczema
<i>Zygophyllum simplex</i> L. Zygophyllaceae/Hv725	Soudano-deccanian	<i>affezzaman</i>	Not found	Lf/D/Iu Lf/D/Eu	Helminthiases Dermatosis, abscesses, boils, mycosis (* plant for mixtures)

The following abbreviations have been chosen for the parts used: aerial parts (Ap), whole plant (Wp), leaf (Lf), flower (Fl), fruit (Fr), seed (Sd), stem (St), root (R), cortex (Bk), gum (Gm), latex (Ltx). For the procedures of preparation (Prp): decoction (D), concentrated decoction (CD), infusion (I), maceration (M), poultice (Plt), powder (Pd). For the modes of administration: internal use (Iu) or external use (Eu). The main indications are in bold letters. Asterisk indicates particular use.

The abbreviations chosen on Table 1 for the parts used, the procedures of preparation and the modes of administration are noted at the bottom of this table. The main indications are in bold letters. Asterisk indicates particular use.

3. Results

More than 100 drugs were investigated, but only wild indigenous species with medicinal qualities identified with certitude and given the same main indication by three separate informants, have been reported in this investigation. There are 80 species belonging to 33 botanical family.

The vegetation, which is relatively homogenous and rare outside wadi-beds, is characterised by predominance of the saharo-arabic elements with 36 species, which account for 45% of the all plants. At the lowest level, the saharo-tropical flora is predominant with *Acacia* and *Balanites*, to which further south, can be added the soudano-deccanian elements, with *Aerva*, *Lep-ladenia* or *Salsola*. However, in altitude can be found species called saharo-mediterranean like *Myrtus*, *Lavandula* or *Teu-crium*, which means that they have a mediterranean origin but have not a mediterranean biology. There are 20 endemic species (25%), nine of them are only found in Central Sahara. Of the 33 families listed, Asteraceae, with 12 species (15%), are the most common, secondly Zygophyllaceae with seven species (9%) and lastly Fabaceae and Lamiaceae.

Usually, the practitioners use the aerial parts without separating the leaves or the flowers, sometimes the cortex is used, exceptionally the latex or the roots. The plants are used fresh or dried, essentially in the form of a decoction, maceration as an infusion in water. Sometimes oils are used and exceptionally milk.

Infusion is reserved for fragile parts such as flowers or plants with essential oils, or for paediatric prescriptions. In summary we can say that there is a standardized decoction in water, prepared with a handful of plants, which varies from 20 to 50 g, depending on the drug. The volumes correspond to the household objects that belong to the nomad: tea pot (250–450 ml) or kettle (1 l), and tea glass. The volume varies according to the time of decoction: after boiling down to obtain two tea glasses.

3.1. Oral administration

The patient drinks one to two tea glasses for each dose. The frequency of the dose is rarely indicated and often adapted to each case “at the time of the spasms, pains, bed time . . .”, and the duration of the treatment refers to “magic” numbers: 3, 7 or 11 days. The dried plant, reduced to a very fine powder, is frequently administered. Each dose of this powder, named “Seffa” or “Abek”, measured by a pinch of three fingers followed by a drink. If the flavour is unpleasant or when children are concerned, the powder is inserted into some dough

used for making “taguella” (local bread), rolled into pills, and swallowed.

3.2. Poultice and local application

With the fresh plant chopped or the dried plant pulverised a dough is made using water or oil, or it is incorporated into the local butter to make an ointment. This technique is used to apply local analgesic, healing lotions and creams, antiparasitics and most of the remedies indicated for rheumatic pains.

3.3. Body baths

Based on decoction are recommended for dermatitis.

3.4. Steam baths and inhaling

This form is recommended for patients suffer from rheumatoid pain. The acting part or the whole body is exposed to the vapour, which comes from the fresh plants soaked in water and heated (embers in general). A thick cloth (a tightly woven fabric) over the steaming liquid forms a closed space, which maintains the steam to medicinal virtues. This procedure is also used for colds and illnesses caused by the cold. The aromatic plants like *Mentha*, *Lavandula*, *Ammodaucus*, *Cymbopogon*, etc. are used in this kind of treatment. They are often found in the composition of various mixtures and a lot of them help in the conservation of the local butter.

As elsewhere in Central Sahara, the populations use complementary treatments: ignipuncture, cauterization, scarification, blood-letting and massages. Blood-letting is systematic with the new-borns and massages are among the practices used until the age of two.

Table 1 lists the 80 wild indigenous plants with their therapeutic indications listed according to the type of complaint. Traditional pharmacopoeia covers most of the pathologies normally found in the population. It shows that the traditional healers of Tassili N’Ajjer use 58 plants (73%) for digestive problems, among them 19 (24%) are recommended for jaundice. With 58 plants (73%) for usual skin infections and 11 plants (14%) used for external treatments of snake bites and scorpion stings the skin diseases are the most numerous. Then, 37 plants (46%) treat non-abdominal pain, 32 (40%) are used for fever, 25 (31%) for diabetes and 23(29%) for genital organ illnesses. The respiratory infections, which are widespread because of the difference of temperature between day and night, show only 22 species (25%), but for 15 of them, it concerns major indications. Finally, the parasitosis and the pathology linked to child birth are respectively treated with a limited number of 17 plants (21%) and 16 (20%). The Touareg pharmacopoeia also takes into con-

sideration feverish states of the child (*Cotula*) and the neo-natal pathology and the ones caused by environment: bites and stings of venomous animals. The camel, so precious in the desert, is not forgotten.

As we have noticed in septentrional Sahara and the Ahaggar (Maiza et al., 1990, 1992, 1993a,b, 1995, 2005), nervous troubles affects a small part of the population; however, we have to be careful because the popular belief links certain disorders to supernatural and demonic causes which are linked with magical treatments. These popular practices take into consideration the notions of doses and toxicity, thus species like *Citrullus colocynthis* and *Hyoscyamus muticus* are used with prudence and only by some tradi-practitioners.

This study finishes our investigations in Central Sahara. We have noted everywhere the same need to protect the flora. Conscious of the phenomena of degradation of the inheritance, and even with the immensity of the territory they avoid using the underground parts not to worsen the phenomena of desertification.

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