



Medicinal Plants Used by Traditional Healers in Algeria: A Multiregional Ethnobotanical Study

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Traditional medicine is the cornerstone that boosts scientific research to explore new therapeutic approaches. The study aimed to assess the traditional knowledge and use of medicinal plants to treat various ailments by Algerian traditional healers. Forty traditional healers were face-to-face interviewed in three different Algerian areas (West, Kabylia, and Sahara). The data collected were analyzed using quantitative indices such as fidelity level (FL) and informant consensus factor (F_{IC}). A total of 167 species belonging to 70 families were recorded. Lamiaceae (13%), Asteraceae (13%), Apiaceae (7%), and Rosaceae and Fabaceae (5% each) were the most cited families. The survey revealed that leaves were the most used parts of the plants (29%). Furthermore, decoction (35%), raw (24%), and infusion (19%) were the common modes for the remedies' preparation. Here, 15% of the total species were newly reported as medicinal plants. Besides, it was reported for the first time a total of 47 new therapeutic uses for 20 known plant species. Of 17 ailments categories, cancer was presented by 44 species, showing the highest F_{IC} of 0.46. *Marrubium vulgare* L., *Artemisia herba-alba* Asso., *Zingiber officinale* Roscoe., and *Juniperus phoenicea* L. recorded the maximum fidelity value of 100%. Therefore, our study reveals strong ethnomedicinal knowledge shared by local populations living in the three regions studied. The medicinal species with a high FL could be promising candidates for identifying new bioactive molecules.

Keywords: Algeria, medicinal plants (herbal drugs), traditional healers, phytotherapy, ethnobotany

INTRODUCTION

Medicinal plants are still considered important and promising sources of drugs to treat various diseases. Their therapeutic uses, vernacular names, modes of preparation, and routes of administration were orally transmitted to constitute a local ancestral knowledge characterizing each population or ethnic group living in a specified area. Actually, from the identification of morphine in opium in the 19th century, drug discovery is based on ethnobotanical investigations and local ethnomedicinal knowledge (Ojah, 2020). Moreover, almost 35% of drugs and about 80% of anticancer drugs used in clinical practice are plants- or natural products-derived (Calixto, 2019).

Algeria is the largest country in the Mediterranean basin, Africa, and the Arab region with a total area of almost 2.4 million km² and 1,600 of coastline. In addition to a diversified climate, Algeria is characterized by a rich flora consisting of 4,000 taxa, 917 genera, and 131 families. Moreover, owing to its ancient history as one of the first cradles of *Homo sapiens* and civilization in the world, Algeria possesses an important and rich cultural diversity. Although several studies have been undertaken to



document the local knowledge regarding the use of medicinal plants to treat different diseases (Benarba, 2015; Benarba et al., 2016; Chelghoum et al., 2021; Mechaala et al., 2021), the Algerian ancestral ethnomedical knowledge deserves more ethnobotanical investigations. On the other hand, almost all of these ethnobotanical studies covered one region and therefore the same culture and traditions. The present study was carried out in three important regions of Algeria: North-West, Kabylia (Center), and Sahara (South) to 1) record the medicinal species used for medicinal purposes and the local therapeutic practices of traditional healers and 2) document the species newly reported as medicinal plants and new uses.

MATERIAL AND METHODS

Description of the Study Area

The multiregional study was carried out in three regions in Algeria: North-West, Kabylia (Center), and Sahara (South) (Figure 1). The ethnobotanical investigations in the North-West were performed in five departments: Mascara (area = 5,139 Km²), Oran (area = 2,114 Km²), Mostaganem (area = 2,269 Km²), Sid Bel Abbas (area = 9,150 Km²), and Tialet (area = 20,673 Km²) and their surrounding villages located from the Mediterranean Sea to the Moroccan borders. Although no data is available regarding the flora of each department, that of the region of Oran showed the presence of

92 taxa; out of them, 72 remain endemic (Miara et al., 2018). The ethnobotanical study carried out in Center Algeria covered one city named Tizi Ouzou and its surrounding villages covering an area of 3,568 Km², located 100 km east of the capital (Algiers) and 30 km south of the Mediterranean Sea. Owing to its favorable climate, this region is characterized by an important vegetal diversity, including 659 species, 95 subspecies, 2 varieties, and 1 forma from 381 genera and 88 botanical families (Meddour and Sahar, 2021). The south areas included in the present study covered three of the main cities of the Algerian large desert: Ghardaïa (area = 32,256 Km²), Bechar (area = 161,400 Km²), and El Bayad (area = 71,686 Km²), characterized by important cultural, ecological, climatic, and botanical diversity (Taïbi et al., 2020; Taïbi et al., 2021). This desert wide region is characterized by sparse vegetation, grasses appearing during a short period of the year, and rare trees. According to its adaptation mode to the drought, Saharan flora can be divided into ephemeral plants, called “achebs” with a short vegetative cycle of one to four months, and perennial plants with morphological and anatomical adaptations based on an enhanced absorbent system and reduced evaporating surface. The local flora comprises 130 species belonging to 40 families (Chehma and Djebbar, 2008).

Data Collection

The ethnobotanical investigations were carried out from December 2019 to June 2020. During this period, we visited

TABLE 1 | Demographic characteristics of the traditional healers.

Gender	n	100%
F	23	57.5%
M	17	42.5%
Areas		
West	26	65.0%
Kabylia	6	15.0%
Sahara (desert)	8	20.0%
Age		
34–49	4	10.0%
50–65	11	27.5%
66–81	15	37.5%
82–98	10	25.0%
Education		
Illiterate	27	67.5%
Literate	13	32.5%
Inherited	28	70.0%
Acquired	7	17.5%
Unknown	5	12.5%

13 cities and 19 villages in the study areas, searching for traditional healers. The data had been gathered from 40 informants; 87.5% of them were professionals, acquiring the therapeutic knowledge by the transition from generation to generation, and 12.5% were herbalists. The traditional healers were interviewed by a face-to-face interview in their homes or workplaces to fill out a questionnaire and collect the data. The responses included the demographic characteristics of healers (**Table 1**) and other information related to the uses of medicinal plants, such as the vernacular name, ailments treated, parts used, preparation, and administration modes. The species were given in their local names in Arabic or Amazigh.

Botanical Identification

The medicinal species mentioned by the traditional healers were collected, coded, and dried. Voucher specimens were deposited at the Herbarium of the Laboratory of Research on Biological Systems and Geomatics (LRSBG), University of Mascara, Algeria.

The taxonomic identification was performed by Professor Bachir Benarba using the standard literature (Baba Aissa, 1999; Kunkele and Lohmeyer, 2007; Trabut, 2015).

Ailment Categories

Table 2 shows more than 100 diseases recorded from the ethnobotanical investigations. All the ailments were classified into 17 categories based on the vital system/organ affected or type of damage.

Data Analysis

Ethnobotanical indices, fidelity level (FL) and informant consensus factor (F_{IC}), were calculated to analyze the data obtained. Consensus indicators FL and F_{IC} were used to quantify the relevance and importance of a species for a given ailment category and the agreement of its use among healers, respectively (Hoffman and Gallaher, 2007; Khan et al., 2014). FL and F_{IC} were calculated using the following formulas (Morvin Yabesh et al., 2014):

$$\text{Fidelity level: FL (\%)} = (N_p/N) \times 100$$

N_p is the number of use reports for a given species reported for a particular ailment category, and N is the total number of use reports cited for any given species.

$$\text{Informant Consensus Factor: } F_{IC} = (Nur - N_t) / (Nur - 1)$$

Nur is the number of use citations in each category, and N_t is the number of species reported in each category.

TABLE 2 | Ailments categories.

Category	Ailments/disorders	Abbreviation
Kidney diseases	Kidney failure, kidney problems, and urolithiasis	KD
Gastrointestinal system diseases	Irritable bowel syndrome (IBS), ulcers, heartburn, hemorrhoids, stomach ache, diarrhea, constipation, colitis, flatulence, gastrointestinal diseases, gallstones, liver diseases, and jaundice/icterus	GISD
Skin diseases	Limb swelling, itchy skin, tinea capitis, scalp ringworm, heel fissures, skin diseases and ulcer, urticaria, lichen, chalazion, albinism, dermatitis or eczema, boils, head ulcers, skin ulcers, leprosy, festering wounds, and burns	SD
Cancer	Cancer, blood cancer, gum tumors, tumors, skin pimples, uterine cysts/tumors, breast cysts, breast tumors lung tumors, liver cancer, breast cancer, legs cancer, skin cancer, early stage cancer, and stomach cancer	Can
Endocrine system diseases	Goiter and diabetes	ESD
Respiratory tract diseases	Sinusitis, bronchitis, nasal-lung inflammation, pneumonia, lung filtering/smoker, chest and lung diseases, cough, pulmonary-breathing problem, asthma, allergy, cold, and chest pain	RTD
Skeletomuscular system disorder	Osteoarthritis, bones pain, acute arthritis, gout, back pain, arthritis, arthrosis, fracture, osteoporosis, and moving difficulty	SMSD
Cardiovascular system diseases	Cardiovascular diseases, hypertension, clogged arteries, and hypercholesterolemia	CVSD
General health	Earache and deafness, hoarseness, sore throat, fever, mouth ulcer, halitosis, gingivitis, anxiety disorders, and hypochondria, tonsillitis, and incurable diseases	GH
Haircare	Baldness, alopecia areata, and hair loss	HC
Nervous system	Migraine, headache, dizziness, head problems, psychosis, insomnia, epilepsy, and sciatica	NS
Sexual-reproductive problems	Uterine problems, uterine microbe, infections, infertility, breast milk outage, and prostatitis	SRP
Infectious diseases	Laryngitis	ID
Poisoning	Scorpion sting and poisoning	P
Hematological system diseases	Anemia, spleen diseases, and blood purification	HSD
Urology system diseases	Bladder disease, urinary tract infection/inflammation, and cystolithiasis	USD

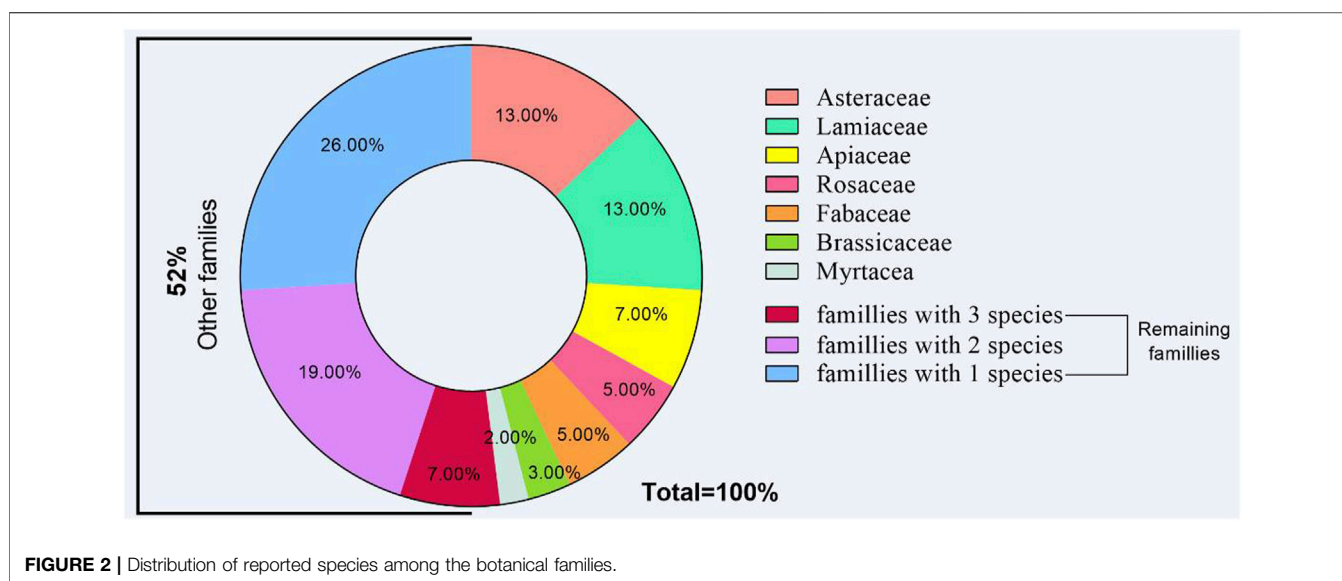


FIGURE 2 | Distribution of reported species among the botanical families.

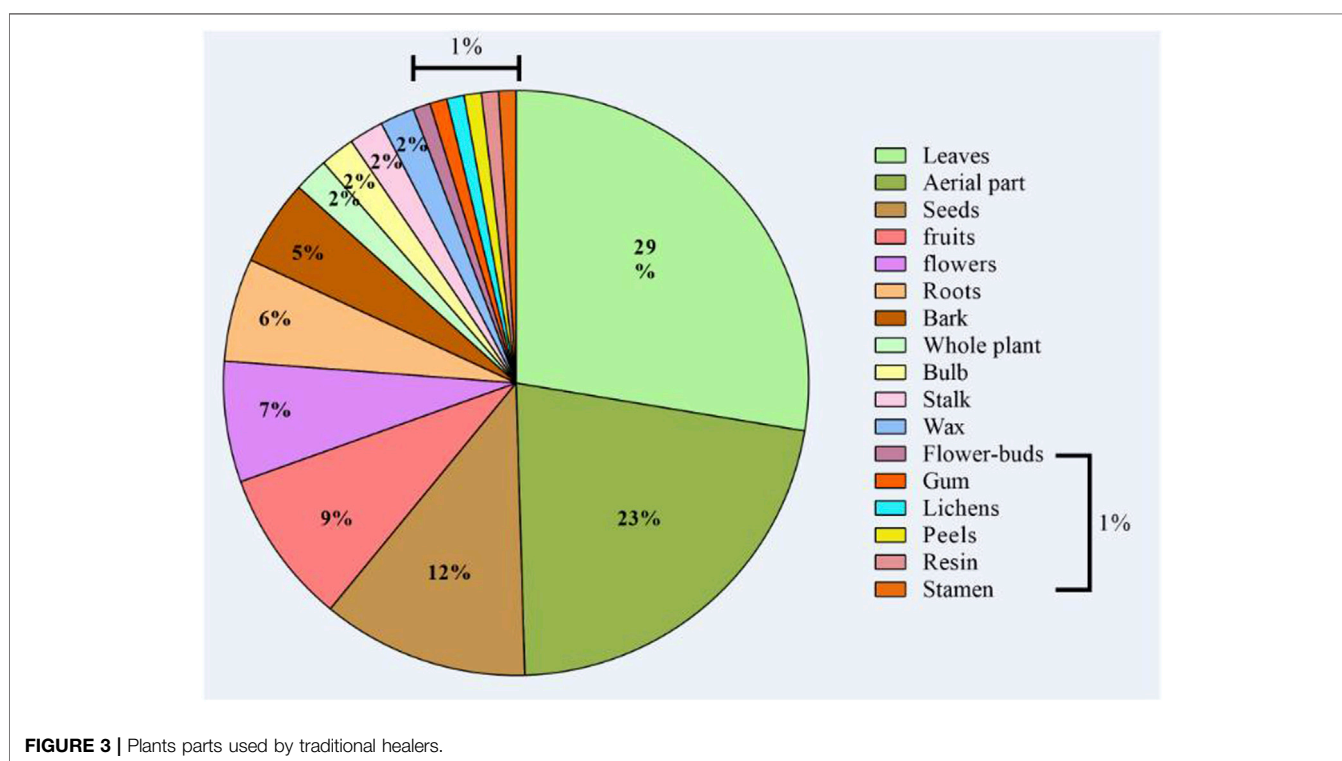


FIGURE 3 | Plants parts used by traditional healers.

RESULTS

Botanical Diversity, Parts Used, Modes of Preparation, and Administration

This study revealed 167 species of medicinal species used for therapeutic purposes, belonging to 70 families. Lamiaceae (13%), Asteraceae (13%), Apiaceae (7%), Rosaceae (5%), and Fabaceae (5%) were the most cited families, while the 66 remaining families (57%) had between 1 and 5 species in each (Figure 2). As shown in Figure 3, the plant parts most frequently

used were leaves (29%), followed by aerial part (23%), seeds (12%), fruits (9%), and flowers (7%). Some used parts were lower than those, such as roots (6%), bark (5%), and whole plant, bulb, wax, and stalk (2% each). Besides, peels, flower buds, stamen, and gum were slightly used (1%).

Regarding the preparation methods (Figure 4), decoction (35%), raw (24%), infusion (19%), paste (10%), and maceration (8%) were the dominant methods for remedies preparation. Surprisingly, the current study recorded burning (2%) as an uncommon/novel mode used by traditional healers. In addition,

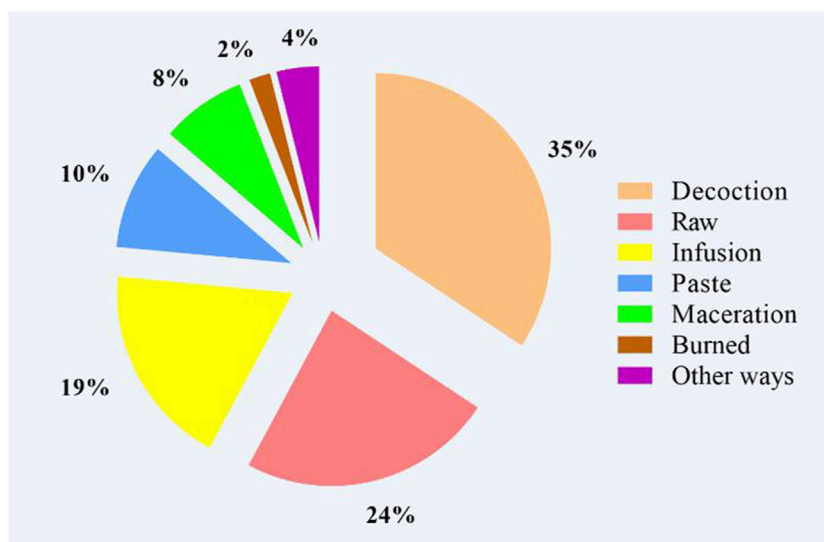


FIGURE 4 | Modes of preparation used by traditional healers.

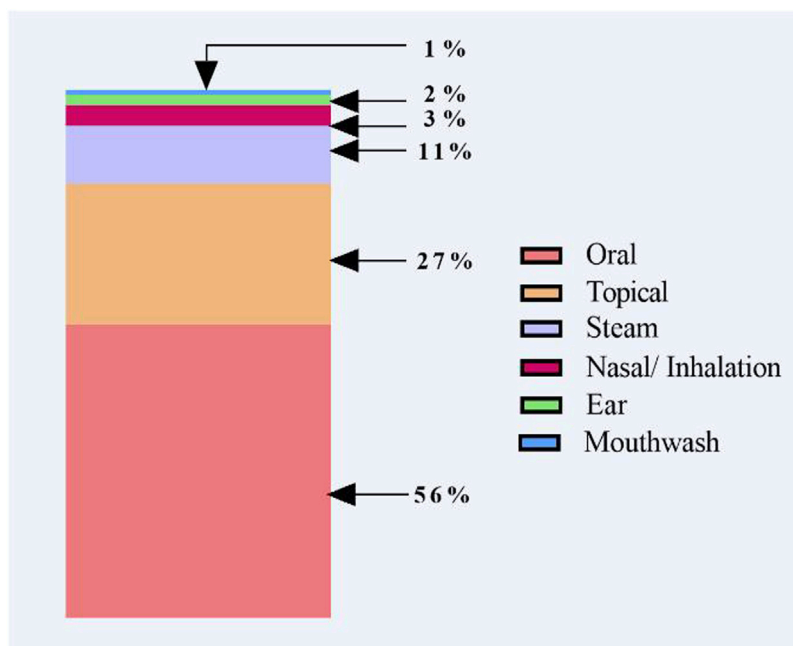


FIGURE 5 | Modes of administration.

the common administration route was the oral ingestion (56%) followed by external application as an ointment on the skin and compress (27%), steam (11%), or internally tract as nasal inhalation (3%), intracanal (2%), and the mouthwash (1%) (Figure 5). Of the remedy's prescription, 64% of medicinal plants were mixed with other ingredients, and 36% were taken without addition. Indeed, there were 32 species combined with one plant, 21 plants with two plants, 19 plants with three or four plants, and 14 plants with more than four plants. Furthermore, some herbal mixtures (43%, $n = 74$ species) were prepared by adding

different adjuvants (Figure 6). These adjuvants include honey (25 use reports) followed by olive oil (22), fat (8), vinegar (7), plant oil, and sulfur and tar (6 times each).

New Reports and New Uses

By comparing the data from this study with other ethnobotanical researches carried out in Algeria and neighboring countries (Morocco, Tunisia, Mauritania, Nigeria, and Mali), we found that 11% of total species have not been previously reported as medicinal plants. Of them, 11 species were documented in

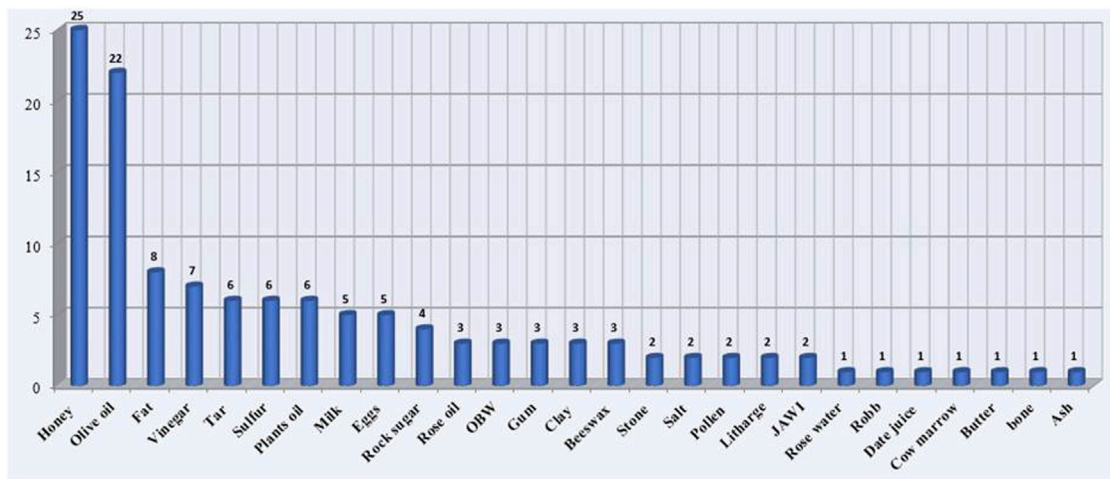


FIGURE 6 | Adjuvants added.

TABLE 3 | New recorded medicinal plants used by traditional healers in Algeria (West-Kabylia-Sahara).

Scientific name	Local name	Ailments	Number of informants citing plants	Number of citations
<i>Inula helenium</i> L.	مطهر	Can: 2* breast cancer and legs cancer	1	2
<i>Centaurea acaulis</i> L.	سنن توري او القنن طريون	Can: 2* breast cancer and legs cancer	1	2
<i>Mellilotus officinalis</i> (L.) Pall.	الهندقوق إكليل الملوك	RTD: 1* chest and lung diseases GISD: 1* IBS	1	2
<i>Lupinus micranthus</i> Guss.	الترمز المر الدقيق	ESD: 1* diabetes	1	1
<i>Boswellia ameero</i> Balf.f.	اللبان	RTD: 1* chest and lung diseases	1	1
<i>Carduus nutans</i> L.	شوك المحنن	HC: 1* alopecia areata	1	1
<i>Quercus faginea</i> Lam.	العصص	SRP: 1* uterine microbe	1	1
<i>Gentiana acaulis</i> L.	كف الذئب او الجنن طيانا	Can: 1* breast cancer and legs cancer	1	1
<i>Digitalis purpurea</i> L.	القمرعية او الديق يتال	CVSD: 1* cardiovascular diseases	1	1
<i>Cistanche tubulosa</i> (Schenk) Wight	ذنون	GISD: 1* colitis	1	1
<i>Hypocoum procumbens</i> L.	زهيرة (الخشخاشية)	Can: 1* skin pimples and tumors	1	1
<i>Phyllanthus niruri</i> L.	الأم لج	Can: 1* cancer RTD: 1* cough	1	2
<i>Verbascum sinuatum</i> L.	مص لجان الأناظر أو البوصير أو تيسراو	SMSD: 1* osteoarthritis	1	1
<i>Lycium shawii</i> Roem. and Schult.	العوسج	SD: 2* skin ulcers and leprosy RTD: 1* pneumonia	2	3
<i>Tamarix aphylla</i> (L.) H.Karst.	طحطاح	NS: 1* headache	1	1
<i>Ulmus rubra</i> Muhl.	الدردار	ID: 1* laryngitis SMSD: 1* moving difficulty	2	2
<i>Telephium imperati</i> L.	تس مرغينن	GH: 1* mouth ulcer HSD: 1* anemia	1	2
<i>Humulus lupulus</i> L.	جنج	HC: 1* alopecia areata and baldness GISD: 2* hemorrhoids	2	3
<i>Cirsium creticum</i> (Lam.) d'Urv.	شوك الرمح	GISD: 1* hemorrhoids	1	1

Sahara, 5 in Kabylia, and 3 in West Algeria. These species are used as remedies to treat both common ailments and incurable diseases. The new reports are listed in Table 3 with their vernacular names, parts used, therapeutic uses, and modes of administration.

Surprisingly, 4 out of the 19 new species (*Lycium shawii* Roem. and Schult, *Humulus lupulus* L., *Crataegus azarolus* L., *Centaurea acaulis* L., and *Verbascum sinuatum* L.) were highly cited by the informants. *V. sinuatum* is used to treat gastrointestinal and respiratory tract diseases such as pneumonia, using the

TABLE 4 | List of new therapeutic uses recorded in Algeria (West-Kabylia-Sahara).

Botanical name	Part used	New uses	Preparation methods	Previously reported uses	References
<i>Silybum marianum</i> (L.) Gaertn.	Leaves	Can: 2 breast cancer and legs cancer	Raw	Biliary, liver disorders, and degenerative necrosis Jaundice and enlarged spleen	Lahlah et al. (2012)
<i>Prunus persica</i> (L.) Batsch.	Leaves	Can: 2* cancer Sd: 1* limb swelling	Raw Infusion	Cough, constipation, and menstruation absent	Lin et al. (2021) Al-Fatimi. (2019)
<i>Inula helenium</i> L.	Capitulum	Can: 2* breast cancer and legs cancer	Raw	Hematomas, relief of bruises, joint pains, rheumatism, and gastrointestinal, otolaryngological, and respiratory diseases	Teixidor-Toneu et al. (2016) Obón et al. (2012)
<i>Calendula arvensis</i> M. Bieb.	Capitulum	Rtd: 1* pneumonia	Decoction	Burns, varicose veins, eczema, fungus, warts, and wounds	Lievre et al. (1992) Lavagna et al. (2001)
<i>Artemisia campestris</i> L.	Leaves	P: 1* scorpion sting	Raw	Digestive troubles, gastric ulcer, and menstrual pains	Baba Aissa (1991)
<i>Cichorium intybus</i> L.	Aerial part/ roots	Usd: 2* cystolithiasis and bladder disease Gisd: 2* hemorrhoids and liver diseases	Decoction Decoction and raw Raw Decoction	Urinary tract infections and urolithiasis, digestive problems, kidney diseases, diabetes, and nervous disorders	Sekkoum et al. (2011) Miara et al. (2013) El-Hilaly et al. (2003) Daoudi et al. (2016) Benarba et al. (2015)
<i>Carlina gummiifera</i> (L.) Less.	Capitulum/ leaves/roots	Can: 4* breast cancer and legs cancer Hsd: 1* spleen diseases Srp: 2* infertility and uterine problems Usd: 2* urinary tract infection and bladder disease Smsd: 1* osteoarthritis	Decoction Decoction Decoction Decoction Decoction	Epilepsy, psoriasis, ulcers, and hemorrhage	Bellakhdar (1997) Ahid et al. (2012) Hamliche et al. (2013)
<i>Echinops spinosissimus</i> Turra.	Aerial part	Can: 1* skin pimples and tumors	Decoction	Hypotensive, diuretic, hypoglycemic, for stomachic effects, liver disorders, and postpartum care	Bouzabata (2013)
<i>Clinopodium nepeta</i> (L.) Kuntze.	Aerial part	Gisd: 1* IBS Esd: 1* diabetes Cvsd: 1* cholesterol Kd: 1* kidney failure Usd: 1* bladder disease	Decoction Decoction Decoction Decoction Decoction	Colon ailments, abdominal pain, influenza, heart problems, bee, and insect stings	Mattalia et al. (2020) Çelik et al. (2021)
<i>Mentha rotundifolia</i> (L.) Huds.	Aerial part	Gisd: 1* IBS	Decoction	Mental illnesses, colds, respiratory problems and to protect removal of "curses" and "evil spirits"	Arnold and Gulumian (1984) Pooley (2005)
<i>Potentilla erecta</i> (L.) Roesch.	Roots	Srp: 1* breast milk outage Rtd: 1* chest and lung diseases Gisd: 2* stomach ache and ulcers	Maceration Raw Maceration Decoction	Wounds, certain forms of cancer, infections, diarrhea, and diabetes mellitus	Synowiec et al. (2014)
<i>Amaranthus spinosus</i> L.	Aerial part	Srp: 1* infertility	Decoction	Internal bleeding, diarrhea, excessive menstruation, and snake bites. Ulcerated mouths, nosebleeds, and wounds Menorrhagia, gonorrhea, eczema and colic, fevers, and urinary troubles Skin diseases, psoriasis, and diabetes	Saravanan (2016) Galle et al. (1994) Missoun et al. (2018) Shao et al. (1998)
<i>Mahonia aquifolium</i> (Pursh) Nutt.	Whole plant	Can: 2* breast cancer and legs cancer	Raw	Antitumor activity	Abdel-Hay et al. (2002)
<i>Boswellia ameero</i> Balf.f.	Gum	Rtd: 1* chest and lung diseases	Maceration	Mouth ulcers, gingivitis, sinusitis, glandular fever, brucellosis, and antiparasitic agent	Abdul-Ghani et al. (2009)
<i>Commiphora myrrha</i> (Nees) Engl.	Wax	Can: 2* breast cancer and legs cancer	Raw Raw	Autoimmune diseases, rheumatic pains, amenorrhea, fever, stomach complaints, gall bladder, nephrosis syndrome, chest ailments, snake and scorpion bites, mouth ulcer, and skin infections	Boual et al. (2020) El Ashry et al. (2003) Massoud et al. (2001) Koba et al. (2007)
<i>Cymbopogon schoenanthus</i> (L.) Spreng.	Leaves	Can: 1* skin pimples and tumors	Decoction	Termites and bruchid, digestive diseases, aerophagia, flatulence and urinary decrease, analeptic, bad breath, gumboils, and urinary incontinence	Hamliche and Maiza (2006)

(Continued on following page)

TABLE 4 | (Continued) List of new therapeutic uses recorded in Algeria (West-Kabylia-Sahara).

Botanical name	Part used	New uses	Preparation methods	Previously reported uses	References
<i>Daphne gnidium</i> L.	Leaves	Hc: 1* hair loss Rtd: 1* sinusitis	Raw Steaming	Constipation and toothache, wounds, hair lice or ticks in animals hair washing and as hair tonic	Allal et al. (2019)
<i>Cistanche tubulosa</i> (Schenk) Wight	Whole plant	Gisd: 1* colitis	Raw	For blood circulation and impotence, female infertility, lumbago, body weakness, and tonic substance	Namba (1994)
<i>Phyllanthus niruri</i> L.	Leaves	Can: 1* cancer Rtd: 1* cough	Raw Decoction	Hepatoprotective functions	Kobayashi et al. (1987) Bhattacharjee & Sil (2007)
<i>Tetraena alba</i> (L.f.) Beier and Thulin.	Leaves/seeds	Esd: 1* diabetes	Decoction	Diabetes, intoxication (toukal), gastrointestinal disorders, hypertension, and arteriosclerosis	Benali et al. (2017) Mnafghi et al. (2016)

decoction method with oral and topical application, respectively. The plant is termed locally “Moslih el-Andar” meaning in the local dialect “tract’s fixer” relating to its effect that repairs the continuous elongated anatomical structure in the body. Similarly, the decoction of *L. shawii* is used to treat two ailments categories: skin diseases (skin ulcers and leprosy) and skeletomuscular system disorder (osteoarthritis). Nevertheless, these ethnomedicinal uses and their pharmacological properties have not been documented in previous studies.

Furthermore, some species were previously reported to be used for culinary purposes such as *Telephium imperati* L. called in local dialect as tassarghit/sarghina. The stems of the plant are usually consumed as soup’ spice for postpartum women in Algeria (Sahara and Kabylia region). As reported here, for the first time, it is newly mentioned to be used for medicinal purposes by the local healers treating mouth ulcers and anemia. Moreover, we found that decoction of *Quercus faginea* Lam. seeds, a popular tree in West Algeria (Alcaraz, 1989), is used to treat sexual-reproductive problems besides the fruits (raw) of *Lupinus micranthus* Guss., a species widely distributed in Algeria and the Mediterranean countries (Msaddak et al., 2017). On the other hand, our results showed that species such as *Phyllanthus niruri* L., *Hypocoum procumbens* L., and *Gentiana acaulis* L. are used to treat skin diseases and cancer via topical application. These species have not been previously reported to be used as medicinal species in the Mediterranean region.

In the present study, we found that 89% of total species have already been mentioned as medicinal plants. In fact, more than 100 species cited in this survey were reported in previous studies from different regions of Algeria. Besides, we found that, despite having similar therapeutic uses, the species had different vernacular names from a region to another. Interestingly, we report here 47 new therapeutic uses for 20 known plant species. Table 4 shows these new uses compared to those previously reported in the world.

Informant Consensus Factor and FL

Table 5 shows the 16 ailments categories arranged in descending order based on the F_{IC} values. Cancer had the highest F_{IC} value of 0.49 with 44 species used, such as *C. colocynthis*, *Panax ginseng* C.A. Mey., *E. alata*, *Aquilaria malaccensis*, *Aristolochia longa* L., and *Taraxacum officinale*. On the other hand, we found that sexual-reproductive problems ($F_{IC} = 0.46$), gastrointestinal system diseases ($F_{IC} = 0.44$), and skeletomuscular system disorders ($F_{IC} = 0.39$) were recorded to have the second, third, and fourth highest F_{IC}

TABLE 5 | Informant consensus factor for commonly used medicinal.

Ailment category	Nur	Nt	F_{IC}
Cancer	86	44	0.49
Sexual-reproductive problems	70	38	0.46
Gastrointestinal system diseases	100	56	0.44
Skeletomuscular system disorder	32	20	0.39
Respiratory tract diseases	51	33	0.36
Skin diseases	42	29	0.32
Urology system diseases	26	21	0.20
General health	39	32	0.18
Nervous system	36	30	0.17
Kidneys diseases	9	8	0.13
Hair care	11	8	0.30
Endocrine system diseases	12	11	0.09
Hematological system diseases	17	16	0.06
Cardiovascular system diseases	18	17	0.06
Poisoning	2	2	0.00
Infectious diseases	2	2	0.00

values, respectively. Respiratory tract diseases were ranked to be the fifth ailment group with an F_{IC} value of 0.36.

According to their knowledge and experience, the local healers preferred some species to treat particular diseases. The highest FL values of the commonly used plants are listed in Table 6. Our results indicated that *M. vulgare*, *A. herba-alba*, *Z. officinale*, and *J. phoenicia* had the absolute FL value of 100% in several ailment categories (SRD, cancer, respiratory diseases, and GISD).

DISCUSSION

Botanical Diversity, Parts Used, Modes of Preparation, and Administration

In the present study, we recorded 167 species belonging to 70 families with a dominance of Lamiaceae, Asteraceae, Apiaceae, Rosaceae, and Fabaceae. Our findings agreed with those we previously reported. Indeed, in Mascara (North-West Algeria), most of the medicinal species used by local healers belonged to these five families (Benarba, 2015). Similar findings were reported in Algeria (Miara et al., 2018; Taibi et al., 2020), Morocco (Barkaoui et al., 2017; Skalli et al., 2019), and Italy (Tuttolomondo et al., 2014). It has been suggested that plants belonging to these families are mainly used by local populations

TABLE 6 | FL of commonly used medicinal plants.

Ailment category	Species	FL (100 (%))
KD	<i>Cichorium alatum</i> Hochst. and Steud.	100
	<i>Artemisia herba-alba</i> Asso.	50
	<i>Parietaria officinalis</i> L.	100
GISD	<i>Marrubium vulgare</i> L.	100
	<i>Zingiber officinale</i> Roscoe	100
	<i>Juniperus Phoenicea</i> L.	100
	<i>Artemisia herba-alba</i> Asso.	100
	<i>Matricaria chamomilla</i> L.	80
	<i>Punica granatum</i> L.	67
	<i>Rhamnus alaternus</i> L.	67
SD	<i>Curcuma longa</i> L.	67
	<i>Thymus vulgaris</i> L.	100
	<i>Origanum majorana</i> L.	50
Can	<i>Eruca sativa</i> L.	50
	<i>Carum carvi</i> L.	50
ESD	<i>Thapsia garganica</i> L.	33
	<i>Marrubium vulgare</i> L.	100
	<i>Zingiber officinale</i> Roscoe	100
	<i>Juniperus phoenicea</i> L.	100
	<i>Artemisia herba-alba</i> Asso.	100
	<i>Matricaria chamomilla</i> L.	40
	<i>Ziziphus spina-christi</i> (L.) Desf.	50
	<i>Pimpinella anisum</i> L.	17
	<i>Saccocalyx satyroides</i> Coss. and Durieu.	100
	RTD	<i>Marrubium vulgare</i> L.
<i>Zingiber officinale</i> Roscoe		100
<i>Glycyrrhiza glabra</i> L.		67
<i>Juniperus phoenicea</i> L.		100
<i>Artemisia herba-alba</i> Asso.		100
SMSD	<i>Pinus maritima</i> L.	50
	<i>Calendula arvensis</i> M.Bieb.	50
	<i>Echinops spinosissimus</i> Turra.	67
	<i>Tussilago farfara</i> L.	100
	<i>Echinops ritro</i> L.	100
CVSD	<i>Myrtus nivellei</i> Batt. and Trab.	51
	<i>Crataegus azarolus</i> L.	50
GH	<i>Nicotiana tabacum</i> L.	50
	<i>Pistacia lentiscus</i> L.	53
HC	<i>Carthamus tinctorius</i> L.	50
	<i>Carduus nutans</i> L.	100
	<i>Daphne gnidium</i> L.	69
NS	<i>Crocus sativus</i> L.	53
	<i>Eriobotrya japonica</i> (Thunb.) Lindl.	67
SRP	<i>Asarum europaeum</i> L.	100
	<i>Hyacinthus orientalis</i> L.	80
	<i>Marrubium vulgare</i> L.	100
	<i>Zingiber officinale</i> Roscoe	100
	<i>Juniperus phoenicea</i> L.	100
ID	<i>Artemisia herba-alba</i> Asso.	100
	<i>Ulmus rubra</i> Muhl.	50
P	<i>Artemisia campestris</i> L.	100
	<i>Cichorium alatum</i> Hochst. and Steud.	100
HSD	<i>Salvia hispanica</i> L.	100
	<i>Vitis vinifera</i> L.	50
	<i>Rubia tinctorum</i> L.	33
	<i>Urtica dioica</i> L.	34
USD	<i>Nitraria retusa</i> (Forssk.) Asch.	50

in Africa owing to their pharmacological effects offering a cheap therapeutic alternative (Sawadogo et al., 2012). Furthermore, leaves, aerial parts, and seeds were the most frequently used parts by local healers. Our results confirm the dominance of leaves as the most common used important plants' part used in

local phytotherapy as has been demonstrated in Algeria (Benarba, 2015; Benarba, 2016; Bouasla and Bouasla 2017; Miara et al., 2018; Taibi et al., 2020) and neighboring countries such as Mauritania (Yeboouk et al., 2020), Morocco (Barkaoui et al., 2017; Skalli et al., 2019), or Italy (Leto et al., 2013). The dominance of leaves in most of the ethnobotanical studies could be explained by their ease collecting and abundance besides the fact that they are considered the site of photosynthesis and therefore of bioactive molecules.

Our results showed that the traditional healers used different preparation methods, including decoction, infusion, paste, or maceration. Decoction was found to be the preferred method. Similar results were found in previous ethnobotanical studies (Benarba, 2015; Merrouni and Elachouri, 2020). In fact, decoction and infusion were found to be the most used in the recent ethnobotanical studies in Algeria (Benarba et al., 2015; Benarba, 2016; Mechaala et al., 2021; Zatout et al., 2021) and neighboring countries such as Tunisia, Egypt, Spain, and Italy in Africa and in Europe (Giday et al., 2009; Benitez et al., 2010; Amri and Kisangau, 2012; Menale et al., 2016; Savić et al., 2019). The dominance of decoction or infusion could be explained by the disinfection potential of heating besides its extraction enhancing effects (Benarba, 2015).

We also found that oral ingestion was the most frequently used mode of administration, followed by external application, steam, and nasal inhalation. Our findings are consistent with those we previously reported in South-West Algeria (Benarba, 2016), North-West Algeria (Benarba, 2015), and Extreme-West Algeria (Tlemcen) (Zatout et al., 2021). Likewise, oral and topical applications were found to be the most frequently used administration methods used by local healers or populations in other regions in Algeria (Hammiche and Maiza, 2006; Boudjelal et al., 2013; Sarri et al., 2014; Miara et al., 2018) and neighboring countries (Mrabti et al., 2019; Fakchich and Elachouri, 2014; Benitez et al., 2010). In this same line, oral and topical administrations are frequently used in traditional medicine. The choice of administration routes is based on the pharmacological effect of each species, the therapy target, duration, and the limitation of treatment to a precise area (Sargin et al., 2015; Benarba, 2016).

The traditional healers in the study areas reported that 64% of medicinal species were mixed with other medicinal plants, whereas 43% of herbal mixtures were prepared by adding different adjuvants with a dominance of honey, olive oil, animal fat, or vinegar. In concordance with our findings, several ethnobotanical investigations carried out in Algeria demonstrated that honey was the adjuvant most frequently added to prepare medicinal herbal mixtures (Benarba, 2016; Ouelbani et al., 2016; Zatout et al., 2021). Our findings are also in perfect consistency with those reported in other regions around the world (Yabesh et al., 2014; Amri and Kisangau, 2012; Pranskuniene et al., 2016). These ingredients could enhance the plant effect, maintain the blend texture, and facilitate the treatment administration. To the best of our knowledge, some adjuvants were not previously mentioned, such as tar and litharge.

TABLE 7 | List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration	
Amaranthaceae	<i>Amaranthus spinosus</i> L. (LRSBG/AB/20/067)	القطفية سالف العروس	Aerial part	SRP: 1* infertility	Decoction	Oral/topical	
	<i>Haloxylon salicornicum</i> (Moq.) Bunge ex Boiss. (LRSBG/AB/20/068)	رمث اللحم او تاسايت	Leaves	Can: 1* cancer P: 1* poisoning	Raw Decoction	Oral Oral	
	<i>Atriplex halimus</i> L. (LRSBG/AB/20/069)	القطف او السرمق، الملوخ	Leaves	Can: 3* uterine cysts and tumors Breast cysts and tumors Cancer	Decoction Decoction Maceration	Oral Oral Oral	
Amaryllidaceae	<i>Allium sativum</i> L. (LRSBG/AB/20/072)	الثوم	Bulb	RTD: 5* asthma Chest and lung diseases Cough Nasal-lung inflammation	Decoction Decoction Raw Maceration/ decoction	Topical Topical Topical Topical/oral Oral	
				SRP: 2* infertility GH: 2* tonsillitis Earache and deafness GISD: 2* jaundice/icterus Liver diseases HC: 1* alopecia areata SD: 1* boils Can: 1* skin pimples and tumors	Decoction Decoction Decoction Raw Raw Frying Frying Decoction	Topical Topical Topical Topical Topical Topical Topical Oral	
				SRP: 3* infertility + uterine problems SD: 2* boils and head ulcers Can: 1* skin pimples and tumors GISD: 1* jaundice/icterus	Decoction Decoction Raw Raw	Topical Topical Topical Topical	
				RTD: 1* pulmonary-breathing problem GISD: 4* heartburn stomach ache Diarrhea GH: 2* mouth ulcer Earache and deafness GH: 2* tonsillitis	Raw Raw Decoction Decoction Decoction Decoction Infusion/raw Raw/decoction	Topical Oral Oral Oral Oral Topical Oral/topical	
				SMSD: 1* arthritis SRP: 2* infertility GISD: 2* stomach ache Jaundice/icterus GH: 1* fever HSD: 1* jaundice/icterus	Infusion Raw/decoction Maceration Decoction Decoction	Topical/oral Topical Oral Oral Oral/topical	
				ESD: 1* diabetes CVSD: 1* cholesterol KD: 1* kidney failure USD: 1* bladder disease RTD: 1* asthma GISD: 1* stomach ache NS: 1* insomnia SD: 1* skin disease SMSD: 2* arthritis SRP: 1* infertility	Decoction Decoction Decoction Decoction Decoction Maceration Decoction Infusion Decoction	Oral Oral Oral Oral Topical Oral Oral Topical Oral/topical Topical	
				SD: 2* limb swelling RTD: 1* chest and lung diseases	Infusion Infusion	Topical Topical	
				GISD: 3* IBS stomach ache Flatulence NS: 1* headache ESD: 1* goiter	Infusion Maceration Decoction Infusion Raw	Oral Oral Oral Oral Oral	
				Anacardiaceae	<i>Pistacia lentiscus</i> L. (LRSBG/AB/20/123)	المصطكى أو المصطكة او الضرو	Leaves/wax
RTD: 1* pulmonary-breathing problem GISD: 4* heartburn stomach ache Diarrhea GH: 2* mouth ulcer Earache and deafness GH: 2* tonsillitis	Raw Raw Decoction Decoction Decoction Decoction Infusion/raw Raw/decoction	Oral Oral Oral Oral Oral Topical Oral/topical					
Apiaceae	<i>Ferula assa-foetida</i> L. (LRSBG/AB/20/145)	الكلخ او الحلتيت	Whole plant	GH: 2* tonsillitis	Infusion/raw Raw/decoction	Topical Oral/topical	
				SMSD: 1* arthritis SRP: 2* infertility GISD: 2* stomach ache Jaundice/icterus GH: 1* fever HSD: 1* jaundice/icterus	Infusion Raw/decoction Maceration Decoction Decoction	Topical/oral Topical Oral Oral Oral/topical	
	<i>Ammoides pusilla</i> (Brot.) Breistr. (LRSBG/AB/20/002)	التونخة أو النانخة	Aerial part		ESD: 1* diabetes CVSD: 1* cholesterol KD: 1* kidney failure USD: 1* bladder disease RTD: 1* asthma GISD: 1* stomach ache NS: 1* insomnia SD: 1* skin disease SMSD: 2* arthritis SRP: 1* infertility	Decoction Decoction Decoction Decoction Decoction Maceration Decoction Infusion Decoction	Oral Oral Oral Oral Topical Oral Oral Topical Oral/topical Topical
					SD: 2* limb swelling RTD: 1* chest and lung diseases	Infusion Infusion	Topical Topical
	<i>Pimpinella anisum</i> L. (LRSBG/AB/20/003)	حبة الحلاوة أو الينسون	Fruits		GISD: 1* stomach ache NS: 1* insomnia SD: 1* skin disease SMSD: 2* arthritis SRP: 1* infertility	Maceration Decoction Infusion Decoction	Oral Oral Topical Oral/topical Topical
					SD: 2* limb swelling RTD: 1* chest and lung diseases	Infusion Infusion	Topical Topical
	<i>Coriandrum sativum</i> L. (LRSBG/AB/20/004)	القزبر أو الكزبرة	Aerial part		GISD: 1* stomach ache NS: 1* insomnia SD: 1* skin disease SMSD: 2* arthritis SRP: 1* infertility	Maceration Decoction Infusion Decoction	Oral Oral Topical Oral/topical Topical
					SD: 2* limb swelling RTD: 1* chest and lung diseases	Infusion Infusion	Topical Topical
	<i>Foeniculum vulgare</i> Mill. (LRSBG/AB/20/005)	البسباس	Seeds		GISD: 3* IBS stomach ache Flatulence NS: 1* headache ESD: 1* goiter	Infusion Maceration Decoction Infusion Raw	Oral Oral Oral Oral Oral
					تالغودة أو آكثار	Roots/seeds	

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration	
Apocynaceae	<i>Bunium mauritanicum</i> L. (LRSBG/AB/20/006)						
	<i>Carum carvi</i> L. (LRSBG/AB/20/007)	كروييا	Seeds	Can: 1* early stage cancer GISD: 1* stomach ache GH: 1* anxiety disorders and hypochondria	Decoction Maceration Raw	Raw Oral Topical	
	<i>Apium graveolens</i> L. (LRSBG/AB/20/008)	الكرفس	Leaves	SMSD: 1* bones pain SMSD: 2* osteoarthritis	Raw Decoction	Oral Oral/topical	
	<i>Thapsia garganica</i> L. (LRSBG/AB/20/009)	درياس أو بون افاع	Aerial part	RTD: 2* chest and lung diseases Can: 1* lung tumors	Maceration/ frying Raw	Topical/oral Topical	
	<i>Petroselinum crispum</i> (Mill.) Fuss. (LRSBG/AB/20/010)	البقدونس أو المعدنوس	Aerial part	KD: 1* urolithiasis GH: 1* mouth ulcer	Decoction Decoction	Oral Oral	
	<i>Nerium oleander</i> L. (LRSBG/AB/20/109)	الدفلة	Leaves	GH: 1* mouth ulcer Can: 1* skin pimples and tumors SD: 3* chalazion Tinea capitis and scalp ringworm	Decoction Burned Decoction Raw	Topical Topical Topical Topical	
	Araliaceae	<i>Panax ginseng</i> C.A.Mey. (LRSBG/AB/20/124)	الجتن سنغ أو الجتن سة	Aerial part	Urticaria Can: 1* stomach cancer SRP: 1* infertility GISD: 1* liver diseases	Maceration Maceration Raw Decoction	Topical Oral Oral Oral
		<i>Aristolochia longa</i> L. (LRSBG/AB/20/097)	أسارون	Leaves	HSD: 1* spleen diseases SRP: 1* uterine microbe and infections	Decoction Decoction	Oral Oral
	Aristolochiaceae	<i>Asarum europaeum</i> L. (LRSBG/AB/20/096)	أسارون	Leaves	HC: 1* baldness Can: 3* breast cancer	Raw Raw	Topical Topical
		<i>Aristolochia longa</i> L. (LRSBG/AB/20/097)	برس طم – برزطم	Stalk	Legs cancer Cancer	Raw Raw	Topical Oral
Asparagaceae	<i>Hyacinthus orientalis</i> L. (LRSBG/AB/20/098)	الخزامى	Flowers	SRP: 4* infertility Uterine problems USD: 2* urinary tract infection/inflammation Bladder disease	Raw/decoction Decoction Decoction Maceration Decoction	Topical Topical Oral Oral/topical	
Asteraceae	<i>Drimia maritima</i> (L.) Stearn. (LRSBG/AB/20/099)	البصل البري أو بصل الحلوف	Bulb	GH: 1* fever SRP: 2* infertility Uterine problems	Decoction Decoction Decoction	Topical Topical Topical	
	<i>Cynara scolymus</i> L. (LRSBG/AB/20/156)	العسلوج او ساق الخرشوف	Stalk	HC: 1* alopecia areata GISD: 1* hemorrhoids	Decoction Decoction	Topical Oral	
	<i>Arctium atlanticum</i> (Pomel) H.Lindb. (LRSBG/AB/20/119)	الأرقطيون	Leaves/ capitulum	SD: 1* boils Can: 1* skin pimples and tumors	Frying Frying	Topical Topical	
	<i>Cirsium creticum</i> (Lam.) d'Urv. (LRSBG/AB/20/160)			GISD: 1* hemorrhoids	Decoction	Topical/oral	
	<i>Carthamus tinctorius</i> L. (LRSBG/AB/20/011)	العصفور أو الجرجوم	Capitulum	GH: 1* anxiety disorders and hypochondria	Raw	Oral/topical	
	<i>Dittrichia viscosa</i> (L.) Greuter (LRSBG/AB/20/012)	مقرمان	Aerial part	SD: 2* festering wounds Skin diseases	Maceration/raw Maceration	Oral/topical Topical	
	<i>Tussilago farfara</i> L. (LRSBG/AB/20/013)	خشيشة السعال أو تافيرا	Aerial part	SMSD: 2* osteoarthritis	Decoction	Oral/topical	
	<i>Echinops ritro</i> L. (LRSBG/AB/20/014)	تاسكرا أو الشوك الأزرق ، و أبونقار	Aerial part	SMSD: 2* osteoarthritis	Decoction	Oral/topical	
	<i>Saussurea costus</i> (Falc.) Lipsch. (LRSBG/AB/20/015)	القسط الهندي	Roots	SRP: 1* infertility	Infusion	Topical	
	<i>Silybum marianum</i> (L.) Gaertn. (LRSBG/AB/20/016)	الخرفيش	Leaves	Can: 2* breast cancer Legs cancer	Raw	Topical	
Asteraceae	<i>Centaurea acaulis</i> L. (LRSBG/AB/20/017)	سنتوري اوالقنطريون	Aerial part	Can: 4* breast cancer Legs cancer Can: 4* tumors and skin pimples	Raw	Topical	
		المطهر	Capitulum	Can: 2* breast cancer	Raw	Topical	

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration
	<i>Inula helenium</i> L. (LRSBG/AB/20/018)			Legs cancer		
	<i>Calendula arvensis</i> M.Bieb. (LRSBG/AB/20/019)	عين البقر	Capitulum	RTD: 1* pneumonia	Decoction	Oral
	<i>Artemisia campestris</i> L. (LRSBG/AB/20/020)	التگوفت	Leaves	P: 1* scorpion sting	Raw	Topical
	<i>Anacyclus valentinus</i> L. (LRSBG/AB/20/021)	القرطوفة	Aerial part	HSD: 1* anemia	Decoction	Oral
	<i>Taraxacum officinale</i> (L.) Weber ex F.H.Wigg. (LRSBG/AB/20/022)	هندباء البر الي عصب	Aerial part	Can: 2* breast cancer Legs cancer	Raw	Topical
	<i>Anacyclus pyrethrum</i> (L.) Lag. (LRSBG/AB/20/023)	تقنطيس أوعاقر قرا	Leaves	RTD: 1* pulmonary- breathing problem SRP: 1 infertility SMSD: 2* arthritis	Raw Raw Maceration	Topical Oral Topical and oral
	<i>Cichorium alatum</i> Hochst. and Steud. (LRSBG/AB/20/024)	تمرزوق. العلت	Aerial part/ roots	USD: 2* cystolithiasis Bladder disease GISD: 2* hemorrhoids liver diseases Can: 4* breast cancer Legs cancer KD: 1* urolithiasis HSD: 1* spleen diseases	Decoction Decoction Raw Raw Decoction Decoction Decoction Decoction	Oral Oral Topical Topical Oral Oral Oral Oral
	<i>Matricaria chamomilla</i> L. (LRSBG/AB/20/025)	البابونج	Capitulum	GISD: 4* liver diseases IBS stomach ache Heartburn HSD: 1* spleen diseases SD: 1* skin ulcers Can: 2* breast cancer Legs cancer USD: 2* urinary tract infection/inflammation Bladder diseases NS: 1* insomnia	Decoction Decoction Raw Raw Decoction Decoction Decoction Decoction Infusion Infusion	Oral Oral Topical Topical Topical Topical Topical Oral Oral
	<i>Carlina gummifera</i> (L.) Less. (LRSBG/AB/20/026)	الأداد	Capitulum leaves/roots	SRP: 2* infertility Uterine problems USD: 2* urinary tract infection and bladder disease SMSD: 1* osteoarthritis	Decoction Decoction Decoction Decoction Decoction	Topical Topical Topical Topical Oral/topical
	<i>Echinops spinosissimus</i> Turra (LRSBG/AB/20/027)	شوك الجمل	Aerial part	Can: 1* skin pimples and tumors	Decoction Decoction	Oral
	<i>Artemisia herba-alba</i> Asso. (LRSBG/AB/20/028)	الشحج	Aerial part	GH: 1* tonsillitis Can: 2* skin cancer Breast cancer ESD: 2* diabetes CVSD: 1* cholesterol KD: 1* kidney failure USD: 1* bladder disease RTD: * asthma GISD: 2* IBS and liver diseases SRP: 2* infertility and uterine problems	Infusion Raw Maceration Decoction Decoction Decoction Decoction Decoction Decoction Decoction	Topical Topical Oral Oral Oral Oral Topical Topical/oral Topical Topical
	<i>Carduus nutans</i> L. (LRSBG/AB/20/104)	شوك المرحني	Capitulum	HC: 1* alopecia areata	Raw	Topical
Berberidaceae	<i>Berberis vulgaris</i> L. (LRSBG/AB/20/070)	عود الريح	Roots/bark	SRP: 1* infertility	Decoction	Topical
	<i>Mahonia aquifolium</i> (Pursh) Nutt. (LRSBG/AB/20/071)	اريغون	Whole plant	Can: 2* breast cancer and legs cancer	Raw	Topical
Betulaceae	<i>Betula pendula</i> Roth (LRSBG/AB/20/149)	عصير الشجر (اللباتولية)	Bark	GISD: 1* ulcers	Infusion	Oral
Boraginaceae		عشبة الثور	Aerial part	SRP: 1* infertility	Decoction	Oral

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration	
Brassicaceae	<i>Borago officinalis</i> L. (LRSBG/AB/20/165)						
	<i>Armoracia rusticana</i> P.Gaertn., B.Mey. and Scherb. (LRSBG/AB/20/085)	فجل العود او الخيول	Aerial part	GH: 2* mouth ulcer Halitosis	Decoction Decoction	Topical Topical	
	<i>Sinapis arvensis</i> L. (LRSBG/AB/20/086)	الخردل	Seeds	RTD: 1* chest and lung diseases	Decoction	Inhalation	
	<i>Eruca sativa</i> Mill. (LRSBG/AB/20/087)	الكثأ أو الجرجير	Aerial part	SD: 1* boils Can: 1* skin pimples and tumors	Frying Frying	Topical Topical	
Bursaceae	<i>Lepidium sativum</i> L. (LRSBG/AB/20/088)	حب الرشاد أو الحبة الحمرء الحرف	Seeds	SRP: 1* breast milk outage RTD: 1* chest and lung diseases Can: 1* cancer GISD: 2* colitis Flatulence	Maceration Raw Raw Raw Decoction	Oral Oral Oral Oral Oral	
	<i>Anastatica hierochuntica</i> L. (LRSBG/AB/20/154)	عشبة مريم	Leaves	GISD: 1* gastrointestinal diseases	Decoction	Oral	
	<i>Boswellia ameero</i> Balf.f. (LRSBG/AB/20/074)	اللبان	Resin	RTD: 1* chest and lung diseases	Maceration	Topical	
	<i>Commiphora myrrha</i> (Nees) Engl. (LRSBG/AB/20/075)	المر	Wax	Can: 2* breast cancer Legs cancer	Raw Raw	Topical Topical	
Cactaceae	<i>Opuntia ficus-indica</i> (L.) Mill. (LRSBG/AB/20/126)	التين الشوكي الكرموس	Leaves	GISD: 1* liver diseases NS: 2* headache and dizziness	Maceration Decoction	Oral Oral	
Cannabaceae	<i>Humulus lupulus</i> L. (LRSBG/AB/20/153)	جنجل	Leaves	HC: 3* alopecia areata Baldness NS: 1* headache GISD: 2* hemorrhoids ID: 2* mouth and ears infections	Raw Raw Raw Raw	Topical Topical Topical Topical	
	Cucurbitaceae	<i>Cucurbita maxima</i> Duchesne (LRSBG/AB/20/100)	القرع البلدي	Seeds	NS: 1* migraine	Decoction	Inhalation
		<i>Citrullus colocynthis</i> (L.) Schrad (LRSBG/AB/20/101)	الحنظل	Fruits	SD: 1* skin ulcers and leprosy GISD: 1* constipation Can: skin cancer	Decoction Decoction Maceration	Oral Oral Oral/topical
Cupressaceae	<i>Juniperus foetidissima</i> Willd. (LRSBG/AB/20/089)	العزعر	Aerial part	GISD: 5* IBS and stomach ache Heartburn	Decoction Decoction	Oral Oral	
	Cyperaceae	<i>Cupressus sempervirens</i> L. (LRSBG/AB/20/090)	السرو	Leaves	RTD: 2* chest and lung diseases Can: 5* breast cancer Legs cancer SD: 1* urticaria SRP: 5* infertility	Decoction Decoction Raw Raw Maceration Decoction	Oral Oral Topical Topical Topical Topical
		<i>Cyperus esculentus</i> L. (LRSBG/AB/20/111)	حب عزي	Seeds	USD: 1* bladder disease SMSD: 1* arthritis HSD: 1* anemia	Decoction Infusion Infusion	Oral Topical Oral
Ephedraceae	<i>Ephedra alata</i> Decne. (LRSBG/AB/20/127)	العلندي	Aerial part	Can: 1* breast cysts and breast tumors	Raw	Topical	
Equisetaceae	<i>Equisetum arvense</i> L. (LRSBG/AB/20/128)	ذيل الحصان ، وذب الخيول	Aerial part	SMSD: 1* arthritis	Decoction	Oral	
Fabaceae	<i>Ceratonia siliqua</i> L. (LRSBG/AB/20/162)	الخروب	Seeds	GISD: 1* gastrointestinal diseases	Raw	Oral	
	<i>Glycyrrhiza glabra</i> L. (LRSBG/AB/20/029)	العرقسوس	Roots	RTD: 2* cough Lung filtering/smoker HSD: 1* spleen diseases NS: 1* head problems Psychosis	Decoction Infusion Decoction Decoction Raw	Oral Oral Oral Oral Topical	
	<i>Senna alexandrina</i> Mill. (LRSBG/AB/20/030)	السنا امكي	Leaves	SD: 1* skin diseases GISD: 4* colitis Flatulence	Maceration Infusion/ decoction	Topical Oral	

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration
				IBS Constipation NS: 1* head problems Psychosis SD: 1* lichen	Decoction Infusion	Topical Oral Topical
	<i>Acacia senegal</i> (L.) Willd. (LRSBG/AB/20/031)	الصمغ العربي	Gum			
	<i>Acacia gummifera</i> Willd. (LRSBG/AB/20/032)	أم غيلا	Leaves	Can: 3* cancer, stomach cancer, and liver cancer GH: 1* incurable diseases	Decoction	Oral
	<i>Trigonella foenum-graecum</i> L. (LRSBG/AB/20/033)	الحلبة	Seeds	HSD: 1* anemia Can: 5* breast cancer Legs cancer Cancer Skin pimples Tumors SMSD: 2* fracture back pain GISD: 1* stomach ache RTD: 1* chest and lung diseases SRP: 2* infertility GH: 1* anxiety disorders and hypochondria	Decoction Maceration Raw Raw Raw Maceration Raw Raw Decoction/raw	Oral Oral Topical Topical Oral Oral Topical Oral Oral/topical Topical Topical
	<i>Mellilotus officinalis</i> (L.) Pall. (LRSBG/AB/20/034)	المنذوق إكليل الملك	Aerial part	RTD: 1* chest and lung diseases GISD: 1* IBS SRP: 1* infertility	Infusion Decoction Raw	Topical Oral Oral
Fagaceae	<i>Lupinus micranthus</i> Guss. (LRSBG/AB/20/035)	الترمز المر الدقيق	Fruits			
	<i>Quercus faginea</i> Lam. (LRSBG/ AB/20/110)	العفص	Seeds	SRP: 1* uterine microbe	Decoction	Topical/oral
Gentianaceae	<i>Gentiana acaulis</i> L. (LRSBG/AB/ 20/112)	كف الذئب او الجنطيانا	Leaves/ flowers	Can: 1* breast cancer Legs cancer	Raw	Topical
Iridaceae	<i>Crocus sativus</i> L. (LRSBG/AB/ 20/113)	الزعفران	Stamen	SD: 1* albinism NS: 1* headache	Raw Raw	Topical Topical
Juglandaceae	<i>Juglans regia</i> L. (LRSBG/AB/ 20/159)	الديرم	Aerial part/ park	GISD: 1* gallstones	Decoction	Oral
Lamiaceae	<i>Lavandula angustifolia</i> Mill. (LRSBG/AB/20/163)	ضرم الحار	Aerial parts	GISD: 1* hemorrhoids	Raw	Topical
	<i>Mentha pulegium</i> L. (LRSBG/ AB/20/036)	النعناع الأوروبي الفلوي	Aerial part	RTD: 1* chest and lung diseases USD: 1* urinary tract infection/inflammation SRP: 1* infertility NS: 1* insomnia GISD: 1* stomach ache ESD: 2* diabetes SD: 1* burns	Decoction Decoction Decoction Decoction Infusion Frying	Oral Oral Oral/topical Oral Oral Topical
	<i>Saccocalyx satuireioides</i> Coss. and Durieu (LRSBG/AB/20/037)	يزير الببل	Leaves			
	<i>Thymus capitatus</i> (L.) Hoffmanns. and Link. (LRSBG/ AB/20/038)	صعتر أو الزعتر	Aerial part	SD: 1* burns	Frying	Topical
	<i>Mentha arvensis</i> L. (LRSBG/AB/ 20/039)	النعناع	Aerial part	CVSD: 1* cardiovascular diseases SRP: 1* infertility RTD: 1* chest and lung diseases GISD: 1* IBS GH: 1* anxiety disorders and hypochondria NS: 2* head problems Psychosis insomnia SRP: 4* infertility Uterine problems GISD: 1* IBS USD: 2* urinary tract infection/inflammation Bladder disease GH: 2* fever NS: 1* dizziness	Raw Raw Raw Decoction Raw Raw Decoction Decoction Decoction Decoction Infusion Decoction Maceration	Oral Topical Oral Oral Oral Oral Oral Topical Topical Oral Oral/topical Topical
	<i>Ocimum basilicum</i> L. (LRSBG/ AB/20/040)	الريحان	Leaves			

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration
	<i>Melissa officinalis</i> L. (LRSBG/AB/20/041)	مليسا	Leaves	CVSD: 1* hypertension NS: 1* insomnia	Infusion Decoction	Topical Oral
	<i>Rosmarinus officinalis</i> L. (LRSBG/AB/20/042)	إكليل الجبل	Aerial part	CVSD: 1* cholesterol GISD: 2* IBS jaundice/ icterus	Decoction Decoction Infusion	Oral Oral Oral
	<i>Origanum majorana</i> L. (LRSBG/AB/20/043)	المردقوش	Aerial part	SD: 1* limb swelling	Maceration	Topical
	<i>Clinopodium nepeta</i> (L.) Kuntze. (LRSBG/AB/20/044)	النباطة أو الفوننج الجبلي	Aerial part	GISD: 1* IBS ESD: 1* diabetes CVSD: 1* cholesterol KD: 1* kidney failure USD: 1* bladder disease	Decoction Decoction Decoction Decoction Decoction	Oral Oral Oral Oral Oral
	<i>Lavandula stoechas</i> L. (LRSBG/AB/20/045)	الحلحال أو أسنان داود	Aerial part	ESD: 1* diabetes CVSD: 1* cholesterol KD: 1* kidney failure USD: 1* bladder diseases	Decoction Decoction Decoction Decoction	Oral Oral Oral Oral
	<i>Thymus vulgaris</i> L. (LRSBG/AB/20/046)	الزعتر البري	Aerial part	HSD: 1* blood purify GISD: 1* IBS jaundice/ icterus SRP: 2* infertility HC: 1* baldness Can: 1* breast cancer legs cancer USD: 1* urinary tract infection GH: 1* fever SD: 4* skin diseases and ulcer	Decoction Decoction/raw Raw Raw Raw Decoction Decoction Decoction Infusion Decoction	Topical Oral Topical Topical Topical Oral Oral/topical Topical Oral Oral
	<i>Salvia officinalis</i> L. (LRSBG/AB/20/047)	المريمية أو القيصع المخزني	Leaves	CVSD: 1* cholesterol	Decoction	Oral
	<i>Salvia hispanica</i> L. (LRSBG/AB/20/048)	بذور شي	Seeds	HSD: 1* anemia	Raw	Oral
	<i>Teucrium spinosum</i> L. (LRSBG/AB/20/049)	الجعدة	Aerial part	HSD: 1* blood purify GISD: 1* ulcers CVSD: 1* diabetes RTD: 1* chest and lung diseases	Maceration Raw Decoction Raw	Oral Topical Oral Topical
	<i>Mentha aquatica</i> L. (LRSBG/AB/20/050)	حبق الماء	Aerial part	GH: 1* anxiety disorders and hypochondria	Raw	Oral
	<i>Marrubium vulgare</i> L. (LRSBG/AB/20/051)	المريوت	Aerial part	Can: 3* skin pimples and tumors Skin cancer Breast cancer SRP: 4* infertility Uterine problems RTD: 1* pulmonary- Breathing problem Can: 3* breast tumor Uterus tumor Gum tumor NS: 1* sciatica CVSD: 1* cholesterol	Raw Raw Decoction/raw Decoction Decoction Frying/ decoction Decoction Decoction Raw Infusion	Topical Topical Topical/oral Topical Topical inhalation/ topical Oral Oral Oral Oral Oral
	<i>Vitex agnus-castus</i> L. (LRSBG/AB/20/052)	كف مريم	Leaves	Can: 3* breast tumor Uterus tumor Gum tumor NS: 1* sciatica CVSD: 1* cholesterol	Decoction Decoction Decoction Raw Infusion	Oral Oral Oral Oral Oral
	<i>Ajuga iva</i> (L.) Schreb. (LRSBG/AB/20/053)	الشندقورة	Leaves	CVSD: 1* cholesterol	Infusion	Oral
	<i>Teucrium polium</i> L. (LRSBG/AB/20/054)	خياطة الجراح	Aerial part	GISD: 1* ulcers	Raw	Oral
	<i>Mentha rotundifolia</i> (L.) Huds. (LRSBG/AB/20/055)	تيمرداد	Aerial part	GISD: 1* IBS	Decoction	Oral
Lauraceae	<i>Cinnamomum camphora</i> (L.) J.Presl. (LRSBG/AB/20/076)	الكافور	Wax	NS: 1* migraine	Infusion	Topical
	<i>Cinnamomum verum</i> J.Presl. (LRSBG/AB/20/077)	قرفة	Bark	NS: 2* migraine USD: 1* urinary tract infection/inflammation GISD: 1* ulcers	Raw Decoction	Oral/topical Oral
	<i>Laurus nobilis</i> L. (LRSBG/AB/20/078)	الرندي	Leaves	GISD: 1* ulcers	Decoction	Oral

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration			
Linaceae	<i>Linum usitatissimum</i> L. (LRSBG/AB/20/130)	زريعة الكتاتان	Seeds	GISD: 1* IBS	Decoction	Oral			
				RTD: 1* chest and lung diseases	Maceration	Topical			
				ESD: 1* goiter	Raw	Oral			
				GH: 1* hoarseness and sore throat	Raw	Oral			
Lythraceae	<i>Lawsonia inermis</i> L. (LRSBG/AB/20/079)	الحناء	Leaves	Can: 1* Skin pimples and tumors	Decoction	Topical			
				SMSD: 1* fracture	Raw	Topical			
				SD: 3* urticaria	Maceration	Topical			
				Warts	Burned	Topical			
				Head ulcers	Raw	Topical			
				GH: 1* anxiety disorders and hypochondria	Raw	Topical			
Malvaceae	<i>Hibiscus sabdariffa</i> L. (LRSBG/AB/20/131)	لكرديّة. او الورد الحمر	Flowers	CVSD: 1* hypertension	Infusion	Oral			
Moraceae	<i>Ficus carica</i> L. (LRSBG/AB/20/155)	التيّن	Fruits	RTD: 2* chest and lung diseases	Decoction	Oral			
				Cough					
Moringaceae	<i>Moringa oleifera</i> Lam. (LRSBG/AB/20/132)	المورينج. او عشبّة الحياءة	Whole plant	GISD: 3* jaundice/icterus liver diseases	Raw/infusion	Oral			
				GH: 1* incurable diseases	Maceration	Oral			
Myristicaceae	<i>Myristica fragrans</i> Houtt. (LRSBG/AB/20/114)	جوزة الطيب	Seeds	GISD: 1* IBS	Infusion	Oral			
				NS: 1* head problems	Raw	Topical			
Myrtaceae	<i>Myrtus communis</i> L. (LRSBG/AB/20/151)	القمّام	Leaves	RTD: 2* chest and lung diseases	Infusion	Topical			
				<i>Myrtus nivellei</i> Batt. and Trab. (LRSBG/AB/20/167)	قمّام الصحرّاء	Leaves	CVSD: 1* clogged arteries	Decoction	Oral
				<i>Syzygium aromaticum</i> (L.) Merr. and L.M.Perry. (LRSBG/AB/20/081)			القرنفل	Flower buds	NS: 1* migraine
				SRP: 3* infertility	Decoction/raw	Topical/oral			
Nitrariaceae	<i>Eucalyptus globulus</i> Labill. (LRSBG/AB/20/082)	شجرة ليهود	Leaves	RTD: 1* chest and lung diseases	Raw	Oral			
				USD: 1* urinary tract infection/inflammation	Decoction	Oral			
				GH: 1* earache and deafness	Decoction	Topical			
				SD: 1* skin diseases, ulcer	Infusion	Topical			
				SRP: 1* infertility	Decoction	Topical			
				<i>Nitraria retusa</i> (Forssk.) Asch. (LRSBG/AB/20/161)	شجرة ليهود	Leaves	USD: 1* bladder disease	Infusion	Oral
Can: 1* tumors	Infusion	Oral							
Oleaceae	<i>Peganum harmala</i> L. (LRSBG/AB/20/133)	الحمرّل	Seeds	GISD: 1* IBS	Decoction	Oral			
				SRP: 1* infertility	Raw	Topical			
				RTD: 2* chest and lung diseases	Raw	Oral			
				Nasal-lung inflammation	Decoction	Inhalation			
				GH: 1* fever	Decoction	Oral			
				USD: 1* urinary tract infection/inflammation	Decoction	Oral			
Oleaceae	<i>Olea oleaster</i> Hoffmanns. and Link (LRSBG/AB/20/094)	الزبوج	Leaves	GH: 1* mouth ulcer	Decoction	Topical			
				<i>Olea europaea</i> L. (LRSBG/AB/20/095)	الزيتون	Leaves fruits	GH: 1* mouth ulcer and halitosis	Decoction	Topical
				NS: 1* head problems			Raw	Topical	
Orobanchaceae	<i>Cistanche tubulosa</i> (Schenk) Wight. (LRSBG/AB/20/134)	ذنون	Whole plant	Psychosis					
				GISD: 1* colitis	Raw	Oral			
Papaveraceae	<i>Hypecoum procumbens</i> L. (LRSBG/AB/20/135)	جهديرة (الخشخاشية)	Aerial part	Can: 1* skin pimples and tumors	Raw	Topical			
Parmeliaceae	<i>Evernia prunastri</i> L. (LRSBG/AB/20/158)	لحيّة شيوخ	Lichens	Can: 1* cancer	Decoction	Oral			
				GISD: 1* gastrointestinal diseases	Decoction	Oral			
				NS: 1* epilepsy	Decoction	inhalation			

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration
Paronychioideae	<i>Telephium imperati</i> L. (LRSBG/AB/20/150)	تسمرغيت	Aerial part	GH: 1* mouth ulcer HSD: 1* anemia	Infusion	Topical/oral
Pedaliaceae	<i>Sesamum indicum</i> L. (LRSBG/AB/20/136)	السمس م أو ج لجان	Seeds	SRP: 2* infertility Breast milk outage GH: 1* mouth ulcer	Raw Maceration Decoction	Oral Oral Oral
Phyllanthaceae	<i>Phyllanthus niruri</i> L. (LRSBG/AB/20/137)	الأم لجان	Leaves	Can: 1* cancer RTD: 1* cough	Raw/decoction	Oral
Pinaceae	<i>Pinus maritima</i> Aiton (LRSBG/AB/20/138)	الزني	Fruits	Can: 2* blood cancer Stomach cancer Liver cancer RTD: 1* chest and lung diseases	Decoction Decoction Decoction Maceration	Oral Oral Oral Topical
	<i>Pinus pinaster</i> Aiton (LRSBG/AB/20/152)	تايدة لجان شجرة الصنوبر البحري	Bark	GISD: 1* diarrhea	Raw	Oral
Piperaceae	<i>Piper cubeba</i> Bojer (LRSBG/AB/20/102)	الكبابة، حب العروس	Seeds	SRP: 1* infertility	Raw	Oral
	<i>Piper nigrum</i> L. (LRSBG/AB/20/103)	الفلفل الأسود	Seeds	GH: 1* earache and deafness	Decoction	Topical
Plantaginaceae	<i>Digitalis purpurea</i> L. (LRSBG/AB/20/115)	القمعية او الديدجيات	Flowers	CVSD: 1* cardiovascular diseases	Raw	Oral
Poaceae	<i>Cymbopogon schoenanthus</i> (L.) Spreng. (LRSBG/AB/20/091)	الإذخر أو الليمونية	Leaves	Can: 1* skin pimples and tumors	Decoction	Topical
	<i>Stipa tenacissima</i> L. (LRSBG/AB/20/092)	نبات الحلفاء	Leaves	CVSD: 1* cholesterol	Maceration	Oral
	<i>Hordeum vulgare</i> L. (LRSBG/AB/20/093)	الشعير الزرع	Seeds	SD: 1* burns	Frying	Topical
Poales	<i>Aristida pungens</i> Desf (LRSBG/AB/20/157)	الدرين	Stalk	HSD: 1* anemia	Decoction	Oral
Portulacaceae	<i>Portulaca oleracea</i> L. (LRSBG/AB/20/116)	البقلة او بندراق	Leaves	GISD: 1* stomach ache	Decoction	Oral
Punicaceae	<i>Punica granatum</i> L. (LRSBG/AB/20/080)	الرمان	Peels/fruits	GISD: 6* gastrointestinal diseases IBS Heartburn Stomach ache Diarrhea GH: 2* mouth ulcer Halitosis	Decoction Raw/decoction Stewing Raw Decoction Decoction	Oral Oral Oral Oral Oral Topical
	<i>Nigella sativa</i> L. (LRSBG/AB/20/139)	حبة البركة، أو الحبة السوداء، او السانوج	Seeds	NS: 1* headache NS: 1* migraine RTD: 1* chest and lung diseases Can: 3* cancer SMSD: 3* acute arthritis and gout SD: 2* itchy skin Limb swelling	Decoction Decoction Raw Raw Raw	Topical Inhalation Oral Oral Oral
Rhamnaceae	<i>Rhamnus alaternus</i> L. (LRSBG/AB/20/083)	أم ليلس أو مليلس أو عود الخيزر	Bark/leaves/flowers	GISD: 2* jaundice and icterus	Decoction	Oral
	<i>Ziziphus spina-christi</i> (L.) Desf. (LRSBG/AB/20/084)	النبق شجرة السدر	Fruits/leaves	GISD: 1* jaundice and icterus Can: 1* cancer SD: 1* skin diseases and ulcer	Raw Raw Decoction	Oral Oral Oral
Rosaceae	<i>Potentilla reptans</i> L. (LRSBG/AB/20/166)	حشيشة الخامسة	Leaves	SD: 2* itchy skin limb swelling	Raw Raw	Oral Oral
	<i>Prunus persica</i> (L.) Batsch. (LRSBG/AB/20/056)	الخوخ	Leaves	Can: 2* cancer SD: 1* limb swelling	Raw Infusion	Oral Topical
	<i>Alchemilla vulgaris</i> L. (LRSBG/AB/20/057)	رجل الأسد	Leaves	SD: 1* skin diseases and ulcer	Infusion	Topical
	<i>Crataegus azarolus</i> L. (LRSBG/AB/20/058)	الزعرور	Fruits/flowers	CVSD: 1* cardiovascular diseases NS: 2* headache	Raw Decoction	Oral Oral

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration
	<i>Eriobotrya japonica</i> (Thunb.) Lindl (LRSBG/AB/20/059)	النبيذلة أو البشملة	Leaves	Dizziness NS: 2* headache	Decoction	Oral
	<i>Potentilla erecta</i> (L.) Raeusch. (LRSBG/AB/20/060)	لنجبار	Roots	Dizziness SRP: 1* breast milk outage RTD: 1* chest and lung diseases	Maceration Raw	Oral Oral
	<i>Prunus domestica</i> L. (LRSBG/AB/20/061)	البرقوق	Fruits	GISD: 2* jaundice Liver diseases	Infusion Decoction	Oral Oral
	<i>Prunus amygdalus</i> L. (LRSBG/AB/20/062)	اللوز	Fruits	SRP: 1* infertility	Decoction	Oral
	<i>Cydonia oblonga</i> Mill. (LRSBG/AB/20/063)	السفرجل	Fruits	CVSD: 1* cardiovascular diseases	Raw	Oral
Rubiaceae	<i>Rubia tinctorum</i> L. (LRSBG/AB/20/117)	الفوة	Roots	NS: 1* sciatica SRP: 1* infertility HSD: 1* anemia USD: 1* urinary tract infection/inflammation	Raw Raw Maceration Decoction	Oral Oral Oral Oral
Rutaceae	<i>Citrus limon</i> (L.) Osbeck. (LRSBG/AB/20/105)	الليمون	Fruits	RTD: 3* asthma Lung filtering/smoker Pneumonia NS: 1* dizziness CVSD: 1* hypertension GISD: 1* liver diseases HSD: 1* spleen diseases	Decoction Decoction Decoction Decoction Decoction Decoction Decoction	Oral Oral Oral Oral Oral Oral Oral
	<i>Ruta chalepensis</i> L. (LRSBG/AB/20/106)	السذاب أو الفيجل	Aerial part	GISD: 2* IBS jaundice/icterus, SRP: 6* infertility GH: 1* earache and deafness SD: 2* limb swelling NS: 1* headache RTD: 2* asthma Lung filtering/smoker SRP: 1* infertility NS: 1* migraine	Decoction Decoction/raw Decoction Infusion Raw Decoction Decoction	Oral/topical Topical Topical Oral Oral Oral Oral Oral
Salvadoraceae	<i>Salvadora persica</i> L. (LRSBG/AB/20/140)	مسواك	Bark	Lung filtering/smoker SRP: 1* infertility	Decoction Decoction	Oral Oral
Santalaceae	<i>Santalum album</i> L. (LRSBG/AB/20/118)	الصندل	Bark/fruits	NS: 1* migraine	Decoction Decoction	Oral Topical/oral
Scrophulariaceae	<i>Verbascum sinuatum</i> L. (LRSBG/AB/20/141)	مصليح الأنطار أو البوصير أو تيسراو	Leaves	RTD: 5* pneumonia, chest and lung diseases, and asthma GISD: 6* IBS and stomach pain	Infusion Decoction	Topical Oral and steam
Solanaceae	<i>Lycium shawii</i> Roem. and Schult (LRSBG/AB/20/142)	العوسج	Roots/fruits/leaves	SD: 5* skin ulcers Leprosy SRP: 4* uterine problems, infertility SMSD: 2* osteoarthritis and gout	Decoction Decoction Decoction	Oral Oral Oral
	<i>Nicotiana tabacum</i> L. (LRSBG/AB/20/129)	الشمة	Leaves	GH: 1* tonsillitis	Infusion	Topical
Tamaricaceae	<i>Tamarix aphylla</i> (L.) H.Karst. (LRSBG/AB/20/143)	طحاح	Leaves	NS: 1* headache	Decoction	Oral
Theaceae	<i>Camellia sinensis</i> (L.) Kuntze. (LRSBG/AB/20/120)	الشاي الأخضر	Leaves	SRP: 1* infertility SD: 1* itchy skin	Maceration Maceration	Topical Topical
Thymelaeaceae	<i>Daphne gnidium</i> L. (LRSBG/AB/20/107)	لازاز	Leaves	HC: 1* hair loss RTD: 1* sinusitis	Raw Steaming	Topical Topical
	<i>Aquilaria malaccensis</i> Lam. (LRSBG/AB/20/108)	العود الهندي أو عود غريس/أغريس	Bark	Can: 4* blood cancer Stomach cancer Liver cancer Cancer	Decoction Decoction Decoction Raw	Oral Oral Oral Topical
Ulmaceae	<i>Ulmus rubra</i> Muhl. (LRSBG/AB/20/144)	الدردار	Leaves	HC: 1* alopecia areata ID: 1* laryngitis	Raw Decoction	Oral Oral
Urticaceae		حريق أو القراص	Leaves	SMSD: 1* moving difficulty	Raw Decoction	Topical Oral

(Continued on following page)

TABLE 7 | (Continued) List of medicinal plants used by traditional healers in the study areas.

Family	Scientific name (voucher number)	Local name	Part used	Ailments	Preparation methods	Administration
	<i>Urtica dioica</i> L. (LRSBG/AB/20/121)			USD: 1* urinary tract infection/inflammation KD: 1* kidney problems	Decoction	Oral
	<i>Parietaria officinalis</i> L. (LRSBG/AB/20/122)	فتات الحجر	Aerial part	SMSD: 1* arthritis KD: 1* urolithiasis	Decoction	Oral
Verbenaceae	<i>Verbena officinalis</i> L. (LRSBG/AB/20/146)	رعي الحمام	Aerial part	SRP: 1* uterine problems	Decoction	Oral
Vitaceae	<i>Vitis vinifera</i> L. (LRSBG/AB/20/147)	زبيب	Fruits	USD: 1* bladder disease HSD: 1* anemia	Decoction Infusion	Oral Oral
				SMSD: 2* back pain	Raw	Topical
Xanthorrhoeaceae	<i>Aloe vera</i> (L.) Burm. f. (LRSBG/AB/20/164)	صبر	Leaves	Moving difficulty	Raw	Oral
	<i>Aloe perryi</i> Baker (LRSBG/AB/20/125)	الصبر السق طري	Leaves	SRP: 1* infertility GISD: 1* stomach ache	Decoction Maceration	Oral Oral
Zingiberaceae	<i>Zingiber officinale Roscoe</i> (LRSBG/AB/20/064)	زنجبيل او س كنن جبير	Roots	GISD: 2* colitis + flatulence	Raw	Oral
				Can: 3* breast cancer Legs cancer	Raw Maceration	Topical Topical
				RTD: 2* chest and lung diseases	Decoction	Oral
				USD: 1* urinary tract infection/inflammation	Raw	Oral
				GISD: 3* colitis	Raw	Oral
				Flatulence	Raw	Topical
				Jaundice/icterus	Raw	Oral
				GH: 1* hoarseness and sore throat	Raw	Oral
				NS: 1* head problems and psychosis	Raw	Topical
				SD: 1* skin diseases and ulcer	Maceration	Topical
				ESD: 1* goiter	Decoction	Oral
	<i>Curcuma longa</i> L. (LRSBG/AB/20/065)	الكركم	Roots	GISD: 2* jaundice	Infusion	Oral
				Liver diseases	Infusion	Oral
				GH: 2* anxiety disorders and hypochondria	Raw	Topical/oral
				NS: 1* head problems and psychosis	Raw	Topical
				GISD: 1* heartburn	Decoction	Oral
Zygophyllaceae	<i>Elettaria cardamomum</i> (L.) Maton. (LRSBG/AB/20/066)	حب الهال	Seeds		Decoction	Oral
	<i>Tetraena alba</i> (L.f.) Beier and Thulin. (LRSBG/AB/20/148)	العكايه	Leaves/seeds	ESD: 1* diabetes	Decoction	Oral

New Reports and New Uses

In the present study, 11% of the recorded 167 species have not been previously reported as medicinal plants in Algeria and neighboring countries in the Mediterranean basin. Moreover, more than 100 species reported here were previously reported to be used for therapeutic purposes in North-West (Benarba, 2015), South-West (Benarba, 2016), and North-East Algeria (Boual et al., 2020). Although each species had mostly the same therapeutic uses, for example, *A. herba-alba*, *Punica granatum* L., and *Senna alexandrina* Mill. were used mainly to treat gastrointestinal disorders, their vernacular names differed from one region to another such as *Aquilaria malaccensis* Lam. called Oud El-Rih in the West and A-ghriss in Sahara. These findings are in agreement with those reported in Algeria (Benarba, 2015; Bouasla and Bouasla, 2017), Morocco (Chaachouay et al., 2020; Merrouni and Elachouri, 2020; Yebouk et al., 2020), and other countries such as Yamen, Turkey, India, and China (Prabhu et al., 2014; Polat, 2019).

Interestingly, our findings report 47 new therapeutic uses for 20 known plant species. In the present study, we found that local populations living in the study areas used *Carlina gummifera* (L.) Less. to treat infertility, uterine problems, urinary tract infection, bladder disease, and osteoarthritis, whereas the plant uses previously reported included epilepsy, psoriasis, ulcers, and hemorrhage (Ahid et al., 2012; Hammiche et al., 2013). Likewise, leaves of *Cymbopogon schoenanthus* (L.) Spreng. were found to be used in the treatment of several types of cancer in the study areas. This use is reported for the first time since the plant was previously reported to be used mainly to treat termites and bruchid (Koba et al., 2007). *Prunus persica*, usually used against cough, constipation, and menstruation absent (Lin et al., 2021; Al-Fatimi., 2019), was reported by local populations to treat skin diseases.

Informant Consensus Factor and FL

Regarding the informant consensus factor, the highest F_{IC} value was recorded for cancer ($F_{IC} = 0.49$) with 44 medicinal species

used. This is the first study carried out in the three regions (West, Sahara, and Kabylia) of Algeria at the same time, calculating the informant consensus factor (F_{IC}). Our results revealed that cancer seems to be one of the most prevalent diseases in the study areas since no previous investigations had found cancer as the first ailment category according to their F_{IC} values. In fact, cancer has become a public health issue due to an increasing incidence, with 19.3 million new cases and about 10.0 million deaths worldwide in 2020 (Ferlay et al., 2021). Likewise, cancer incidence is increasing in Algeria. Actually, Algeria has the highest incidence of gastric (6%) (Behar et al., 2021) and liver cancer (Benarba and Meddah, 2014) when compared to North African countries. Moreover, breast and thyroid cancer incidence rose significantly in the last two decades (Mehemmai et al., 2020; Halfaoui et al., 2021). This pattern may be attributed to several causes, such as a westernized lifestyle, contaminated foods, pollution, and deteriorated living conditions. Furthermore, sexual-reproductive problems, gastrointestinal system diseases, skeletomuscular system disorders, and respiratory tract diseases were recorded to have higher F_{IC} values. In a previous study carried out in North-West Algeria, we found that gastrointestinal diseases had the highest F_{IC} value of 0.658, followed by general health ($F_{IC} = 0.645$) and respiratory diseases (0.642), while the cancer category was recorded to be the 4th highest ($F_{IC} = 0.524$) (Benarba et al., 2015). Moreover, a recent study carried out in the extreme North-West of Algeria reported that the reproductive and sexual disorders F_{IC} value were the highest score (0.98), and for the cancer category, they had an F_{IC} value of 0.77 with 6 species (Zatout et al., 2021). In disagreement with our findings, Bouasla and Bouasla (2017) indicated that cancer ($F_{IC} = 0.25$) was the least known ailment to be treated in the traditional medicine of the local population in North-East Algeria.

According to our results, *M. vulgare*, *A. herba-alba*, *Z. officinale*, and *J. phoenicia* had the absolute FL value of 100% in several ailment categories (SRD, cancer, respiratory diseases, and GISD). These findings are in agreement with those previously reported in different neighboring regions (Benarba et al., 2015; Bouasla and Bouasla, 2017; Chaachouay et al., 2020). Besides these species, *Parietaria officinalis* L. was found to possess an FL of 100% for kidney diseases which is consistent with findings previously reported in North-West Algeria (Benarba, 2016) and Morocco (Ammor et al., 2020). Inconsistent with our previous findings in both North-West (Benarba et al., 2015) and South-West Algeria (Benarba, 2016), *T. vulgaris* was the only species having the highest FL of 100% for skin diseases. This could be attributed to its antifungal and antimicrobial potentials demonstrated against the main pathogens causing skin diseases (Tadele et al., 2009; Vinciguerra et al., 2019). Recently, a facial phytocosmetic preparation from *T. vulgaris* was found to possess promising antiskin aging effects, as shown by enhanced adipogenesis through upregulation of PPAR- γ expression (Caverzan et al., 2021).

CONCLUSION

This is the first study carried out in three regions in Algeria (North, Center, and South) revealing an important botanical diversity and ethnobotanical knowledge held by local populations. The ethnobotanical survey allowed us to document 167 medicinal plants belonging to 70 families with their indigenous therapeutic uses (Table 7). Furthermore, 47 therapeutic uses for 20 known plant species were newly recorded, besides 25 species reported for the first time as medicinal plants in this study. On the other hand, *A. sativum*, *T. foenum-graecum*, *Z. officinale*, *R. chalepensis*, *A. herba-alba*, *P. anisum*, *M. chamomilla*, *O. basilicum*, and *T. vulgaris* had the highest UV. Moreover, some species had the absolute FL value of 100% in several ailment categories such as *M. vulgare*. These species could be further investigated to explore their curative properties and identify the possible active compounds.

Moreover, future ethnobotanical studies should adopt a multiple evidence-based approach that considers both the social-ecological-cultural context and local linguistic characteristics. In the same line, there is an urgent need for a clear strategy to include the local ethnobotanical knowledge in the conservation of biodiversity besides strong legislation aiming to protect the local medicinal species. Furthermore, establishing a unified local folk pharmacopeia based on different ethnobotanical and pharmacological investigations could be considered as one of the most important challenges in the future decade.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/Supplementary Material; further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

BB designed the study and prepared the questionnaire. KB carried out the ethnobotanical investigations. BB performed the identification of medicinal species. BB and KB verified the vernacular and scientific names of medicinal species. BB and KB analyzed the data and wrote the manuscript. BB revised the final version of the manuscript. All authors read and approved the manuscript.

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REFERENCES

- Abdel-Hay, M. H., Saleh, A., El Ashry, E. S. H., Rashed, N., and Salama, O. (2002). Colorimetric Determination of Crude Powdered Myrrh, Purified Myrrh Extract, Oily Fraction, and its Different Pharmaceutical Dosage Forms. *Spectrosc. Lett.* 35 (2), 183–197. doi:10.1081/sl-120003804
- Abdul-Ghani, R. A., Loutfy, N., and Hassan, A. (2009). Myrrh and Trematodoses in Egypt: an Overview of Safety, Efficacy and Effectiveness Profiles. *Parasitol. Int.* 58 (3), 210–214. doi:10.1016/j.parint.2009.04.006
- Ahid, S., El Cadi, M. A., Meddah, B., and Cherrah, Y. (2012). *Attractylis Gummifera*: from Poisoning to the Analytic Methods. *Ann. Biol. Clin. (Paris)* 70 (3), 263–268. doi:10.1684/abc.2012.0699
- Aissa, F. B. (1991). *Medicinal Plants in Algeria. Identification, Description of Active Ingredient Properties and Traditional Use of Common Plants in Algeria.*
- Al-Fatimi, M. (2019). Ethnobotanical Survey of Medicinal Plants in central Abyan Governorate, Yemen. *J. Ethnopharmacol* 241, 111973. doi:10.1016/j.jep.2019.111973
- Alami Merrouni, I., and Elachouri, M. (2020). Anticancer Medicinal Plants Used by Moroccan People: Ethnobotanical, Preclinical, Phytochemical and Clinical Evidence. *J. Ethnopharmacol* 266, 113435–435. doi:10.1016/j.jep.2020.113435
- Alcaraz, C. (1989). Contribution à l'étude des groupements à *Quercus ilex* et *Quercus faginea* subsp. *tlemcenensis*, des monts de Tlemcen (Algérie). *ecmed* 15 (3), 15–32. doi:10.3406/ecmed.1989.1638
- Allal, A., Bellifa, S., Benmansour, N., Selles, C., Semaoui, M., Hassaine, H., et al. (2019). Essential Oil and Hydrosol Extract Chemical Profile, Antioxidant and Antimicrobial Potential of *Daphne Gnidium* L. From Algeria. *J. Essent. Oil Bearing Plants* 22 (5), 1277–1288. doi:10.1080/0972060x.2019.1673832
- Ammor, K., Mahjoubi, F., Bousta, D., and Chaqroune, A. (2020). Ethnopharmacological Survey of Medicinal Plants Used in the Traditional Treatment of Kidney Stones Realized in Fez-Morocco. *Ethnobotany Res. Appl.* 19, 1–2. doi:10.32859/era.19.50.1-12
- Amri, E., and Kisangau, D. P. (2012). Ethnomedicinal Study of Plants Used in Villages Around Kimboza forest reserve in Morogoro, Tanzania. *J. Ethnobiol. Ethnomed* 8 (1), 1–9. doi:10.1186/1746-4269-8-1
- Arnold, H. J., and Gulumian, M. (1984). Pharmacopoeia of Traditional Medicine in Venda. *J. Ethnopharmacol* 12 (1), 35–74. doi:10.1016/0378-8741(84)90086-2
- BabaAissa, F. (1999). *Encyclopédie des plantes utiles*. Algiers: EDAS.
- Barkaoui, M., Katiri, A., Boubaker, H., and Msanda, F. (2017). Ethnobotanical Survey of Medicinal Plants Used in the Traditional Treatment of Diabetes in Chtouka Ait Baha and Tiznit (Western Anti-atlas), Morocco. *J. Ethnopharmacol* 198, 338–350. doi:10.1016/j.jep.2017.01.023
- Behar, D., Boublenza, L., Chabni, N., Hassaine, H., Dahmani, B., Masdoua, N., et al. (2021). Retrospective Epidemiological Study on Stomach Cancer in a Region of Western Algeria: about 394 Cases between 2011 and 2015. *J. Gastrointest. Canc* 52 (2), 706–710. doi:10.1007/s12029-020-00459-z
- Bellakhdar, J. (1997). *Contribution à l'étude de la pharmacopée traditionnelle au Maroc: la situation actuelle, les produits, les sources du savoir (enquête ethnopharmacologique de terrain réalisée de 1969 à 1992)*. Metz, France: Doctoral dissertation, Université Paul Verlaine-Metz.
- Benali, T., Khabbach, A., Ennabili, A., and Hammani, K. (2017). Ethnopharmacological Prospecting of Medicinal Plants from the Province of Guercif (NE of Morocco). *Moroccan J. Biol.* 14, 1–14.
- Benarba, B., Belabid, L., Righi, K., Bekkar, A. A., Elouissi, M., Khaldi, A., et al. (2015). Ethnobotanical Study of Medicinal Plants Used by Traditional Healers in Mascara (North West of Algeria). *J. Ethnopharmacol* 175, 626–637. doi:10.1016/j.jep.2015.09.030
- Benarba, B., and Meddah, B. (2014). Ethnobotanical Study, Antifungal Activity, Phytochemical Screening and Total Phenolic Content of Algerian *Aristolochia Longa*. *J. Intercult Ethnopharmacol* 3 (4), 150–154. doi:10.5455/jice.20140826030222
- Benarba, B. (2016). Medicinal Plants Used by Traditional Healers from South-West Algeria: An Ethnobotanical Study. *J. Intercult Ethnopharmacol* 5 (4), 320–330. doi:10.5455/jice.20160814115725
- Benarba, B. (2015). Use of Medicinal Plants by Breast Cancer Patients in Algeria. *EXCLI J.* 14, 1164–1166. doi:10.17179/excli2015-571
- Benarba, B., Pandiella, A., and Elmallah, A. (2016). Anticancer Activity, Phytochemical Screening and Acute Toxicity Evaluation of an Aqueous Extract of *Aristolochia Longa* L. *Int. J. Pharm. Phytopharmacological Res.* 6 (1), 20–26.
- Benítez, G., González-Tejero, M. R., and Molero-Mesa, J. (2010). Pharmaceutical Ethnobotany in the Western Part of Granada Province (Southern Spain): Ethnopharmacological Synthesis. *J. Ethnopharmacology* 129 (1), 87–105.
- Bhattacharjee, R., and Sil, P. C. (2007). Protein Isolate from the Herb, *Phyllanthus Niruri* L. (Euphorbiaceae), Plays Hepatoprotective Role against Carbon Tetrachloride Induced Liver Damage via its Antioxidant Properties. *Food Chem. Toxicol.* 45 (5), 817–826. doi:10.1016/j.fct.2006.10.029
- Boual, Z., Pierre, G., Kemassi, A., Mosbah, S., Benaoun, F., Delattre, C., et al. (2020). Chemical Composition and Biological Activities of Water-Soluble Polysaccharides from *Commiphora Myrrha* (Nees) Engl. *GUM. Analele Universității din Oradea, Fascicula Biologie.* 27 (1), 50–55.
- Bouasla, A., and Bouasla, I. (2017). Ethnobotanical Survey of Medicinal Plants in Northeastern of Algeria. *Phytomedicine* 36, 68–81. doi:10.1016/j.phymed.2017.09.007
- Boudjelal, A., Henchiri, C., Sari, M., Sarri, D., Hendel, N., Benkhaled, A., et al. (2013). Herbalists and Wild Medicinal Plants in M'Sila (North Algeria): An Ethnopharmacology Survey. *J. Ethnopharmacol* 148 (2), 395–402. doi:10.1016/j.jep.2013.03.082
- Bouzabata, A. (2013). Traditional Treatment of High Blood Pressure and Diabetes in Souk Ahras District. *J. Pharmacognosy Phytotherapy* 5 (1), 12–20.
- Calixto, J. B. (2019). The Role of Natural Products in Modern Drug Discovery. *Acad. Bras Cienc* 91 Suppl 3, e20190105. doi:10.1590/0001-3765201920190105
- Caverzan, J., Mussi, L., Sufi, B., Padovani, G., Nazato, L., Camargo, F. B., et al. (2021). A New Phytocosmetic Preparation from *Thymus Vulgaris* Stimulates Adipogenesis and Controls Skin Aging Process: *In Vitro* Studies and Topical Effects in a Double-blind Placebo-controlled Clinical Trial. *J. Cosmet. Dermatol.* 20 (7), 2190–2202. doi:10.1111/jocd.13818
- Çelik, G., Kılıç, G., Kanbolat, Ş., Özlem Şener, S., Karaköse, M., Yaylı, N., et al. (2021). Biological Activity, and Volatile and Phenolic Compounds from Five *Lamiaceae* Species. *Flavour Fragrance J.* 36 (2), 223–232.
- Chaachouay, N., Benkhnigui, O., Khamar, H., and Zidane, L. (2020). Ethnobotanical Study of Medicinal and Aromatic Plants Used in the Treatment of Genito-Urinary Diseases in the Moroccan Rif. *J. Mater. Environ. Sci.* 11 (1), 15–29.
- Chehma, A., and Djebbar, M. R. (2008). Les espèces médicinales spontanées du Sahara septentrional algérien: distribution spatio-temporelle et étude ethnobotanique. *Revue Synthèse* 17, 36–45.
- Chelghoum, M., Khitri, W., Bouzid, S., and Lakermi, A. (2021). New Trends in the Use of Medicinal Plants by Algerian Diabetic Patients, Considerations of Herb-Drug Interactions. *J. Ethnopharmacology* 274, 113984. doi:10.1016/j.jep.2021.113984
- Daoudi, A., Bammou, M., Zarkani, S., Slimani, I., Ibjibijen, J., and Nassiri, L. (2016). Étude ethnobotanique de la flore médicinale dans la commune rurale d'Aguelmouss province de Khénifra (Maroc). *Phytothérapie* 14 (4), 220–228. doi:10.1007/s10298-015-0953-z
- El Ashry, E. S., Rashed, N., Salama, O. M., and Saleh, A. (2003). Components, Therapeutic Value and Uses of Myrrh. *Pharmazie* 58 (3), 163–168.
- El-Hilaly, J., Hmamouchi, M., and Lyoussi, B. (2003). Ethnobotanical Studies and Economic Evaluation of Medicinal Plants in Taounate Province (Northern Morocco). *J. Ethnopharmacol* 86 (2-3), 149–158. doi:10.1016/s0378-8741(03)00012-6
- Fakchich, J., and Elachouri, M. (2014). Ethnobotanical Survey of Medicinal Plants Used by People in Oriental Morocco to Manage Various Ailments. *J. Ethnopharmacology* 154 (1), 76–87.
- Ferlay, J., Colombet, M., Soerjomataram, I., Parkin, D. M., Piñeros, M., Znaor, A., et al. (2021) 1994). Cancer Statistics for the Year 2020: An overview *In Vitro* Experimental Infection of Primary Human Hepatocytes with Hepatitis B Virus. *Int. J. Cancer Gastroenterology* 149106 (43), 779664–789673. doi:10.1002/ijc.33588
- Giday, M., Asfaw, Z., Woldu, Z., and Teklehaymanot, T. (2009). Medicinal Plant Knowledge of the Bench Ethnic Group of Ethiopia: an Ethnobotanical Investigation. *J. Ethnobiol. Ethnomed* 5, 34. doi:10.1186/1746-4269-5-34
- Halfaoui, N. S., Majda, D., Nouria, D., Boulououar, H., Behar, A., and Belhadj, M. (2021). Dietary and Female Reproductive Risk Factors for Thyroid Cancer: a Case-Control Study in Western Algeria. *WCRJ* 8, e1927.

- Hammiche, V., and Maiza, K. (2006). Traditional Medicine in Central Sahara: Pharmacopoeia of Tassili N'ajjer. *J. Ethnopharmacol* 105 (3), 358–367. doi:10.1016/j.jep.2005.11.028
- Hammiche, V., Merad, R., and Azzouz, M. (2013). *Plantes toxiques à usage médicinal du pourtour méditerranéen*. Paris: Springer.
- Hoffman, B., and Gallaher, T. (2007). Importance Indices in Ethnobotany. *Ethnobot. Res. App.* 5, 201–218. doi:10.17348/era.5.0.201-218
- Khan, I., Abdelsalam, N. M., Fouad, H., Tariq, A., Ullah, R., and Adnan, M. (2014). Application of Ethnobotanical Indices on the Use of Traditional Medicines against Common Diseases. *Evid Based. Complement. Altern. Med* 2014, 1–21. doi:10.1155/2014/635371
- Koba, K., Poutouli, P. W., Nenenene, Y. A., Songai, M. S., Raynaud, C., and Sanda, K. (2007). Chemical Composition and Anti-termite Activity of Three Tropical Essential Oils against Termite Species *Trinervitermes Geminatus* (Wasmann). *J. Sci. Technol.* 5 (2), 39–46.
- Kobayashi, H., Oguchi, H., Takizawa, N., Miyase, T., Ueno, A., Usmanhani, K., et al. (1987). New Phenylethanoid Glycosides from *Cistanche Tubulosa* (SCHRENK) HOOK. F. I. *Chem. Pharm. Bull.* 35 (8), 3309–3314. doi:10.1248/cpb.35.3309
- Kunkele, L., and Lohmeyer, T. R. (2007). *Plantes Médicinales*. London: Parragon Books Ltd.
- Lahlah, Z. F., Meziani, M., and Maza, A. (2012). Silymarin Natural Antimicrobial Agent Extracted from *Silybum marianum*. *J. Acad.* 2, 164–169.
- Lavagna, S. M., Secci, D., Chimenti, P., Bonsignore, L., Ottaviani, A., and Bizzarri, B. (2001). Efficacy of Hypericum and Calendula Oils in the Epithelial Reconstruction of Surgical Wounds in Childbirth with Caesarean Section. *Farmacologia* 56 (5–7), 451–453. doi:10.1016/s0014-827x(01)01060-6
- Leto, C., Tuttolomondo, T., La Bella, S., and Licata, M. (2013). Ethnobotanical Study in the Madonie Regional Park (Central Sicily, Italy)--medicinal Use of Wild Shrub and Herbaceous Plant Species. *J. Ethnopharmacol* 174 (1), 90–112. doi:10.1016/j.jep.2012.11.042
- Lievre, M., Marichy, J., Baux, S., Foyatier, J. L., and Perrot, J. (1992). Controlled Study of Three Ointments for the Local Management of 2nd and 3rd Degree burns. *Clin. trials meta-analysis* 28 (1), 9–12.
- Lin, Y., Wang, S. P., Zhang, J. Y., Zhuo, Z. Y., Li, X. R., Zhai, C. J., et al. (2021). Ethnobotanical Survey of Medicinal Plants in Gaomi, China. *J. Ethnopharmacol* 265, 113228. doi:10.1016/j.jep.2020.113228
- Massoud, A., El Sisi, S., Salama, O., and Massoud, A. (2001). Preliminary Study of Therapeutic Efficacy of a New Fasciolicidal Drug Derived from *Commiphora Molmol* (Myrrh). *Am. J. Trop. Med. Hyg.* 65 (2), 96–99. doi:10.4269/ajtmh.2001.65.96
- Mattalia, G., Sökand, R., Corvo, P., and Pieroni, A. (2020). Blended Divergences: Local Food and Medicinal Plant Uses Among Arbëreshë, Occitans, and Autochthonous Calabrians Living in Calabria, Southern Italy. *Plant Biosyst. - Int. J. Dealing all Aspects Plant Biol.* 154 (5), 615–626. doi:10.1080/11263504.2019.1651786
- Mechaala, S., Bouatrous, Y., and Adouane, S. (2021). Traditional Knowledge and Diversity of Wild Medicinal Plants in El Kantara's Area (Algerian Sahara Gate): An Ethnobotany Survey. *Acta Ecologica Sinica*. doi:10.1016/j.chnaes.2021.01.007
- Meddour, R., and Sahar, O. (2021). Floristic Inventory of Djurdjura National Park, Northern Algeria: a First Checklist of its Vascular flora. *Phytotaxa* 490 (3), 221–238. doi:10.11646/phytotaxa.490.3.1
- Mehemmai, C., Cherbal, F., Hamdi, Y., Guedioura, A., Benbrahim, W., Bakour, R., et al. (2020). Correction to: BRCA1 and BRCA2 Germline Mutation Analysis in Hereditary Breast/Ovarian Cancer Families from the Aures Region (Eastern Algeria): First Report. *Pathol. Oncol. Res.* 26 (2), 2009–2010. doi:10.1007/s12253-019-00625-0
- Menale, B., De Castro, O., Cascone, C., and Muoio, R. (2016). Ethnobotanical Investigation on Medicinal Plants in the Vesuvio National Park (Campania, Southern Italy). *J. Ethnopharmacol* 192, 320–349. doi:10.1016/j.jep.2016.07.049
- Miara, M. D., Ait, H. M., Dahmani, W., Negadi, M., and Djelaloui, A. (2018). Nouvelles données sur la flore endémique du sous-secteur de l'Atlas tellien Oranais "O3" (Algérie occidentale). *abm* 43, 63–69. doi:10.24310/abm.v43i0.4453
- Miara, M. D., Hammou, M. A., and Aoul, S. H. (2013). Phytothérapie et taxonomie des plantes médicinales spontanées dans la région de Tiaret (Algérie). *Phytothérapie* 11 (4), 206–218. doi:10.1007/s10298-013-0789-3
- Missoun, F., Bouabdelli, F., Awatif, B., Amari, N., and Djebli, N. (2018). Antidiabetic Bioactive Compounds from Plants. *Méd Tech. J.* 2 (2), 199–214. doi:10.26415/2572-004x-vol2iss2p199-214
- Mrabti, H. N., Jaradat, N., Kachmar, M. R., Ed-Dra, A., Ouahbi, A., Cherrah, Y., et al. (2019). Integrative Herbal Treatments of Diabetes in Beni Mellal Region of Morocco. *J. Integr. Med.* 17 (2), 93–99. doi:10.1016/j.joim.2019.01.001
- Msaddak, A., Durán, D., Rejili, M., Mars, M., Ruiz-Argüeso, T., Imperial, J., et al. (2017). Diverse Bacteria Affiliated with the Genera *Microvirga*, *Phyllobacterium*, and *Bradyrhizobium Nodulate* *Lupinus Micranthus* Growing in Soils of Northern Tunisia. *Appl. Environ. Microbiol.* 83 (6), e02820–16. doi:10.1128/AEM.02820-16
- Namba, H., Narahara, K., Tsuji, K., Yokoyama, Y., Murakami, M., Matsubara, T., et al. (1994). "Developmental Change in Activity of Red Cell Porphobilinogen Deaminase and its Electrophoretic Variant in the Japanese Population," in *The Encyclopedia of Wakan-Yaku (Traditional Sino-Japanese Medicines) with Color Picture* (Tokyo: Hoiku-sha), 36, 16–19. doi:10.1111/j.1442-200x.1994.tb03122.x
- Obón, C., Rivera, D., Verde, A., Fajardo, J., Valdés, A., Alcaraz, F., et al. (2012). Árnica: a Multivariate Analysis of the Botany and Ethnopharmacology of a Medicinal Plant Complex in the Iberian Peninsula and the Balearic Islands. *J. Ethnopharmacol* 144 (1), 44–56. doi:10.1016/j.jep.2012.08.024
- Ojah, E. O. (2020). Medicinal Plants: Prospective Drug Candidates against the Dreaded Coronavirus. *Iberoam J. Med.* 2, 314–321. doi:10.53986/ibjm.2020.0055
- Ouelbani, R., Bensari, S., Mouas, T. N., and Khelifi, D. (2016). Ethnobotanical Investigations on Plants Used in Folk Medicine in the Regions of Constantine and Mila (North-East of Algeria). *J. Ethnopharmacol* 194, 196–218. doi:10.1016/j.jep.2016.08.016
- Polat, R. (2019). Ethnobotanical Study on Medicinal Plants in Bingöl (City center) (Turkey). *J. Herbal Med.* 16, 100211. doi:10.1016/j.hermed.2018.01.007
- Pooley, R. A. (2005). AAPM/RSNA Physics Tutorial for Residents: Fundamental Physics of MR Imaging. *Radiographics* 25 (4), 1087–1099. doi:10.1148/rg.254055027
- Prabhu, S., Vijayakumar, S., Yabesh, J. E., Ravichandran, K., and Sakthivel, B. (2014). Documentation and Quantitative Analysis of the Local Knowledge on Medicinal Plants in Kalrayan hills of Villupuram District, Tamil Nadu, India. *J. Ethnopharmacol* 157, 7–20. doi:10.1016/j.jep.2014.09.014
- Pranskuniene, Z., Bernatoniene, J., Simaitiene, Z., Pranskunas, A., and Mekas, T. (2016). Ethnomedicinal Uses of Honeybee Products in Lithuania: the First Analysis of Archival Sources. *Evidence-Based Complement. Altern. Med.* 2016, 9272635. doi:10.1155/2016/9272635
- Saravanan, R. (2016). *Evaluation of In-Vitro and In-Vivo Anticancer Activity of Leaf Extracts of Amaranthus Spinosa Linn (Doctoral Dissertation)*. Chennai: College of Pharmacy Madras Medical College.
- Sargin, S. A., Selvi, S., and Büyükcengiz, M. (2015). Ethnomedicinal Plants of Aydıncık District of Mersin, Turkey. *J. Ethnopharmacol* 174, 200–216. doi:10.1016/j.jep.2015.08.008
- Sarri, M., Mouyet, F. Z., Benziane, M., and Cheriet, A. (2014). Traditional Use of Medicinal Plants in a City at Steppic Character (M'sila, Algeria). *J. Pharm. Pharmacognosy Res* 2 (2), 31–35.
- Savić, J., Mačukanović-Jocić, M., and Jarić, S. (2019). Medical Ethnobotany on the Javor Mountain (Bosnia and Herzegovina). *Eur. J. Integr. Med* 27, 52–64.
- Sawadogo, W. R., Schumacher, M., Teiten, M. H., Dicato, M., and Diederich, M. (2012). Traditional West African Pharmacopoeia, Plants and Derived Compounds for Cancer Therapy. *Biochem. Pharmacol.* 84 (10), 1225–1240. doi:10.1016/j.bcp.2012.07.021
- Sekkuou, K., Cheriti, A., Taleb, S., Bourmita, Y., and Belboukhari, N. (2011). Traditional Phytotherapy for Urinary Diseases in Bechar District (South West of Algeria). *Electron. J. Environ. Agric. Food Chem.* 10 (8), 2616–2622.
- Shao, Z. M., Wu, J., Shen, Z. Z., and Barsky, S. H. (1998). Genistein Exerts Multiple Suppressive Effects on Human Breast Carcinoma Cells. *Cancer Res.* 58 (21), 4851–4857.
- Skalli, S., Hassikou, R., and Arahou, M. (2019). An Ethnobotanical Survey of Medicinal Plants Used for Diabetes Treatment in Rabat, Morocco. *Heliyon* 5 (53), e01421. doi:10.1016/j.heliyon.2019.e01421
- Synowicz, A., Gniewosz, M. A. L. G. O. R. Z. A. T. A., Baczek, K., and Przybyl, J. L. (2014). Antimicrobial Effect of an Aqueous Extract of *Potentilla Erecta* Rhizome. *Herba Pol.* 60 (2). doi:10.2478/hepo-2014-0007
- Tadele, A., Urga, K., Gameda, N., Lemma, H., Melaku, D., and Mudie, K. (2009). Antimicrobial Activity of Topical Formulations Containing Thymus Vulgaris Essential Oil on Major Pathogens Causing Skin Diseases. *Ethiopian Pharm. J.* 26 (2), 103–110. doi:10.4314/epj.v26i2.43041
- Taïbi, K., Abderrahim, L. A., Ferhat, K., Betta, S., Taïbi, F., Bouraada, F., et al. (2020). Ethnopharmacological Study of Natural Products Used for Traditional

- Cancer Therapy in Algeria. *Saudi Pharm. J.* 28 (11), 1451–1465. doi:10.1016/j.jsps.2020.09.011
- Taibi, K., Abderrahim, L. A., Helal, F., and Hadji, K. (2021). Ethnopharmacological Study of Herbal Remedies Used for the Management of Thyroid Disorders in Algeria. *Saudi Pharm. J.* 29 (1), 43–52.
- Teixidor-Toneu, I., Martin, G. J., Ouhammou, A., Puri, R. K., and Hawkins, J. A. (2016). An Ethnomedicinal Survey of a Tashelhit-Speaking Community in the High Atlas, Morocco. *J. Ethnopharmacol* 188, 96–110. doi:10.1016/j.jep.2016.05.009
- Trabut, L. (2015). *Répertoire des noms des plantes du Maghreb*. Algiers: Livres Editions.
- Tuttolomondo, T., Licata, M., Leto, C., Savo, V., Bonsangue, G., Letizia Gargano, M., et al. (2014). Ethnobotanical Investigation on Wild Medicinal Plants in the Monti Sicani Regional Park (Sicily, Italy). *J. Ethnopharmacol* 14153 (3), 568–586. doi:10.1016/j.jep.2014.02.032
- Vinciguerra, V., Rojas, F., Tedesco, V., Giusiano, G., and Angiolella, L. (2019). Chemical Characterization and Antifungal Activity of *Origanum Vulgare*, *Thymus Vulgaris* Essential Oils and Carvacrol against *Malassezia Furfur*. *Nat. Prod. Res.* 33 (22), 3273–3277. doi:10.1080/14786419.2018.1468325
- Yabesh, J. E., Prabhu, S., and Vijayakumar, S. (2014). An Ethnobotanical Study of Medicinal Plants Used by Traditional Healers in Silent valley of Kerala, India. *J. Ethnopharmacol* 154, 774–789. doi:10.1016/j.jep.2014.05.004
- Yabesh, J. E., Prabhu, S., and Vijayakumar, S. (2014). An Ethnobotanical Study of Medicinal Plants Used by Traditional Healers in Silent valley of Kerala, India. *J. Ethnopharmacol* 154 (3), 774–789. doi:10.1016/j.jep.2014.05.004
- Yebouk, C., Redouan, F. Z., Benítez, G., Bouhbal, M., Kadiri, M., Boumediana, A. I., et al. (2020). Ethnobotanical Study of Medicinal Plants in the Adrar Province, Mauritania. *J. Ethnopharmacol* 246, 112217. doi:10.1016/j.jep.2019.112217
- Zatout, F., Benarba, B., Bouazza, A., Babali, B., Bey, N. N., and Morsli, A. (2021). Ethnobotanical Investigation on Medicinal Plants Used by Local Populations in Tlemcen National Park (Extreme North West Algeria). *Mediterr. Bot.* 15 (30), 1–12. doi:10.5209/mbot.69396

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