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Aromatic and medicinal plants used in traditional medicine in the region of Tiaret, North West of Algeria

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Abstract. Herbal medicine is gaining an increasing importance in the management of various ailments, but little is known about traditional practices in Algeria. This ethnopharmacological study aims to document medicinal and aromatic plants used in traditional medicine in the region of Tiaret (northwest of Algeria) in order to contribute to safeguard the local pharmacopoeia as cultural heritage, and to provide a scientific basis for developing novel strategies for such practices which can help for drugs discovery. Semi-structured interviews with 64 traditional healers and herbalists were realized in the region of Tiaret (Algeria) throughout field studies achieved from December 2018 to May 2020. Interviews covered sociodemographic information, popular and vernacular names of the medicinal plants, mode of use and toxicity among other data. Results reveal the use of 107 plant species belonging to 45 families and 97 genera for the treatment of various ailments. Lamiaceae, Apiaceae and Asteraceae were the most represented families. The most frequently cited species were *Senna alexandrina* Mill. (FC=27), *Atriplex halimus* L. and *Bunium incrassatum* Amo (FC=23 each), *Foeniculum vulgare* Mill. (FC=22), and *Matricaria chamomilla* L. (FC=21). However, the higher use values were reported for *Nigella sativa* L. (UV=1.5), *Trigonella foenum-graecum* L. (UV=1.38), *Thymus serpyllum* L. (UV=1.2), *Ziziphus lotus* (L.) Lam. (UV=1.14), *Urtica dioica* L. (1.13), and *Senna alexandrina* Mill. (UV=0.52) respectively. Interestingly, *Bunium incrassatum* Amo, *Echinops spinosissimus* Turra, *Cucurbita moschata* Duchesne, *Pennisetum glaucum* (L.) R.Br and *Malus domestica* Borkh. were reported for the first time as medicinal plants in the north Africa and Algeria. Moreover, 246 new therapeutic uses were described. It should be noted that *Pistacia atlantica* Desf., *Tetraclinis articulata* (Vahl) Mast., *Oudneya africana* R. Br., *Euphorbia guyoniana* Boiss. & Reut, *Teucrium polium* L. and *Marrubium deserti* (Noë) Coss. are endemic to North Africa-Algeria, Northern and Central Sahara. Furthermore, *Artemisia herba-alba* Asso, *Anacyclus pyrethrum* (L.) Lag., *Cuminum cyminum* L., *Saussurea costus* (Falc.) Lipsch., *Boswellia sacra* Flueck. and *Pistacia atlantica* Desf. are considered threatened, rare or endangered species. Our findings are relevant not only for the future studies and experiments in the search for novel compounds, but also for the safeguard of traditional knowledge and biodiversity.

Keywords: Herbal medicine; plant diversity; traditional practices; local knowledge; Tiaret (Algeria).

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1. Introduction

The use of aromatic and medicinal plants and their derivatives for food and therapeutic purposes is very common worldwide since ancient times. Currently, almost 80% of the world's population, mainly in developing countries, depend on herbal medicines to answer their basic primary health needs for the management of numerous diseases (WHO, 2004, 2018). The difficulties to obtain essential health services along with the failure of modern medicine in finding effective treatments for several diseases have promoted remarkably the resurgence of traditional medicine (Taïbi *et al*., 2020a). In addition, the indiscriminate use of chemicals and synthetic drugs led to the emergence of pathogenic multidrug resistant microbes responsible of severe health issues (Ait Abderrahim *et al*., 2017).

In Algeria, phytotherapy constitutes an integral part of the local culture of population which holds an important knowledge acquired empirically from a generation to another. Indeed, Algeria is characterized by a very rich and highly diversified flora due to its geographical location and the significant diversity of its climatic and topographic conditions (Azzi *et al*., 2012; Berrabah *et al*., 2019; Boussaid *et al*., 2018; Makhloufi *et al*., 2021; Makhloufi *et al*., 2020). The diversity of plant taxa is represented by 3183 plant species which constitutes an important opportunity for focused screening of biological compounds based on traditional usages (CBD, 2020; Taïbi *et al*., 2020a)

Indeed, the ethnomedicinal approach resulted in the search of aromatic and medicinal plants as a promising source of various bioactive compounds which constitutes the basis of new drug discovery with less or no side effects. Therefore, ethnomedicinal and ethnopharmacological studies are very required to disclose local medicinal plant species, and to document and save local popular knowledge (Orhan, 2014). Although numerous

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ethnobotanical and ethnopharmacological studies have been undertaken in various region in Algeria (Azzi *et al*., 2012; Benarba, 2016; Benarba *et al*., 2015; Benderradji *et al*., 2014; Boudjelal *et al*., 2013; Ouelbani *et al*., 2016; Sarri *et al*., 2014, 2015; Taïbi *et al*., 2020a, b), this field of study remains insufficiently covered to document the huge diversity of taxa and ancestral knowledge. Also, there is an urgent need to develop a national pharmacopoeia besides national standards and guidelines of collect and uses. Moreover, the collected data are being used as basis in research that needs to be tested in clinical and lab trials.

In this context, the current study is an ethnopharmacological investigation aiming to document the use of traditional medicines based on aromatic and medicinal plants used by traditional healers for the management of various ailments in the region of Tiaret (North West of Algeria). To our knowledge, this is the first ethnopharmacological investigation carried out in the region on high number of herbalists and traditional healers. The obtained data are believed to enrich national and world's databases of traditional knowledge and safeguard the cultural heritage as recognized by the UNESCO in 2003.

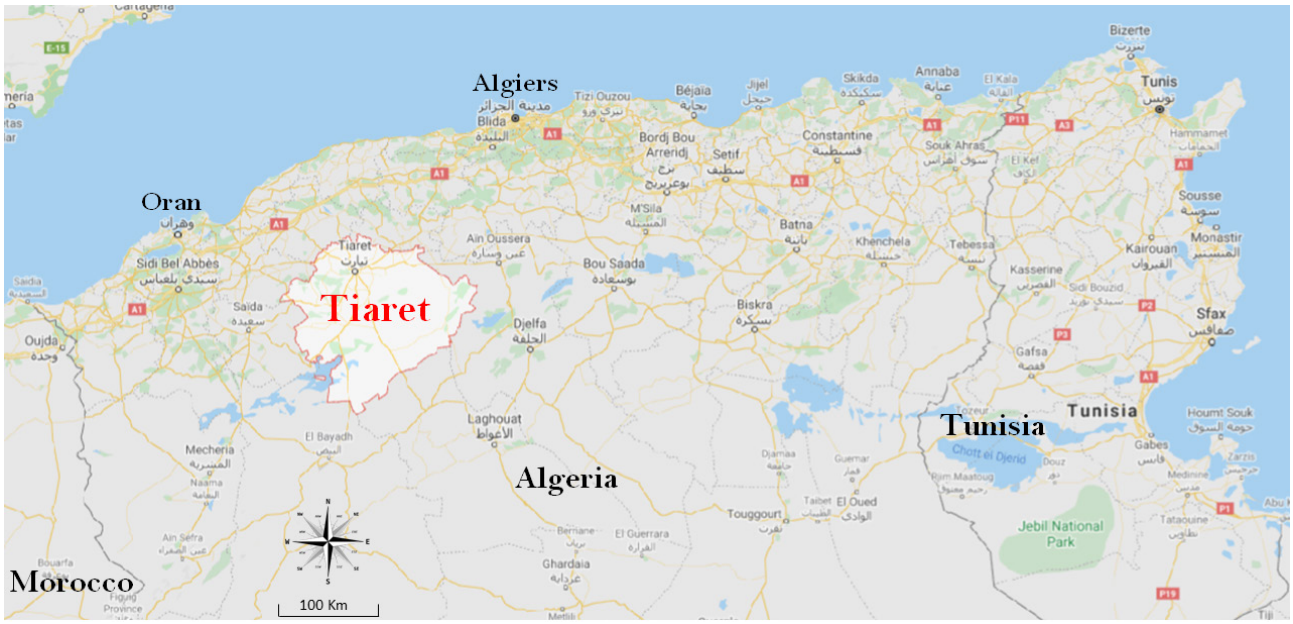

Figure 1. Geographical location of the region of Tiaret, North West Algeria (with red color border filled white) (Google Maps 2020).

The study area includes a part of the Tell Atlas chain located at 1150 m asl on Mount of Guezoul and the Massif of Saida and Frenda at 1200 m asl. The study area also covers the mounts of Nadhor on the edge of the steppe plains of Ain Deheb and the Eastern zone of Chott Chergui to the south. In general, the relief is very heterogeneous including a mountainous area to the north, high plains in the center and semi-arid areas and steppe to the south. This significant natural potential includes more than 1,600.000 ha of agricultural lands dominated by the culture of cereal and fruit trees, 142.422 ha of forest area characterized by a rugged and wooded relief covered mainly by holm oaks and Aleppo pines, and 143.000 ha of steppes dominated by the typical formation of *Stipa tenacissima* L., *Artemisia herba-alba* Asso, *Atriplex halimus* L. and the associated vegetation. The variety of relief implies as well a very heterogeneous soil types which are characterized in general by the presence of lime accumulation, low content of organic matter and high sensitivity to erosion and degradation (Achir, 2016).

The climate is semiarid typically Mediterranean characterized by a harsh cold winter and hot and dry summer. Climatic data recorded from 1986 to 2018 indicated that annual rainfall ranges from 200 to 400 mm per year with a seasonal fluctuation ranging from 157 mm in winter to 31 mm in summer with an average temperature of 37.2°C. The warmest months are from Jun to September, while the coldest months are from November to March (Taïbi, 2009).

The health sector of the region is composed of five public hospital establishments, three specialized hospital establishments along with many proximities to public health establishments for an estimated population of 1,007.635 inhabitants. According to the epidemiological assessment launched in 2017, this region had a high rate (21.1%) of deaths caused by different diseases (mainly cardiovascular diseases, cancer, chronic respiratory diseases, chronic kidney diseases and diabetes among others). This may be due to several factors such as the significant deficit in specialist doctors, the lack of equipment, the poverty of the populations, the difficulty of access to medications among others which have led unfortunately to a remarkable deterioration of people health in the region. Historically, the region of Tiaret was an important political and economic center in the northwest of Algeria and constitutes a crossroads of several civilizations namely Ziride, Hammadite, Abdelwadid, Rostemide, Ottoman Empire and French colonization (Kouzmine *et al*., 2009). In addition to its location as a connection city between east and west regions of the country, Tiaret region is also considered as the Saharan gate which ensures the connection and the passage of travelers from the north to the south

regions of Algeria. The historical view and geographical location make the region of Tiaret a place of diffusion and center of transfer of a great traditional knowledge. Local population works mainly in agriculture (animal farming, pastoralism and plant farming), commercial sector and service industries. Socio-demographic characteristics of the informants are exposed in Table 1.

Table 1. Socio-demographic features of the informants.

Socio-demographic features		Number	Percentage (%)
Age	<30	10	15.63
	30-45	29	45.31
	45-60	18	28.13
	>60	7	10.94
Gender	Male	60	93.75
	Female	4	6.25
Habitat	Urban	28	43.75
	Rural	36	56.25
Education	Illiterate	6	9.38
	Primary	5	7.81
	Middle	21	32.81
	Secondary	28	43.75
	University	4	6.25

2.2. Data collection

The present ethnopharmacological study was conducted through field studies achieved from December 2018 to May 2020 to list the most medicinal plants used for the treatment of various diseases in the region of Tiaret, North West of Algeria.

In total, sixty-four herbalists and traditional practitioners interviewed throughout this study (n=64). This study is directed in agreement with the requirements of the declarations of Helsinki and was approved by the scientific committee (PVCSF/FSNV/27 Nov 2018) for ethical criterion in the faculty of Natural and Life Sciences, Ibn Khaldoun University of Tiaret (Algeria). Hence, semi-structured interviews based on note-taking while interviewing were conducted with the local dialect and were generally took place in public spaces in collecting the ethnopharmacological data as described by Martin (1995).

Informant consent was obtained through oral agreement prior to the interviews to authorize the collection, use and publication of data, then informants were asked to list aromatic and medicinal plants used for the treatment of various ailments and were requested to provide detailed information about their uses (Albuquerque *et al*., 2014).

Interviews covered popular and vernacular names of the used species, parts used, mode of preparation and administration, dosage, period of treatment and toxicity or side effects among other information. Local names were provided mostly in Arabic language and informants were asked whether they would be willing to deliver a sample or to recognize it in photos if the material was not available. The collected specimens were pressed and dried on site then the voucher specimens were identified by specialists and conserved in the laboratory at the Faculty of Natural and Life Sciences, University of Tiaret (Algeria). The identity of plant species was verified according to the available bibliographical resources and scientific names were confirmed in accordance with the International Index of Plant Name (http://www.ipni.org) and the Plant List database (http://www.theplantlist.org).

2.3. Data analysis

The obtained ethnopharmacological data were assigned into various ailments categories which have been reported by informants. The use report (UR) was assessed by calculating the total uses for the plant species by all informants within each use-category for that plant (Prance *et al*., 1987).

$$UR = \sum_{u=u1}^{uNC} \sum_{i=i1}^{iN} UR_{ui}$$

The Frequency of Citation (FC) is calculated as the sum of informants that cite a use for the plant species (Prance *et al*., 1987).

$$FC = \sum_{i=i1}^{iN} UR_i$$

The use value (UV) is a quantitative method that can be used in order to prove the relative importance of the plant species known locally. It was calculated following the adaptation of da Silva *et al*. (2014) using the following formula:

$$UV = \frac{\sum UR_{ip}}{n_{ip}}$$

where UV is the use value of the plant species *p* mentioned by the informant *i*; ΣUR_{ip} is the number of uses reports of the plant species *s* mentioned in each event by the informant *i*; n_{ip} is the number of events in which the informant *i* cited the plant species *p*.

The homogeneity on the informants' knowledge was evaluated by calculating the Informants' Consensus Factor (F_{IC}) (Andrade-Cetto & Heinrich, 2011) using the formula:

$$F_{IC} = \frac{(N_{ur} - \bar{N_t})}{(N_{ur} - 1)}$$

where N_{ur} is the number of use reports for a particular ailment category and N_t is the number of species cited for the same ailment by all informants. The values of the index range between 0 and 1, where values close to '1' indicate the highest level of consensus.

All the statistical analyses were performed using the computing environment R (R Development Core Team, 2013). Continuous data were represented as mean ± standard deviation while frequencies and percentages were calculated for categorical variables.

3. Results and Discussion

3.1. Sociodemographic features

In the present study, the number of men herbalists was higher than that of women (60 men versus 4 women). The observed gender bias might be due to the cultural traditions and structure of the society, where work outside the family, such as this kind of activity, is not allowed for women. Overall, the age group of 30-45 years-old is the most frequent amongst the herbalists involved in this study (45%). However, the age group over 60 years-old is less represented (about 11%). Besides, most of the herbalists have secondary (42%) or middle (33%) institutional level while around 9% were illiterate. Nevertheless, only 4 herbalists (6%) are undergraduate or graduate from the university. This could be explained by the fact that the majority of herbalists belongs to rural poor regions where the access to school and university is not usually allowed.

Almost all the interrogated herbalists have acquired their knowledge from other persons, and they refer mainly to the experiences of their ascendants or of other traditional healers to use medicinal plants as remedies. It should be noted that older herbalists, mainly illiterates, have shared more knowledge about the diversity and uses of medicinal plants. This is due certainly to vast experience accumulated along times and transmitted from generation to generation throughout practices especially where no other alternative was available. In fact, the transmission of this valuable ethnomedicinal knowledge is presently in danger of loss especially that the new modern generations have changed their lifestyle and habitudes and tend to not believe too much of using plants as remedies (Bouasla & Bouasla, 2017; Sargin *et al*., 2015).

3.2. Botanical diversity of ethnomedicinal plants

Overall, herbalists have reported the use of 107 medicinal plant species belonging to 45 families and 97 genera for the treatment of various ailments (Table 2). Previous ethnobotanical studies carried out in Algeria have reported 58 plant species (50 genera and 27 families) in the region of M'sila (east Algeria) (Boudjelal *et al*., 2013), 41 plant species (37 genera and 24 families) in the region of Hodna (east Algeria) (Sarri *et al*., 2015), 141 plant species (125 genera and 54 families) in the region of Mascara (north west Algeria) (Benarba *et al*., 2015), 98 species (90 genera and 48 families) in the region of Tizi-ouzou (north center Algeria) (Meddour & Meddour-Sahar, 2016) and 90 species (85 genera and 42 families) in the region of Skikda (north east Algeria) (Bouasla & Bouasla, 2017).

Lamiaceae was the most represented botanical family with 15 plant species (33%), followed by Apiaceae with 11 species (24%), Asteraceae with 10 species (22%), Fabaceae and Rosaceae with 6 species each (13%). However, the remaining botanical families were represented by equal or less than three species each (Figure 2). The predominance of these plant families in the medicinal flora is well established in Algeria (Benarba *et al*., 2015; Meddour and Meddour-Sahar, 2016; Sarri *et al*., 2015; Sarri *et al*., 2014) and in the whole Mediterranean region (González-Tejero *et al*., 2008; Slimani *et al*., 2016). The benefic effects of plant species belonging to these families could be due to the presence of special and effective bioactive compounds holding potential biological activities, e.g., arbutin (Rychlinska & Nowak, 2012), apigenin and naringenin (Stacks, 2015), luteolin (Lopez-Lazaro, 2009), hesperidin (Lee *et al*., 2010) and rutin (Chua, 2013) in the Lamiaceae family. As well, lot of bioactive compounds such as flavonoids, sesquiterpenes and germacranolide sesquiterpene lactones in the Asteraceae family (Babaei *et al*., 2018; Shoaib *et al*., 2017), and terpenoids, flavonoids, coumarins, polyacetylenes, steroids, sesquiterpenes and flavonols in the Apiaceae family (Moazzami Farida *et al*., 2018).

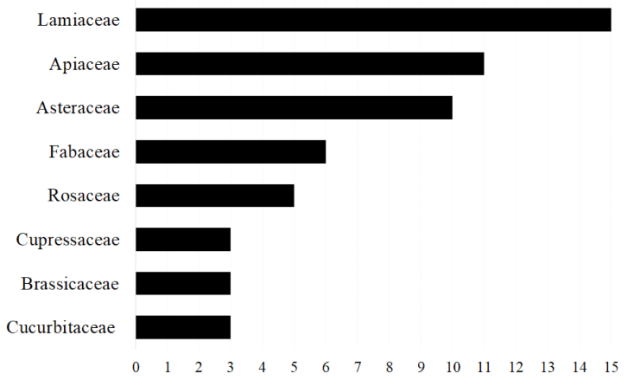

Figure 2. Number of species per family of the most representative botanical families.

The reported plant species include both monocotyledonous (9 species, 8.41%) and dicotyledonous (94 species, 87.85%) classes most of them are herbs (60 species, 56.07%) while shrubs represent 27.1% (29 species) and trees 16.82% (18 species). In addition, 4 species of Gymnospermae (3.74%) have been reported. In fact, 57% of the species used by the local population are spontaneous, while 43% are cultivated and used either for direct consumption or vended commercially such as *Allium* spp., *Daucus carota*, *Vicia faba* among others. Remarkably, several species belong to the Algerian steppe region and Sahara namely *Artemisia* spp., *Atriplex halimus*, *Haloxylon scoparium*, *Origanum majorana*, *Peganum harmala* and *Pistacia* spp. among others. Besides, 8% of the used plants by respondents are introduced species such as *Curcuma longa*, *Boswellia sacra* and *Saussurea costus*.

3.3. Plant parts used

Leaves were the most frequent used plant part (27%), followed by aerial parts (23%), seeds (15%), roots (9%), flowers (7%), and fruits (6%). However, the use of stems, barks, tubers, rhizomes and bulbs was less frequent and was cited less than 5% each (Figure 3). It should be noted that phytochemical compounds differ in quantity and quality according to the plant part in which they are accumulated. The interrogated herbalists

throughout the present study are not fully aware of this aspect but they use the different plant parts according to traditional heritage rather than a scientific basis. Most of ethnobotanical studies have reported the frequent use of leaves in herbal remedies (Adnan *et al*., 2014; Sher *et al*., 2015). Leaves are very useful for plants identification, very abundant, easily accessible to local populations and rich with bioactive compounds derived from photosynthesis (Bouasla & Bouasla, 2017; Sargin *et al*., 2015). Besides, the use of leaves is better for the survival of plants as the use of whole plant or roots can seriously threaten the local flora (Umair *et al*., 2017).

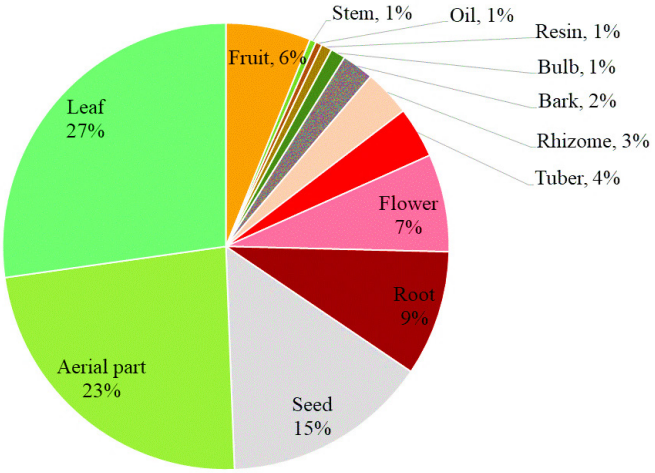

Figure 3. Plant parts used and their frequency.

3.4. Modes of preparation and administration

Most of plants are used as infusion (47%), decoction (28%) or even powdered (10%) to be ingested or used in other mixtures and preparations. However, some plant parts are eaten raw (6%) or used for inhalation (2%) and maceration (1%) (Figure 4). The mentioned methods of preparation could be suitable for some plants but not for the others. In fact, the boiling procedure can cause severe degradation of the therapeutic components in some medicinal plants. In addition, the suitable dosage required to reach the expected benefits could not be acknowledged with precision since it was dissimilar among informants interrogated throughout this study. This concern has been raised also by several researchers indicating that the fixed doses to be administered by patients in traditional medicine is still not yet well-defined (Jaradat *et al*., 2016). Therefore, further studies are needed to determine the concentration of active ingredients with respect to their method of preparation.

Herbalists prescribed most of their preparations through oral administration (91%) followed by topical application (7%) and nasal and gargling (1% each). These findings agree with those of Ahmad *et al*. (2014), Rashid *et al*. (2015). Oral and topical modes of administration permit rapid physiological action to promote healing power (Rehman *et al*., 2015).

Herbalists advised the use of mixtures based on several plant species with other ingredients such as honey, olive oil, goat milk and butter, water, yogurt, couscous, eggs, etc. to improve the taste and enhance the therapeutic effects. Mixtures of various species might have positive synergic effects and attenuate the adverse effects or toxicity of some plants of the mixture (Ait Abderrahim *et al*., 2019a, b, c).

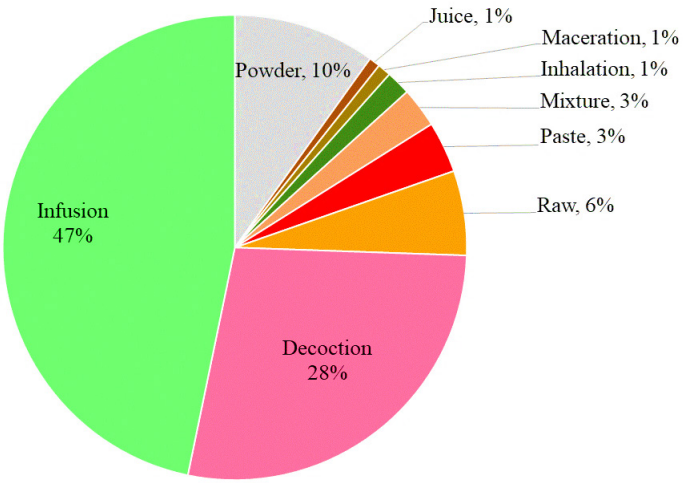

Figure 4. Modes of preparation of the reported ethnomedicinal plant species.

Table 2. Medicinal and aromatic plant species used in the region of Tiaret (north west of Algeria).

Plant family, Species(voucher)	Vernacular name	FC	UR	UV	Used parts	Mode of preparation	Mode of administration	Therapeutic uses
Amaranthaceae								
Atriplex halimus L. (TDF023)	القطف Guettaf	23	32	0.50	Leaves	Decoction, infusion, powder	Oral, topical	Cancer, cysts, high blood pressure, thyroid disorders, ulcer, uterine fibroids.
Haloxylon scoparium Pomel (TDF032)	الرمث Remth	11	12	0.19	Aerial parts	Decoction, infusion, powder	Oral, topical	Allergy, cancer, cholesterol, colon, cysts, intoxications, skin, snake bites.
Amaryllidaceae								
Allium cepa L. (TDF107)	البصل Bassal	1	1	0.02	Bulbs	Raw	Oral	Hepatitis
Allium sativum L. (TDF047)	الثوم Thoum	4	7	0.11	Bulbs	Inhalation, raw	Nasal, oral, topical	Alopecia areata, antimicrobial, cancer, depurative, high blood pressure, influenza.
Anacardiaceae								
Pistacia atlantica Desf. (TDK053)	البطمة Botma	1	1	0.02	Barks	Powder	Oral	Thyroid disorders
Pistacia lentiscus L. (TDF025)	الضرو Dharw	8	11	0.17	Fruit oils, leaves	Decoction, infusion, paste, raw	Oral, topical	Allergy, burns, colon, depurative, stomach.
Apiaceae								
Ammi visnaga (L.) Lam. (TDF009)	النوخة Noukha	11	15	0.23	Aerial parts	Decoction, infusion	Oral	Analgesic, calming, high blood pressure, influenza, thyroid disorders, vomiting
Apium graveolens L. (TDF029)	الكرافس Krafes	2	5	0.08	Aerial parts	Infusion	Oral	Anguish, colon, dysuria, renal lithiasis, strengthening.
Bunium incrassatum Amo (TDF013)	تالغودة Talghouda	23	29	0.45	Tubers	Infusion, powder	Oral	Allergy, asthma, cough, cysts, tonsillitis, thyroid disorders.
Carum carvi L. (TDT086)	الكروية Karwiya	2	3	0.05	Seeds	Infusion	Oral	Calming, colon, bloating.
Coriandrum sativum L. (TDT049)	الكسبر Kosbor	2	2	0.03	Seeds	Decoction, infusion	Oral	Diabetes.
Cuminum cyminum L. (TDT063)	الكمون Kemoun	5	12	0.19	Seeds	Infusion, powder	Oral	Analgesic, bloating, calming, cholesterol, colon, cough, fever inflammation, influenza, rheumatism.
Daucus carota L. (TDC094)	الجزر Jazar	2	4	0.06	Seeds	Infusion, juice	Oral	Colon, depurative, prostate, ulcer.
Foeniculum vulgare Mill. (TDF001)	البسباس Besbas	22	29	0.45	Seeds	Decoction, infusion,	Oral, topical	Anemia, anxiety, bloating, colon, constipation, hair loss, obesity, tonsillitis, wrinkles.
Petroselinum crispum (Mill.) Fuss (TDF084)	المعدنوس Maadnous	1	1	0.02	Aerial parts	Infusion	Oral	Cancer.
Pimpinella anisum L. (TDF027)	اليانسون Yanssoun	6	6	0.09	Seeds	Infusion	Oral	Calming, colon, influenza.
Thapsia garganica L. (TDF085)	الدرياس Deryas	1	2	0.03	Roots	Powder	Oral, topical	Anorexia, wounds.
Aristolochiaceae								
Aristolochia longa L. (TDF040)	برستم Berestom	7	8	0.12	Roots	Mixture, powder	Oral	Cancer, diabetes.
Asparagaceae								
Asparagus officinalis L. (TDF105)	السكوم Sekoum	1	1	0.02	Aerial parts	Decoction	Oral	Rheumatism.

Plant family, Species(voucher)	Vernacular name	FC	UR	UV	Used parts	Mode of preparation	Mode of administration	Therapeutic uses
Asteraceae								
Anacyclus pyrethrum (L.) Lag. (TDT067)	تقنطس Tegontos	3	3	0.05	Roots	Decoction, infusion, powder	Oral	Cough, thrombosis.
Artemisia absinthium L. (TDT073)	الشهيبة Chehaiba	4	8	0.12	Aerial parts, roots	Decoction, infusion	Oral	Colon, diarrhea, dysuria, heart, intestinal parasitosis, liver, osteoarthritis, uterine fibroids.
Artemisia campestris L. (TDT060)	التقفت Tegouffet	5	6	0.09	Aerial parts	Decoction, infusion	Oral	Allergy, analgesic, cholesterol, colon, intoxications, stomach.
Artemisia herba-alba Asso (TDF003)	الشيح Chih	17	24	0.37	Aerial parts	Decoction, infusion, inhalation, paste	Nasal, oral, topical	Calming, colon, diabetes, diarrhea, hair loss, heart, high blood pressure, influenza, intestinal parasitosis, low blood pressure.
Cynara scolymus L. (TDT081)	القرناع Gorenaâ	1	1	0.02	Leaves	Infusion	Oral	Cholesterol.
Dittrichia viscosa (L.) Greuter (TDF104)	أمقرمان Amaquramane	1	1	0.02	Leaves	Paste	Oral	Rheumatism.
Echinops spinosissimus Turra (TDF106)	تسكرة Tassekra	1	3	0.05	Roots	Decoction	Oral	Cough, influenza, pregnancy.
Matricaria chamomilla L. (TDF019)	البابونج Babounej	21	31	0.48	Flowers	Decoction, infusion, Paste	Oral, topical	Analgesic, anguish, calming, cephalalgia, colon, cough, depurative, diarrhea, hair loss, inflammation, influenza, insomnia, migraine.
Saussurea costus (Falc.) Lipsch. (TDF083)	القسط الهندي Kest hindi	1	1	0.02	Roots	Powder	Oral	Tonsillitis.
Silybum marianum (L.) Gaertn. (TDR097)	شوك الجمل Chouk eljemal	1	1	0.02	Leaves	Infusion	Oral	Constipation.
Berberidaceae								
Berberis vulgaris L. (TDF020)	غريس Ghriss	15	16	0.25	Aerial parts, roots	Decoction, infusion, maceration, mixture, powder	Oral	Cancer, diabetes, intestinal parasitosis.
Brassicaceae								
Eruca vesicaria (L.) Cav. (TDT050)	الجرجير Jarjir	1	1	0.02	Leaves	Infusion	Oral	Rheumatism.
Lepidium sativum L. (TDF002)	الحرف Horf	11	20	0.31	Seeds	Infusion, raw	Oral, topical	Allergy, asthma, cholesterol, cough, depurative, osteoarthritis, influenza, rheumatism, vitiligo.
Oudneya africana R. Br. (TDF022)	حنة الابل Henet el ibil	2	3	0.05	Leaves	Decoction	Oral	Cholesterol, thrombosis.
Burseraceae								
Boswellia sacra Flueck. (TDR100)	اللبان Louban	3	3	0.05	Resins	Raw	Oral	Asthma, influenza, kidney.
Cactaceae								
Opuntia ficus-indica (L.) Mill. (TDT071)	الهندي Hindi	4	4	0.06	Fruits, stems	Decoction, paste, raw	Oral, topical	Diarrhea, hair loss, kidney.

Plant family, Species(voucher)	Vernacular name	FC	UR	UV	Used parts	Mode of preparation	Mode of administration	Therapeutic uses
Caryophyllaceae								
Paronychia argentea Lam. (TDK054)	النعيمة الفضية Naima Fedhia	1	1	0.02	Flowers	Infusion	Oral	Renal lithiasis.
Spergularia rubra J. Presl & C. Presl (TDT061)	بصاط الملوك Bessat l'mlouk	6	6	0.09	Leaves	Decoction, infusion	Oral	Kidney, renal lithiasis
Cucurbitaceae								
Citrullus colocynthis (L.) Schrad. (TDF018)	الحنظل Handhal	3	3	0.05	Fruits	Juice, raw	Topical	Diabetes, eczema.
Cucurbita moschata Duchesne (TDK057)	اليقطين Yaqtin	1	1	0.02	Seeds	Decoction	Oral	Renal lithiasis.
Ecballium elaterium (L.) A. Rich. (TDT069)	فقوس الحمير Fegouss el'hmir	2	2	0.03	Fruits	Inhalation, paste	Nasal, topical	Hemorrhoids, hepatitis.
Cupressaceae								
Juniperus phoenicea L. (TDF015)	العرعار Arrâar	17	20	0.31	Aerial parts	Decoction, infusion, paste, powder, raw	Oral, topical	Asthma, colon, cough, influenza, rheumatism, ulcer.
Juniperus oxycedrus L. (TDR092)	الطاقة Tagga	1	1	0.02	Aerial parts	Infusion	Oral	Fever.
Tetraclinis articulata (Vahl) Mast. (TDF014)	الدباغ Debagh	2	2	0.03	Fruits	Infusion, powder	Oral	Ulcer.
Cyperaceae								
Cyperus esculentus L. (TDT101)	حب العزيز Hab el-aziz	1	1	0.02	Fruits	Decoction	Oral	Dysuria.
Ephedraceae								
Ephedra alata Decne. (TDF041)	العلندة El-alinda	10	10	0.16	Aerial parts	Decoction, infusion	Oral	Cancer, renal lithiasis.
Ericaceae								
Arbutus unedo L. (TDF044)	اللنج Lindj	1	1	0.02	Leaves	Infusion	Oral	Renal lithiasis.
Euphorbiaceae								
Euphorbia guyoniana Boiss. & Reut (TDT062)	اللبينة Loubbina	2	2	0.03	Aerial parts	Decoction, mixture	Oral	Cancer, diabetes.
Ricinus communis L. (TDF098)	الخروع Kharewâa	1	1	0.02	Seeds	Raw	Oral	Constipation.
Fabaceae								
Ceratonia siliqua L. (TDF010)	الخروب Kharoub	4	4	0.06	Fruits	Decoction, infusion, powder, raw	Oral	Anemia, ulcer.
Glycyrrhiza glabra L. (TDF017)	عرق السوس Arqsouss	4	5	0.08	Roots	Decoction	Oral	Cough, prostate, rheumatism, stomach, ulcer.
Lupinus albus L. (TDT079)	الترمس المر Termes lmour	2	2	0.03	Fruits	Infusion, raw	Oral, topical	Diabetes.
Senna alexandrina Mill. (TDF005)	السنا المكي Sana el-miki	27	33	0.52	Leaves	Decoction, infusion	Oral	Analgesic, colon, constipation, gout, rheumatism, vomiting.
Trigonella foenum-graecum L. (TDF026)	الحلبة Helba	14	88	1.37	Seeds	Decoction, infusion, maceration, powder, raw	Oral	All reported ailments.
Vicia faba L. (TDT072)	الفول Foul	1	1	0.02	Seeds	Decoction	Oral	Allergy.
Fagaceae								
Quercus rotundifolia Lam. (TDF035)	البلوط Ballout	2	2	0.03	Fruits	Decoction	Oral	Enuresis.

Plant family, Species(voucher)	Vernacular name	FC	UR	UV	Used parts	Mode of preparation	Mode of administration	Therapeutic uses
Gentianaceae								
Centaurium erythraea Rafn (TDT058)	مرارة الحنش Merraret el-hnech	4	4	0.06	Flowers, leaves	Infusion	Oral	Colon, diabetes, high blood pressure.
Lamiaceae								
Ajuga iva (L.) Schreb. (TDT068)	شندقورة Chendgoura	2	4	0.06	Aerial parts	Decoction, infusion	Oral	Diabetes, intoxications, snake bites, wounds.
Lavandula stoechas L. (TDF006)	الخزامى Khezama	10	13	0.20	Flowers, seeds	Decoction, infusion	Gargle, oral	Antimicrobial, colon, dental gingiva, influenza, kidney, mouth infections, uterine fibroids, vomiting.
Marrubium deserti (Noë) Coss. (TDS087)	الجعدة Jaâda	2	2	0.03	Aerial parts	Decoction, paste	Oral, topical	Colon, rheumatism.
Marrubium vulgare L. (TDT070)	تمريوت Timeriouet	3	4	0.06	Aerial parts	Decoction, infusion	Nasal, oral	Asthma, heart, influenza, rheumatism.
Mentha × piperita L. (TDF042)	النعناع Naâ'naâ	11	17	0.27	Leaves	Decoction, infusion, paste	Oral	Calming, diarrhea, high blood pressure, inflammation, influenza, pregnancy, rheumatism, stomach, uterine fibroids.
Mentha pulegium L. (TDT059)	فليو Flio	5	5	0.08	Aerial parts	Decoction, infusion, paste	Oral, topical	Hair loss, heart, influenza, vomiting.
Mentha suaveolens Ehrh. (TDT075)	تيمرساط Timerssat	1	2	0.03	Leaves	Powder	Oral	Heart, ulcer.
Ocimum basilicum L. (TDR096)	الحبق Hebak	1	1	0.02	Leaves	Infusion	Oral	Constipation.
Origanum majorana L. (TDL048)	المردقوش Merdekouch	5	11	0.17	Leaves	Decoction, infusion	Oral	Anxiety, asthma, calming, cough, diabetes, high blood pressure, inflammation, influenza, migraine, rheumatism.
Rosmarinus officinalis L. (TDF039)	اكليل الجبل Iklil el jabal	13	20	0.31	Leaves	Decoction, infusion, paste	Oral, topical	Calming, cholesterol, colon, cough, depurative, hair loss, high blood pressure, influenza, obesity, prostate, rheumatism, stomach.
Salvia officinalis L. (TDF004)	الميرامية Miramiya	13	20	0.31	Leaves	Decoction, infusion	Oral	Analgesic, anorexia, anguish, calming, cholesterol, colon, depurative, hair loss, high blood pressure, inflammation, obesity, pregnancy, renal lithiasis.
Satureja calamintha (L.) Scheele TDS090)	النابطة Nabta	1	1	0.02	Leaves	Infusion	Oral	Cough.
Teucrium polium L. (TDK051)	الخياطة Khiyata	7	8	0.12	Aerial parts	Decoction, infusion	Oral	Analgesic, diabetes, heart, ulcer, vomiting, wounds.
Thymus serpyllum L. (TDF033)	الزعتر البري Zaâter el bari	9	77	1.20	Aerial parts	Decoction, infusion	Oral	All reported ailments.
Thymus vulgaris L. (TDF045)	الزعتر Zaâter	14	16	0.25	Aerial parts	Decoction, infusion	Oral	Cholesterol, cough, influenza, strengthening.
Lauraceae								
Cinnamomum verum J.Presl (TDF038)	القرفة Qarfa	11	15	0.23	Barks	Decoction, infusion	Oral	Alopecia areata, asthma, cancer, colon, cough, diabetes, obesity.
Laurus nobilis L. (TDF043)	الرند Rand	12	18	0.28	Leaves	Decoction, infusion	Oral	Diabetes, high blood pressure, low blood pressure, stomach, strengthening.

Plant family, Species(voucher)	Vernacular name	FC	UR	UV	Used parts	Mode of preparation	Mode of administration	Therapeutic uses
Linaceae								
Linum usitatissimum L. (TDF007)	زريعة الكتان Zeriêet el kettan	9	14	0.22	Seeds	Infusion, paste, powder	Oral, topical	Allergy, anorexia, cholesterol, diabetes, hair loss, obesity.
Lythraceae								
Lawsonia inermis L. (TDT064)	الحنة Henna	1	3	0.05	Leaves	Decoction	Oral	Colon, hair loss, ulcer.
Punica granatum L. (TDF030)	الرمان Romman	10	10	0.16	Barks, flowers, fruits	Decoction, infusion, mixture, powder	Oral	Ulcer.
Malvaceae								
Hibiscus sabdariffa L. (TDF034)	الكركديه Karkadia	11	14	0.22	Flowers	Decoction, infusion	Oral	Diabetes, high blood pressure, low blood pressure.
Tilia cordata Mill. (TDF082)	الزيزفون Zaizafoun	1	1	0.02	Leaves	Infusion	Oral	Anguish.
Myrtaceae								
Myrtus communis L. (TDF016)	الريحان Rayehan	11	14	0.22	Leaves	Decoction, infusion, paste	Oral, topical	Colon, diabetes, dysuria, hair loss, stomach.
Syzygium aromaticum (L.) Merr. & L.M. Perry (TDT078)	قرنفل Kronfol	4	4	0.06	Fruits	Maceration, raw	Oral, topical	Cough, toothache.
Oleaceae								
Olea europaea L. (TDF028)	زيتون Zitoun	5	6	0.09	Fruit oils, leaves	Infusion, raw	Oral, topical	Burns, diabetes, high blood pressure.
Papaveraceae								
Papaver rhoeas L. (TDT080)	بن نعمان Ben naâ'man	1	1	0.02	Flowers	Infusion	Oral	Asthma.
Pinaceae								
Pinus halepensis Mill. (TD074)	الصنوبر Snawbar	2	3	0.05	Barks, seeds	Paste	Oral, topical	Burns, cough, osteoarthritis.
Plantaginaceae								
Globularia alypum L. (TDT102)	تاسلغة Tasselgha	1	1	0.02	Leaves	Infusion	Oral	Kidney.
Plantago ciliata Desf. (TDS091)	لالمة Lalma	1	1	0.02	Leaves	Inhalation	Nasal	Mouth infections.
Poaceae								
Pennisetum glaucum (L.) R.Br. (TDK055)	البشنة Bechna	2	4	0.06	Seeds	Infusion, powder	Oral	Anorexia, breastfeeding, osteoarthritis.
Zea mays L. (TDF037)	الذرى Dherra	2	2	0.03	Fruits	Infusion	Oral	Dysuria, renal lithiasis.
Ranunculaceae								
Nigella sativa L. (TDF024)	السانوج Sanouj	7	96	1.50	Seeds	Infusion, inhalation, raw	Nasal, oral	All reported ailments.
Rhamnaceae								
Rhamnus alaternus L. (TDF021)	مليلس Meliless	14	14	0.22	Aerial parts	Decoction, infusion	Oral	Anemia, hepatitis.
Ziziphus lotus (L.) Lam. (TDF008)	السدرة Sedra	6	73	1.14	Fruits, leaves, roots	Decoction, infusion	Oral, topical	All reported ailments.

Plant family, Species(voucher)	Vernacular name	FC	UR	UV	Used parts	Mode of preparation	Mode of administration	Therapeutic uses
Rosaceae								
Crataegus monogyna Jacq. (TDA103)	الزعرور Zaârour	1	1	0.02	Fruits	Infusion	Oral	Cephalalgia.
Cydonia oblonga Mill. (TDK052)	السفرجل Sefarjel	1	1	0.02	Barks	Decoction	Oral	Ulcer.
Malus domestica Borkh. (TDK056)	التفاح Teffah	2	2	0.03	Fruits	Maceration	Oral	Cholesterol, high blood pressure.
Prunus dulcis (Mill.) D.A. Webb (TDT077)	اللوز Louz	3	3	0.05	Roots	Decoction	Oral	Anemia.
Prunus persica (L.) Batsch (TDS088)	الخوخ Khoukh	2	2	0.03	Leaves	Infusion	Oral	Cysts.
Rubiaceae								
Rubia tinctorum L. (TDF011)	الفوة Fouwa	18	18	0.28	Roots	Decoction, infusion, powder, raw	Oral	Anemia.
Salicaceae								
Populus nigra L. (TDT065)	الصفصاف Safsaf	1	1	0.02	Leaves	Infusion	Oral	Colon.
Santalaceae								
Viscum album L. (TDR095)	لنجبار Lendjebar	2	2	0.03	Roots	Infusion, powder	Oral	Breastfeeding, obesity.
Thymelaeaceae								
Daphne gnidium L. (TDF031)	لازاز Lazzaz	4	4	0.06	Leaves	Infusion, paste	Oral, topical	Hair loss, sinusitis.
Thymelaea hirsuta (L.) Endl. (TDS089)	المثنان Methnan	3	4	0.06	Aerial parts	Inhalation, powder	Oral	Pregnancy, uterine fibroids.
Urticaceae								
Urtica dioica L. (TDF036)	الحريق Hourrig	4	72	1.12	Leaves	Decoction, infusion, paste	Oral, topical	All reported ailments.
Verbenaceae								
Verbena officinalis L. (TDT066)	اللويزة Lewiza	2	3	0.05	Leaves	Decoction	Oral	Anguish, insomnia stomach.
Xanthorrhoeaceae								
Asphodelus ramosus L. (TDT076)	بلواز Blouaz	2	2	0.03	Roots	Infusion	Nasal	Otitis.
Zingiberaceae								
Curcuma longa L. (TDC093)	الكركم Korkom	4	4	0.06	Rhizomes	Decoction, infusion, powder	Oral	Antimicrobial, influenza, hepatitis.
Zingiber officinale Roscoe (TDF046)	الزنجبيل Zandjabil	16	27	0.42	Rhizomes	Decoction, infusion paste, powder	Oral, topical	Antimicrobial, asthma, bloating, calming cholesterol, colon, cough, influenza, intoxications, obesity, rheumatism, vomiting, weight gain.
Zygophyllaceae								
Peganum harmala L. (TDF099)	الحرمل Harmel	1	1	0.02	Aerial parts	Powder	Oral	Rheumatism.
Zygophyllum album L.F. (TDF012)	العقاية Aggaya	6	7	0.11	Leaves	Decoction, infusion	Oral	Anemia, cancer, diabetes.

3.5. Categories of diseases and therapeutic indications

The ethnomedicinal plants reported throughout this study were used to treat 68 different ailments classified into 13 categories; digestive (52 species), circulatory (39 species), respiratory (37 species), urogenital (33 species), glandular (29 species), neurological and psychological (28 species), dermatological (27 species), osteoarticular (25 species), cancer (15 species), ocular (10 species), mouth (8 species), general ailments (21 species) and others (7 species) (Figure 5).

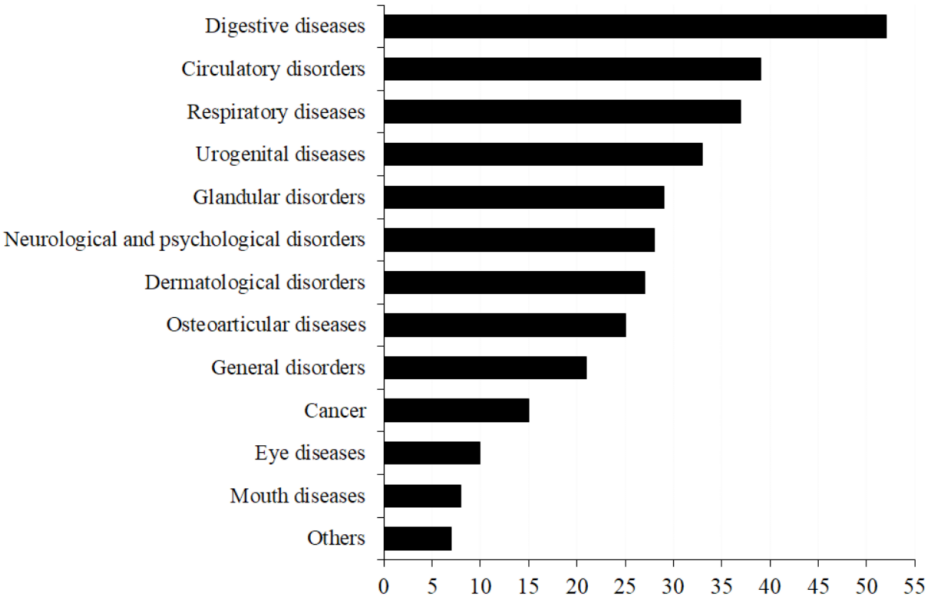

Figure 5. Number of used medicinal plant species in each ailment category.

The obtained results indicated that 31% of the reported plant species are recommended for the treatment of digestive diseases. However, 16% of the plant species are used to treat respiratory diseases. Nevertheless, the management of circulatory system, skin alterations and nervous diseases was secured by 10% of the inventoried plant taxa for each ailment. The remaining 23% of the cited species are used for the treatment of a wide range of diseases such as urinary ailments and metabolic disorders including diabetes and cancer (Figure 4). These findings are in accordance with previous studies carried out in Algeria and in the Mediterranean region. Most of medicinal plants listed by Boudjelal *et al*. (2013) in the region of M'Sila (north east of Algeria) were recommended to treat digestive problems, diabetes, blood pressure and cancers. In addition, Ouelbani *et al*. (2016) have reported the use of medicinal plants mainly for the treatment of gastrointestinal disorders in the region of Constantine and Mila (north east of Algeria). Similar findings were reported by González-Tejero *et al*. (2008) and Slimani *et al*. (2016) in the Mediterranean region.

4.6. Most frequently cited taxa

The frequency of citation index (FC) for all the reported species value ranged from 1 to 27 (Table 2). *Senna alexandrina* Mill. was ranked first (FC=27), followed by *Atriplex halimus* and *Bunium incrassatum* (FC=23 each), *Foeniculum vulgare* (FC=22), *Matricaria chamomilla* (FC=21), *Rubia tinctorum* (FC=18), *Artemisia herba-alba* and *Juniperus phoenicea* (FC=17 each).

Senna alexandrina is indicated in this study for the treatment of colon, constipation, gout, rheumatism, vomiting and as an analgesic. By the same, Bouasla & Bouasla (2017) and Elansary *et al*. (2018) have reported its traditional use for the treatment of constipation, stomach, pain and hair loss. The dried leaves and pods of *S. alexandrina* Mill. contain molecules called sennosides among them sennosides A and B which have carminative, purgative, antidysenteric, expectorant properties (Mishra *et al*., 2018). Additionally, its leaves are rich in bioactive biomolecules such as tinnevellin glycoside, kaempferol, scutellarein, isorhamnetin-3-O-beta-gentiobioside, apigenin-6,8-di-C-glycoside, D-3-O-methylinositol, Quercimeritrin, emodin-8-O-beta-D-glucopyranoside E, and rutin (Wang *et al*., 2020). This species possesses confirmed antioxidant, anti-inflammatory, antimicrobial, antipyretic, laxative, diuretic, and purgative effects (Elansary *et al*., 2018; Wang *et al*., 2020).

The use of the perennial halophyte shrub *Atriplex halimus* is reported for the treatment of cancer, inflammatory diseases and hypertension. Benhammou *et al*. (2009) have reported its use to treat diabetes and internal parasites while Lakhdari *et al*. (2016) have noted its use for the management of gastrointestinal, cardiovascular, inflammatory and respiratory diseases besides diabetes and fall of placentae. This species is rich in tannins, flavonoids (flavone, flavanone, flavonols and isoflavone glycosides), saponins, alkaloids, resins, naringin, and naringenin 7-O-glucoside (Benhammou *et al*., 2009; Emam, 2011). The previous studies of Kabbash & Shoeib (2012) and Al-Senosy *et al*. (2018) have demonstrated its antioxidant, antimicrobial, antileishmanial, anti-inflammatory, antiproliferative and antidiabetic effects.

Furthermore, *Bunium incrassatum* is indicated to treat allergy, asthma, cough, cysts, tonsillitis and thyroid disorders. According to Benarba *et al*. (2015), this species is used in the treatment of allergy, bronchitis and cough. The powder of dried tubers of this species was used for bronchitis, cough, inflammatory hemorrhoids and as astringent and anti-diarrheal agent (Bousetla *et al*., 2015). The phytochemical analyses have demonstrated its richness in several active compounds such as scopoletin, coumarins, scoparone, β-sitosterol, caryophyllene, germacrene and farnesene (Bousetla *et al*., 2014; Bousetla *et al*., 2015; El Kolli *et al*., 2017). In addition, the tested activity of its essential oil has shown antioxidant, anti-hemolytic, anti-inflammatory, antibacterial and antimicrobial properties (Bousetla *et al*., 2014; El Kolli *et al*., 2017).

All plant parts of *Foeniculum vulgare* are used for the treatment of digestive, reproductive, respiratory and endocrine disorders. In general, this plant constitutes a common remedy for gastrointestinal disorders including bloating, indigestion (Kaur & Arora, 2009). Ouelbani *et al*. (2016) stated that it is used in the treatment of rheumatism, muscular problems, lactation, weight loss as it possesses an antispasmodic activity. Its seeds are known to improve the unpleasant odor of the mouth (Badgujar *et al*., 2014). They are consumed either raw or as a tea made by adding boiling water to a teaspoon of seeds. Its extracts are also useful in the treatment of hypertension and glaucoma (Rather *et al*., 2016). This plant is a rich source of polyphenols, flavonoids, terpenoids, carotenoids, coumarins, curcumin, fenchone, estragole, phenolic glycosides and trans-anethole (Rather *et al*., 2016; Zellagui *et al*., 2011).

Besides, *Matricaria chamomilla* was recommended for gastric, respiratory, neurologic, and inflammatory problems. Bigagli *et al*. (2017) reported the use of chamomile to treat ulcers, stomachache, inflammations, wounds, skin irritation, gastrointestinal disorders, pharyngitis, and rheumatic pain. The popular uses of this plant are infusion, tea, and capsules (Petruľová-Poracká *et al*., 2013; Tolouee *et al*., 2010). Singh *et al*. (2011) described infusion of chamomile for urinary inflammation, digestive and menstruation disorders, and powder for external use for wounds and hemorrhoids. However, Rebbas *et al*. (2012) stated that oily maceration of leaves is useful for rheumatic and migraine pain. Phytochemical analyses have shown its richness in terpenoids, luteolin, apigenin, α-bisabolol, caffeic acid, matricin, coumarins, α-bisabolol oxides A and B, chlorogenic acid, quercetin and naringenin (Bigagli *et al*., 2017; Singh *et al*., 2011).

As well, *Rubia tinctorum* is reported in this study to treat anemia. Baghalian *et al*. (2010) have cited that its roots are useful for the treatment of kidney and bladder stones due to the presence of 1-hydroxyanthraquinone which is a laxative and sedative agent. In addition, Esalat Nejad & Esalat Nejad (2013) have indicated it to treat urinary diseases and menstruation pain. This plant is also indicated against cancer, inflammation, tuberculosis, wounds, rheumatism and metrorrhagia (Nejat *et al*., 2017). Ford *et al*. (2015) and Nejat *et al*. (2017) have attributed the biological properties of this species mainly to the anthraquinones along with other bioactive phytochemical compounds such as polyphenols, flavonoids, alkaloids, terpenes, tannins, cardiac glycosides, coumarins and iridoid asperuloside.

However, many species has been reported just once such as *Thapsia garganica*, *Vicia faba*, *Tilia cordata* and *Ricinus communis* which may translate the lack of knowledge about their uses and their beneficial effects.

4.7. New therapeutic uses and new ethnomedicinal plant species

In general, 246 new therapeutic uses of 55 known medicinal plant species belonging to 29 botanical families have been reported for the first time in the north Africa throughout the present study (Appendix 1). These species are belonging mainly to Apiaceae (8 species), Asteraceae (8 species), Lamiaceae (7 species), Fabaceae (5 species) and Rosaceae (4 species) families. These findings consolidate the importance of the cited botanical families as effective source of bioactive molecules holding potential therapeutic effects (Benarba *et al*., 2015; Meddour & Meddour-Sahar, 2016; Sarri *et al*., 2014, 2015).

Moreover, five plant species have not been previously reported as medicinal plants in the north Africa and Algeria namely *Bunium incrassatum*, *Echinops spinosissimus*, *Cucurbita moschata*, *Pennisetum glaucum* and *Malus domestica*.

Interestingly, *Bunium incrassatum* was used to treat asthma, cysts, thyroid disorders and tonsillitis. However, *Echinops spinosissimus* was indicated for cough, influenza, inflammation and it is widely used to clean the female genital apparatus after childbirth. In addition, *Cucurbita moschata* was indicated for renal lithiasis while *Pennisetum glaucum* was recommended for anorexia, breastfeeding and osteoarthritis. Besides, *Malus domestica* was used to normalize cholesterol and high blood pressure.

4.8. Endemic, rare and endangered plants species

Among the 107 medicinal plants species reported throughout this study, 6 species are endemic to North Africa-Algeria, Northern and Central Sahara i.e. *Pistacia atlantica*, *Tetraclinis articulata*, *Oudneya africana*, *Euphorbia guyoniana*, *Teucrium polium* and *Marrubium deserti*. Furthermore, six species are considered threatened, rare or endangered i.e. *Artemisia herba-alba*, *Anacyclus pyrethrum*, *Cuminum cyminum*, *Saussurea costus*, *Boswellia sacra* and *Pistacia atlantica*. In addition, 7 species are listed as uncultivated plant species protected by the Algerian law (executive decree corresponding to January 2012) i.e. *Pistacia atlantica*, *Oudneya africana*, *Teucrium polium*, *Juniperus oxycedrus*, *Juniperus phoenicea* and *Tetraclinis articulata*. Unfortunately, the intensive use of rare and threatened plant species by the local population might lead to the loss of these genetic resources and consequently to their extinction.

4.9. Use value

The use value index (UV) of the reported medicinal plant species ranged from 1.5 to 0.016 (Table 2). This

quantitative index is used in order to prove the relative importance of the plant species known locally. The highest values were reported respectively for *Nigella sativa* (UV=1.5), *Trigonella foenum-graecum* (UV=1.38), *Thymus serpyllum* (UV=1.2), *Ziziphus lotus* (UV=1.14), *Urtica dioica* (1.13), *Senna alexandrina* (UV=0.52), *Atriplex halimus* (UV=0.5), *Matricaria chamomilla* (UV=0.48), *Bunium incrassatum* and *Foeniculum vulgare* (UV=0.45 each) respectively. However, the lowest use values have been reported for *Saussurea costus*, *Silybum marianum*, *Tilia cordata* and *Vicia faba* (UV=0.016 each).

These results corroborate the previous findings of Benarba *et al*. (2014), Ouelbani *et al*. (2016) and Eddouks *et al*. (2017) which demonstrated also higher use values for *Trigonella foenum-graecum* and *Nigella sativa*. The traditional indication of *N. sativa* to treat anemia and inflammation has been proven and attributed mainly to its thymoquinone and nigellone molecules which can act as inhibitors of the generation of eicosanoids, leukotrienes, and histamine (Al-Saleh *et al*., 2006; Tayman *et al*., 2013). As well, the antioxidant activity of *N. sativa* was also determined (Bouasla *et al*., 2014). In addition, *T. foenum-graecum* has also a long history of use in the treatment of respiratory infections, reproductive disorders, treating hormonal disorders, increasing milk supply, and reducing menstrual pain and reduce fever. This species has been shown to possess antiviral, antimicrobial, hypotensive, antioxidant, anti-inflammatory, hypoglycemic, hypolipidemic and antitumor activity (Al-Oqail *et al*., 2013).

However, Bouasla and Bouasla (2017) have mentioned *Thymus vulgaris* and *Mentha* × *piperita* with highest use values. *Thymus* spp. have been one of plants having the highest use values in Portugal (Neves *et al*., 2009) and Italy (Idolo *et al*., 2010) to treat different respiratory ailments such as bronchitis, allergy, cold, flu and cough. *Thymus* spp. are rich in several active compounds mainly in thymol, carvacrol, p-cymene, eugenol, and luteolin that may explain its remedial potential (Monira & Naima, 2012). These compounds are known to have antiviral, anti-inflammatory, antioxidant, anti-nociceptive, anti-anaphylactic and antibacterial properties (Javed *et al*., 2013).

4.10. Informant consensus factor

The documented use reports data have been classified into different ailment categories. The informant consensus factor (FIC) was calculated for each ailment category to select the categories of diseases for which the species are traditionally used, and the range was from 0.54 to 0.81 (Table 4). The highest F_{IC} value (0.81) was reported for digestive diseases with 52 used plant species and 274 reported uses, followed by cardiovascular and urogenital diseases (0.73 each). The higher values of the index indicate higher homogeneity of knowledge among informants. Similar results have been reported by Benarba *et al*. (2015) in Mascara (northwest of Algeria), Bouasla & Bouasla (2017) in Skikda (northeast of Algeria), Fakchich & Elachouri (2014) in Morocco and Tuttolomondo et al. (2014) in Italy. The high F_{IC} value of digestive diseases may be explained by its high incidence in the region from apart, and the ability of the traditional healers to easily diagnose these pathologies from another part (Punnam Chander *et al*., 2014). The high incidence of digestive disorders might inform probably an unhealthy lifestyle. Interestingly, cancer is reported to have the 5th highest F_{IC} value (0.66) which could be attributed mainly to the high incidence of cancers in the region.

Table 4. Informant consensus factor for commonly used medicinal plants.

Ailment	Number of taxa	Use reports	F_{IC}
Digestive disorders *Bloating*, *colon*, *constipation*, *diarrhea*, *hemorrhoids*, *hepatitis*, *intoxications*, *liver*, *intestinal parasitosis*, *stomach*, *ulcer*, *vomiting*	52	274	0.81
Circulatory disorders *Anemia*, *cholesterol*, *heart*, *high blood pressure*, *low blood pressure*, *thrombosis*	39	142	0.73
Respiratory disorders *Allergy*, *asthma*, *cough*, *influenza*	37	132	0.72
Urogenital diseases *Cysts*, *dysuria*, *enuresis*, *prostate*, *kidney*, *pregnancy*, *renal lithiasis*, *strengthening*, *uterine fibroids*	33	120	0.73
Glandular disorders Breastfeeding, diabetes, thyroid disorders	29	86	0.67
Neurological and psychological disorders *Analgesic*, *anguish*, *anorexia*, *anxiety*, *calming*, *cephalalgia*, *insomnia*, *migraine*	28	94	0.71
Dermatological disorders *Alopecia areata*, *burns*, *Eczema*, *hair loss*, *skin*, *vitiligo*, *wounds*, *wrinkles*	27	74	0.64
Osteoarticular diseases *Gout*, *inflammation*, *osteoarthritis*, *rheumatism*	25	57	0.57
General disorders *Antimicrobial*, *depurative*, *fever*, *obesity*, *weight gain*	21	61	0.66
Cancer	15	43	0.66

Table 4. Informant consensus factor for commonly used medicinal plants.

Eye diseases *Otitis*, *sinusitis*, *tonsillitis*	10	24	0.61
Mouth diseases *Dental gingiva*, *mouth infections*, *toothache*	8	25	0.71
Others *Measles*, *snake bites*	7	14	0.54

4. Conclusion

The obtained results reveal the importance of local knowledge throughout the variety and the large number of reported aromatic and medicinal plants used in traditional medicines to treat various ailments among local populations in the region of Tiaret.

Overall, informants have described the use of 107 medicinal plants belonging to 45 families and 97 genera for the treatment of various ailments. Lamiaceae, Apiaceae and Asteraceae were the most represented families. Besides, the most frequently cited species are *Senna alexandrina*, *Atriplex halimus* and *Bunium incrassatum*, *Foeniculum vulgare*, *Matricaria chamomilla*, *Rubia tinctorum*, *Artemisia herba-alba* and *Juniperus phoenicea*. However, the higher use values were reported for *Nigella sativa* L., *Trigonella foenum-graecum*, *Thymus serpyllum*, *Ziziphus lotus*, *Urtica dioica*, *Senna alexandrina*, *Atriplex halimus*, *Matricaria chamomilla*, *Bunium incrassatum* and *Foeniculum vulgare* respectively.

Interestingly, *Bunium incrassatum*, *Echinops spinosissimus*, *Cucurbita moschata*, *Pennisetum glaucum* and *Malus domestica* were reported for the first time as medicinal plants in the north Africa and Algeria. Moreover, 246 new therapeutic uses were described.

It should be noted that *Pistacia atlantica*, *Tetraclinis articulata*, *Oudneya africana*, *Euphorbia guyoniana*, *Teucrium polium* and *Marrubium deserti* are endemic to North Africa-Algeria, Northern and Central Sahara. Furthermore, *Artemisia herba-alba, Anacyclus pyrethrum*, *Cuminum cyminum*, *Saussurea costus*, *Boswellia sacra* and *Pistacia atlantica* are considered threatened, rare or endangered species. Therefore, an urgent intervention is required to protect these genetic resources from the abusive use by local population which might lead to their loss and extinction.

Evidently, it is the time to increase effective scientific studies on the determination of the nature and mechanisms of action of bioactive compounds included in these medicinal plants in order to produce effective and safe drugs.

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Appendix 1. New medicinal uses compared with previous ethnomedicinal studies carried out in Algeria and Morocco.

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Amaranthaceae			
Atriplex halimus L.	High blood pressure, ulcer.	Caner, goiter.	(Benarba et al., 2015)
		Eczema.	(Boudjelal et al., 2013)
		Diabetes, uterus cysts.	(Lakhdari et al., 2016)
		Thyroid.	(Ouelbani et al., 2016)
Haloxylon scoparium Pomel	Allergy, cancer, cholesterol, colon, cysts, intoxications, skin, snake bites	Diabetes.	(Telli et al., 2016)
Anacardiaceae			
Pistacia atlantica Desf.	Thyroid disorders.	Astringent.	(Benderradji et al., 2014)
		Dental pain, gingivitis, leishmaniasis, thrush.	(Chermat & Gharzouli, 2015)
		Diabetes.	(Telli et al., 2016)
Apiaceae			
Ammi visnaga (L.) Lam.	High blood pressure, thyroid disorders, vomiting.	Diabetes.	(Azzi et al., 2012)
		Nephritic colic, sedative, urethral lithiasis, vasodilator.	(Bouzabata & Mahomoodally, 2019)
		Kidney, respiratory.	(González-Tejero et al., 2008)
		Asthma, heart attack, joints pains, renal lithiasis, stomachache.	(Bouasla & Bouasla, 2017)
Apium graveolens L.	Anguish, renal lithiasis, strengthening.	Digestive system.	(Boughrara & Belgacem, 2016)
		Antispasmodic, carminative, diuretic.	(Bouzabata, 2013) (Benarba et al., 2015)
		Hypertension.	(Azzi et al., 2012)
		Diabetes.	
Bunium incrassatum Amo	Asthma, cysts, thyroid disorders, tonsillitis.	Not reported.	
Cuminum cyminum L.	Cholesterol, fever, influenza.	Infected wounds, skin infections.	(Volpato et al., 2012)
		Abdominal pains, colon, stomach ulcer.	(Sarri et al., 2015)
			(Benarba, 2016)
		Constipation, gases, kids cough, menstrual pain, stomachache.	(Ouelbani et al., 2016)
		Analgesic, antispasmodic, cough, lactation, rheumatism, tranquilizer.	
Daucus carota L.	Colon, depurative, ulcer.	Respiratory, urinary or genital infections	(Bouasla & Bouasla, 2017)
		Cysts, urinary tract.	
Foeniculum vulgare Mill	Anemia, hair loss, tonsillitis, wrinkles.	Antidiarrheal, antispasmodic, carminative.	(Lakhdari et al., 2016) (Sarri et al., 2015)
		Antiemetic.	(Meddour & Meddour-Sahar, 2016)
		Digestive, mental nervous, nutritional.	(González-Tejero et al., 2008)
		Gastrointestinal system diseases.	(Benarba et al., 2015)
Petroselinum crispum (Mill) Fuss	Cancer.	Acne, anti-infective, blood circulation, urinary infections.	(Bouasla & Bouasla, 2017)
		Diuretic, hypotensive.	(Bouzabata, 2013)
		Diabetes.	(Azzi et al., 2012)

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Thapsia garganica L.	Anorexia, wounds.	Bronchitis, rheumatic pain.	(Benderradji et al., 2014)
		Anti-inflammatory, eczema.	(Boudjelal et al., 2013)
		Respiratory diseases.	(Boughrara & Belgacem, 2016)
		Antipyretic, weakness, weight loss.	(Meddour & Meddour-Sahar, 2016)
Aristolochiaceae			
Aristolochia longa L.	Diabetes.	Cancer.	(Benarba et al., 2015)
Asteraceae			
Anacyclus pyrethrum (L.) Lag.	Thrombosis.	Flatulence, respiratory system diseases, spermatozoids, tonic.	(Ouelbani et al., 2016)
		Female sterility.	(Benarba, 2016)
		Cancer, cough, female sterility.	(Benarba et al., 2015)
		Diabetes.	(Azzi et al., 2012)
Artemisia absinthium L.	Dysuria, heart, uterine fibroids.	Appetizer, hypertensive, vulnerary.	(Sarri et al., 2014)
		Antiseptic, digestive disorders, wormer.	(Sarri et al., 2015)
			(Rebbas et al., 2012)
		Anti-inflammatory, antiseptic, aperitive, aromatic, bitter tonic, cholagogue, digestive, diuretic, vermifuge.	(Meddour & Meddour-Sahar, 2016)
		Antidiabetic, antiseptic injury, diuretic, stomachic.	
Artemisia campestris L.	Allergy, cholesterol.	Analeptic, dandruff, healing, helminthiases, mycosis, spasms and aid to menstruation, stomach and liver diseases, vulnerary.	(Hammiche & Maiza, 2006)
		Intestinal bloating, intestinal parasites.	(Chermat & Gharzouli, 2015)
		After childbirth, hair loss, digestive diseases, fever.	(Ramdane et al., 2015)
Artemisia herba-alba Asso	Hair loss.	Antigastralgic, antispasmodic, emmenagogue, stomachic, vermifuge.	(Rebbas et al., 2012)
			(Bouchikh et al., 2016)
		Antigastralgic, antispasmodic, calming, digestive, emmenagogue, heart, hypertension, memory, sedative, spasms, tics, vermifuge.	(Sari et al., 2012)
		Arterial hypertension.	(Ouelbani et al., 2016)
		Analgesic, blood purification, cancer, respiratory system diseases.	
Cynara scolymus L.	Cholesterol.	Antidiarrheal, appetizer, blood purification, cholagogue, choleretic, diuretic, energy, hypoglycemic, nutritious, stimulating.	(Benderradji et al., 2014)
		Digestive, urogenital diseases.	(Boughrara & Belgacem, 2016)
		Depurative, hypoglycemic.	(Bouzabata, 2013)
Echinops spinosissimus Turra	Cough, influenza, inflammation, cleaning the female genital apparatus after childbirth	Not reported	

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Matricaria chamomilla L.	Anguish, cephalalgia, colon, cough, hair loss, influenza, insomnia.	Analgesic, anti-inflammatory, antiseptic, antispasmodic, bitter vetch, carminative, emmenagogue, febrifuge, sedative, stomachic, tonic.	(Benderradji et al., 2014)
		Skin diseases.	(Boughrara & Belgacem, 2016)
Saussurea costus Flueck.	Tonsillitis.	Diabetes.	(Bouzabata & Mahomoodally, 2019)
Berberidaceae			
Berberis vulgaris L.	Intestinal parasitosis.	Diabetes.	(Bouzabata and Mahomoodally, 2019)
		Cancer.	(Benarba et al., 2015)
Brassicaceae			
Eruca vesicaria (L.) Cav.	Rheumatism.	Fractures, stomachache, urinary infections.	(Bouasla and Bouasla, 2017)
Lepidium sativum L.	Cholesterol.	Elimination of dirt from eyes.	(Volpato et al., 2012)
		Anemia, anthelmintic, broken bones, fatigue, hair loss, hypoglycemic for women after childbirth	(Sarri et al., 2014) (Ouelbani et al., 2016)
		Anemia, antibiotic, anti-hair loss, antioxidant, appetite, dermatological problems, diuretic, goiter, hypoglycemic, immune system, memory, rheumatism and bone problems, tonics, tumors.	(Benarba et al., 2015)
		Respiratory tract diseases.	
Oudneya africana R. Br.	Thrombosis.	Skin diseases and lesions.	(Lakhdari et al., 2016)
		Diabetes.	(Telli et al., 2016)
Burseraceae			
Boswellia sacra Flueck.	Asthma, influenza, kidney.	Diabetes.	(Bouzabata & Mahomoodally, 2019)
Cactaceae			
Opuntia ficus-indica (L.) Mill.	Hair loss, kidney.	Antidiabetic, diarrhea.	(Sarri et al., 2015)
		Digestive, muscular, nutritional.	(González-Tejero et al., 2008)
		Diarrhea, hemorrhoids.	(Meddour & Meddour-Sahar, 2016)
		Hemorrhoids, respiratory system diseases.	(Ouelbani et al., 2016)
Cucurbitaceae			
Citrullus colocynthis L. Schrad.	Eczema.	Antihypertensive, antitumor.	(Boudjelal et al., 2013)
		Headaches, tinea, vitiligo.	(Hammiche & Maiza, 2006)
		Diabetes.	(Azzi et al., 2012)
Cucurbita moschata Duchesne	Renal lithiasis.	Not reported.	
Cupressaceae			
Tetraclinis articulata (Vahl) Mast.	Ulcer.	Diabetes	(Azzi et al., 2012)
		Hypoglycemic, hypotensive.	(Bouzabata, 2013)
Cyperaceae			
Cyperus esculentus L.	Dysuria.	Aphrodisiac, appetite, weight gain.	(Benarba et al., 2015)
		Kids appetite	(Benarba, 2015)

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Ephedraceae			
Ephedra alata Decne.	Cancer, renal lithiasis.	Body weakness, cold, hypertension, influenza, respiratory problems.	(Lakhdari et al., 2016)
Euphorbiaceae			
Euphorbia guyoniana Boiss. & Reut	Cancer.	Diabetes. Diarrhea, scorpion stings, snake bites, skin diseases.	(Telli et al., 2016) (Lakhdari et al., 2016)
Fabaceae			
Ceratonia siliqua L.	Anemia, ulcer.	Appetite, antihypertensive, blood purification, cough, rheumatism, salivary secretions. Diarrhea.	(Ouelbani et al., 2016) (Bouasla and Bouasla, 2017)
Glycyrrhiza glabra L.	Prostate, ulcer.	Anti-virus and fungi, chest diseases, deodorant, eyes treatment, hypertension, rheumatism, spleen and liver pain, stomach pain, teeth cleaner. Bronchitis, cough, laryngitis.	(Lakhdari et al., 2016) (Benarba, 2016)
Senna alexandrina Mill.	Gout, rheumatism, vomiting.	Articulation pains, constipation, hair falls. Constipation, gases, stomachache.	(Bouasla and Bouasla, 2017) (Benarba, 2016)
Trigonella foenum-graecum L.	Anorexia, antimicrobial, alopecia areata, burns, cancer, cephalalgia, dental gingiva, hair loss, insomnia, measles, migraine, mouth infections, pregnancy, skin, toothache, uterine fibroids, vitiligo, wrinkles.	Anxiety, diabetes, purification, stomachache. Anemia, anti-inflammatory, appetite, digestive disorders, diuretic, immune system diseases, lactation, metabolic system diseases, respiratory system diseases, wounds. Anguish, antidiabetic, eczema. Ear afflictions, eye, snake bites.	(Bouasla and Bouasla, 2017) (Ouelbani et al., 2016) (Sarri et al., 2015) (Volpato et al., 2012)
Vicia faba L.	Allergy.	Eczema, hyperacidity. Chronic cough.	(Meddour and Meddour-Sahar, 2016) (Benarba et al., 2015)
Lamiaceae			
Ajuga iva (L.) Schreb.	Wounds.	Antidiabetic, antihypertensive, digestive disorders, eczema, leishmanicidal. Animal bites, headache, stomach upset.	(Boudjelal et al., 2013) (Meddour and Meddour-Sahar, 2016)
Lavandula stoechas L.	Antimicrobial, uterine fibroids.	Asthma, burns, colds, rheumatism. Respiratory and urinary infections, stomachache. Digestive problems, diseased hearts and circulatory problems.	(Sarri et al., 2015) (Bouasla and Bouasla, 2017) (Meddour and Meddour-Sahar, 2016)
Marrubium deserti (Noë) Coss.	Rheumatism.	Arterial hypertension, fever. Diabetes, fever, jaundice, respiratory diseases, vascular hypertension. Eye treatment, hemorrhoids, stomach pain.	(Ramdane et al., 2015) (Hammiche and Maiza, 2006) (Chermat and Gharzouli, 2015)
Mentha × piperita L.	Inflammation, influenza, pregnancy, rheumatism, stomach, uterine fibroids.	Anxiety, diarrhea, hypotensive, menstrual pains, skin care, tonic. Mental nervous. Analgesic, carminative. Articular pain, fever, migraine.	(Bouasla and Bouasla, 2017) (González-Tejero et al., 2008) (Bouzabata, 2013) (Ouelbani et al., 2016)

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Mentha suaveolens Ehrh.	Heart.	Antiseptic injury, dizziness, fever, frigidity, headache, stomachic.	(Meddour and Meddour-Sahar, 2016)
Salvia officinalis L.	Depurative, hair loss, pregnancy, renal lithiasis.	Antidiabetic, antihypertensive, eczema, weight loss.	(Boudjelal et al., 2013)
		Antiperspirant, antispasmodic, carminative, choleretic, hypoglycemic, sedative nervous, stomachic, tonic.	(Benderradji et al., 2014)
		Antispasmodic, digestive, wormer.	(Sarri et al., 2015)
Thymus serpyllum L.	Allergy, alopecia areata, analgesic, anemia, anguish, anorexia, antimicrobial, anxiety, asthma, burns, breastfeeding, calming, cancer, cephalalgia, cholesterol, cough, cysts, depurative, diabetes, eczema, fever, gout, hair loss, heart, high blood pressure, inflammation, influenza, insomnia, low blood pressure, measles, migraine, osteoarthritis, otitis, pregnancy, prostate, rheumatism, sinusitis, skin, snake bites, strengthening, thrombosis, thyroid disorders, tonsillitis, uterine fibroids, vitiligo, wounds, wrinkles.	Digestive system, kidney.	(González-Tejero et al., 2008)
Lauraceae			
Cinnamomum verum J. Presl	Alopecia areata, cancer, colon, obesity.	Menstrual pain, respiratory and urinary infections.	(Bouasla and Bouasla, 2017)
		Diabetes.	(Telli et al., 2016)
		Menstruations.	(Ouelbani et al., 2016)
Linaceae			
Linum usitatissimum L.	Anorexia, hair loss.	Allergy, cough, menstrual pains, respiratory.	(Bouasla and Bouasla, 2017)
		Anti-inflammatory, cancer prevention, headache, hypoglycemic and cholesterol, weight loss.	(Ouelbani et al., 2016)
		Allergy, diabetes, digestive disorders, hypertension.	(Benarba, 2016)
Lythraceae			
Lawsonia inermis L.	Colon, ulcer.	Diabetes.	(Azzi et al., 2012)
		Kidney diseases.	(Benarba et al., 2015)
Malvaceae			
Hibiscus sabdariffa L.	Diabetes.	Cholesterol, hypertension.	(Benarba et al., 2015)
Pinaceae			
Pinus halepensis Mill.	Burns, osteoarthritis.	Disinfectant respiratory tract antifungal.	(Chermat and Gharzouli, 2015)
		Asthma.	(Meddour and Meddour-Sahar, 2016)
		Burns, cough, flu, inflammation of the skin, rheumatism, wounds.	(Rebbas et al., 2012)

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Poaceae			
Pennisetum glaucum (L.) R.Br.	Anorexia, breastfeeding, osteoarthritis.	Not reported.	
Ranunculaceae			
Nigella sativa L.	Anguish, anorexia, antimicrobial, breastfeeding, cephalalgia, cholesterol, cysts, depurative, fever, gout, heart, inflammation, influenza, insomnia, measles, migraine, osteoarthritis, otitis, pregnancy, prostate, sinusitis, snake bites, strengthening, thrombosis, thyroid disorders, uterine fibroids, wrinkles.	Analgesic, antiseptic, antispasmodic, appetizer, carminative, digestive, diuretic, expectorant. Allergy, anemia, anxiety, flatulence, respiratory infections, skin care, allergy. Cancer. Internals hemorrhoids, pharyngitis, tonsillitis.	(Benderradji et al., 2014) (Bouasla and Bouasla, 2017) (Benarba, 2015) (Meddour and Meddour-Sahar, 2016)
Rhamnaceae			
Ziziphus lotus (L.) Lam.	Anguish, alopecia areata, anemia, anorexia, antimicrobial, anxiety, breastfeeding, cephalalgia, depurative, heart, insomnia, measles, migraine, pregnancy, sinusitis, strengthening, thrombosis, uterine fibroids, vitiligo, wrinkles.	Anti-inflammatory, eczema, wound healing. Hypoglycemic, urinary infections. Hypertension, stomach acidity. Abdominal pain, boils, burns, constipation, diabetes, diarrhea, fever, lips herpes, sores, tumors.	(Boudjelal et al., 2013) (Bouzabata, 2013) (Chermat and Gharzouli, 2015) (Hammiche and Maiza, 2006)
Rosaceae			
Cydonia oblonga Mill.	Ulcer.	Good breath. Cardiovascular, sensory, skin care.	(Bouasla and Bouasla, 2017) (González-Tejero et al., 2008)
Malus domestica Borkh.	Cholesterol, high blood pressure.	Not reported.	
Prunus dulcis (Mill.) D.A. Webb	Anemia.	Disorders, healing, pregnant women, skin allergy, vision. Kidney disease.	(Benarba et al., 2015) (Meddour and Meddour-Sahar, 2016)
Prunus persica (L.) Batsch	Cysts.	Auditory duct's infections, skin care, cancer.	(Bouasla and Bouasla, 2017)
Thymelaeaceae			
Thymelaea hirsuta (L.) Endl.	Pregnancy.	Sterility, cysts. Eczema, leishmanicidal, vermifuge.	(Ouelbani et al., 2016) (Boudjelal et al., 2013)
Urticaceae			
Urtica dioica L.	Analgesic, anguish, anorexia, antimicrobial, anxiety, breastfeeding, calming, cancer, cephalalgia, depurative, fever, heart, high blood pressure, insomnia, low blood pressure, measles, migraine, pregnancy, sinusitis, snake bites, thrombosis, strengthening, uterine fibroids.	Antidiabetic, anti-inflammatory. Anemia, coagulant, thyroid problems, suprarenal gland Anemia, Diabetes, weight gain. Digestive system.	(Boudjelal et al., 2013) (Ouelbani et al., 2016) (Benarba, 2016) (González-Tejero et al., 2008)

Family / Plant species	New therapeutic uses	Other uses in Algeria and Morocco	References
Zingiberaceae			
Curcuma longa L.	Antimicrobial, influenza.	Liver diseases. Aches and pains, anxiety, skin care. Colic, body care for the new born, diabetes, dysmenorrhea, eczema, gastric aches, liver attack, myalgia, rheumatism.	(Benarba, 2016) (Bouasla and Bouasla, 2017) (Hammiche & Maiza, 2006)
Zygophyllaceae			
Zygophyllum album L. F.	Anemia, cancer.	Anti-virus and fungi, diabetes, indigestion, laxative, purgative.	(Lakhdari et al., 2016)