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 ethnomedicinal 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 Sena 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., Tetroclinis articulata (Vahl) Mast., Oudneya africana R. Br., Euphorbia gymoniana Boiss. & Reut, Teucrrium 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 costeae (Falc.) Lipsch., Boswellia sacra F. & Reut., 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
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.

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.

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

\[ UR = \sum_{i=1}^{n} \sum_{p=1}^{N} UR_{ip} \]

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

\[ FC = \sum_{i=1}^{n} UR_{i} \]

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 \( i \); \( \sum UR_{ip} \) 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:

\[ F_{IC} = \frac{(N_{ur} - N_{t})}{(N_{ur} - 1)} \]

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’ila (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) (Bousla & 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, polycateylenes, 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.](image)

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).

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).
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 | Allergy, asthma, cough, cysts, tonsillitis, thyroid disorders. |
| **Anacardiaceae**              |                |    |    |    |            |                    |                      |                  |
| *Pistacia atlantica* Desf. (TDK053) | البقمة Botma | 1  | 1  | 0.02| Barks      | Powder             | Oral                 | Thyroid disorders |
| *Pistacia lentiscus* L. (TDF025) | المصرو 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 Nourka   | 11 | 15 | 0.23| Aerial parts | Decoction, infusion | Oral                 | Analgesic, calming, high blood pressure, influenza, thyroid disorders, vomiting |
| *Apium graveolens* L. (TDF029) | الكروفس Krafes  | 2  | 5  | 0.08| Aerial parts | Infusion            | Oral                 | Anguish, colon, dysuria, renal lithiasis, strengthening. |
| *Bunium incrassatum* Amo (TDF013) | الالغودة Talghouda | 23 | 29 | 0.45| Tubers      | Infusion, powder    | Oral                 | Allergy, asthma, cough, cysts, tonsillitis, thyroid disorders. |
| *Carum carvi* L. (TDT086)     | الكروسة Karwiya| 2  | 3  | 0.05| Seeds      | Infusion            | Oral                 | Calming, colon, bloating. |
| *Coriandrum sativum* L. (TDT049) | الكسام Ksbor | 2  | 2  | 0.03| Seeds      | Decoction, infusion | Oral                 | Analgesic, bloating, calming, cholesterol, colon, cough, fever inflammation, influenza, rheumatism. |
| *Cuminum cyminum* L. (TD063)  | الكمون Kemoun  | 5  | 12 | 0.19| Seeds      | Infusion, powder    | Oral                 | Colon, depurative, prostate, ulcer. |
| *Daucus carota* L. (TDC094)   | الجزير Jazar    | 2  | 4  | 0.06| Seeds      | Infusion            | Oral                 | Anemia, anxiety, bloating, colon, constipation, hair loss, obesity, tonsillitis, wrinkles. |
| *Foeniculum vulgare* Mill. (TDF001) | البسباس Besbas | 22 | 29 | 0.45| Seeds      | Decoction, infusion, | Oral, topical       | Cancer. |
| *Petroselinum crispum* (Mill.) Fuss (TDF084) | المعدنو Maadnous | 1  | 1  | 0.02| Aerial parts | Infusion            | Oral                 | Calming, colon, influenza. |
| *Pimpinella anisum* L. (TDF027) | اليانسون Yanssoun | 6  | 6  | 0.09| Seeds      | Infusion            | Oral                 | Anorexia, wounds. |
| *Thapsia garganica* L. (TDF085) | الدرياس Deryas | 1  | 2  | 0.03| Roots      | Powder              | Oral, topical        | Cancer, diabetes. |
| **Aristolochiaceae**           |                |    |    |    |            |                    |                      |                  |
| *Aristolochia longa* L. (TDF040) | برميت Berestom | 7  | 8  | 0.12| Roots      | Mixture, powder     | Oral                 |                  |
| **Asparagaceae**               |                |    |    |    |            |                    |                      |                  |
| *Asparagus officinalis* L. (TDF105) | السكرم 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 | 3  | 3  | 0.05 | Roots | Decoction, infusion, powder | Oral | Cough, thrombosis. |
| *Artemisia absinthium* L. (TDT073) | الشهبية | 4  | 8  | 0.12 | Aerial parts, roots | Decoction, infusion | Oral | Colon, diarreha, dysuria, heart, intestinal parasitosis, liver, osteoarthritis, uterine fibroids. |
| *Artemisia campestris* L. (TDT060) | النقلف | 5  | 6  | 0.09 | Aerial parts | Decoction, infusion | Oral | Allergy, analgesic, cholesterol, colom, intoxications, stomach. |
| *Artemisia herba-alba* Asso (TDF003) | الشيح | 17 | 24 | 0.37 | Aerial parts | Decoction, infusion, inhalation, paste | Nasal, oral, topical | Calming, colom, diabetes, diarrhea, hair loss, heart, high blood pressure, influenza, intestinal parasitosis, low blood pressure. |
| *Cynara scolymus* L. (TDT081) | القرناع | 1  | 1  | 0.02 | Leaves | Infusion | Oral | Cholesterol. |
| *Dittrichia viscosa* (L.) Greuter (TDF104) | أمقرمان | 1  | 1  | 0.02 | Leaves | Paste | Oral | Rheumatism. |
| *Echinops spinosissimus* Turra (TDF106) | تاسكرا | 1  | 3  | 0.05 | Roots | Decoction | Oral | Cough, influenza, pregnancy. |
| *Matricaria chamomilla* L. (TDF019) | البابونج | 21 | 31 | 0.48 | Flowers | Decoction, infusion, paste | Oral, topical | Analgesic, anguish, calming, cephalalgia, colon, cough, depurative, diarrhea, hair loss, inflammation, influenza, insomnia, migraine, Tonsillitis. |
| *Saussurea costus* (Falc.) Lipsch. (TDF020) | القسط الهندي | 15 | 16 | 0.25 | Aerial parts, roots | Decoction, infusion, maceration, mixture, powder | Oral | Cancer, diabetes, intestinal parasitosis. |
| *Berberis vulgaris* L. (TDF020) | غريس | 15 | 16 | 0.25 | Aerial parts, roots | Decoction, infusion, maceration, mixture, powder | Oral | Cancer, diabetes, intestinal parasitosis. |
| *Eruca vesicaria* (L.) Cav. (TDT050) | الجرحى | 1  | 1  | 0.02 | Leaves | Infusion | Oral | Rheumatism. |
| *Lepidium sativum* L. (TDF002) | الحرف | 11 | 20 | 0.31 | Seeds | Infusion, raw | Oral, topical | Allergy, asthma, cholesterol, cough, depurative, osteoarthritis, influenza, rheumatism, vitiligo. |
| *Oudneya africana* R. Br. (TDF022) | جلطة الأناناس | 2  | 3  | 0.05 | Leaves | Decoction | Oral | Cholesterol, thrombosis. |
| *Boswellia sacra* Flueck. (TDR100) | اللبان | 3  | 3  | 0.05 | Resins | Raw | Oral | Asthma, influenza, kidney. |
| *Opuntia ficus-indica* (L.) Mill. (TDT071) | الهندي | 4  | 4  | 0.06 | Fruits, stems | Decoction, paste, raw | Oral, topical | Diarreha, 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) |                | 1  | 1  | 0.02 | Flowers     | Infusion            | Oral                  | Renal lithiasis.  |
| Sparganium rubra J. Presl & C. Presl (TDT061) |                | 6  | 6  | 0.09 | Leaves      | Decoction, infusion | Oral                  | Kidney, renal lithiasis.  |
| **Cucurbitaceae**             |                |    |    |    |            |                     |                        |                 |
| Citrullus colocynthis (L.) Schrad. (TDF018) |                | 3  | 3  | 0.05 | Fruits      | Juice, raw          | Topical               | Diabetes, eczema.  |
| Cucumis moschata Duchesne (TDK057) |                | 1  | 1  | 0.02 | Seeds       | Infusion            | Oral                  | Renal lithiasis.  |
| Echeallium elaterium (L.) A. Rich. (TDT069) |                | 2  | 2  | 0.03 | Fruits      | Infusion, powder    | Oral                  | Ulcer.          |
| **Cupressaceae**              |                |    |    |    |            |                     |                        |                 |
| Juniperus phoenicea L. (TDF015) |                | 17 | 20 | 0.31 | Aerial parts | Decoction, infusion, paste, powder, raw | Oral, topical | Asthma, colon, cough, influenza, rheumatism, ulcer.  |
| Juniperus oxycedrus L. (TDR092) |                | 1  | 1  | 0.02 | Aerial parts | Infusion            | Oral                  | Fever.          |
| Tetraclinis articulata (Vahl Mast. (TDF014) |                | 2  | 2  | 0.03 | Fruits      | Infusion, powder    | Oral                  | Ulcer.          |
| **Cyperaceae**                |                |    |    |    |            |                     |                        |                 |
| Cyperus esculentus L. (TDT101) |                | 1  | 1  | 0.02 | Fruits      | Decoction           | Oral                  | Dysuria.        |
| **Ephedraceae**               |                |    |    |    |            |                     |                        |                 |
| Ephedra alata Decne. (TDF041) |                | 10 | 10 | 0.16 | Aerial parts | Decoction, infusion | Oral                  | Cancer, renal lithiasis.  |
| **Ericaceae**                 |                |    |    |    |            |                     |                        |                 |
| Arbutus unedo L. (TDF044)     |                | 1  | 1  | 0.02 | Leaves     | Infusion            | Oral                  | Renal lithiasis.  |
| **Euphorbiaceae**             |                |    |    |    |            |                     |                        |                 |
| Euphorbia guyoniana Boiss. & Reut (TDT062) |                | 2  | 2  | 0.03 | Aerial parts | Decoction, mixture | Oral                  | Cancer, diabetes. |
| Ricinus communis L. (TDF098)  |                | 1  | 1  | 0.02 | Seeds       | Raw                 | Oral                  | Constipation. |
| **Fabaceae**                  |                |    |    |    |            |                     |                        |                 |
| Ceratonia siliqua L. (TDF010) |                | 4  | 4  | 0.06 | Fruits      | Decoction, infusion, powder, raw | Oral | Anemia, ulcer.  |
| Glycyrhiza glabra L. (TDF017) |                | 4  | 5  | 0.08 | Roots       | Decoction            | Oral                  | Cough, prostate, rheumatism, stomach, ulcer.  |
| Lupinus albus L. (TDT079)     |                | 2  | 2  | 0.03 | Fruits      | Infusion, powder    | Oral, topical         | Diabetes. |
| Senna alexandrina Mill. (TDF005) |                | 27 | 33 | 0.52 | Leaves     | Raw                 | Decoction, infusion   | Analgesic, colon, constipation, gout, rheumatism, vomiting. |
| Trigonella foenum-graecum L. (TDF026) |                | 14 | 88 | 1.37 | Seeds       | Decoction, infusion, maceration, powder, raw | Oral | All reported ailments.  |
| **Fagaceae**                  |                |    |    |    |            |                     |                        |                 |
| Quercus rotundifolia Lam. (TDF035) |                | 2  | 2  | 0.03 | Fruits      | Decoction           | Oral                  | Enuresis.        |

Vernacular name: Arabic, French, and Latin names are provided for each plant species. The table includes family, species, vernacular name, FC (frequency of citation), UR (urgency rating), UV (urgency value), used parts, mode of preparation, mode of administration, and therapeutic uses.
| 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 تمريرات Chendgoura Timériouet | 2  | 4  | 0.06 | Aerial parts | Decoction, infusion | Oral                | Diabetes, intoxications, snake bites, wounds. |
| Lavandula stoechas L. (TDF006) | الخزامى Na‘naa | 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. (TDT087) | الجعدة Jaâda | 2  | 2  | 0.03 | Aerial parts | Decoction, infusion | Oral, topical   | Colon, rheumatism. |
| Marrubium vulgare L. (TDF070) | مرادقة Merdekouch | 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 Flío | 5  | 5  | 0.08 | Aerial parts | Decoction, infusion, paste | Oral, topical   | Hair loss, heart, influenza, vomiting. |
| Mentha suaveolens Ehrh. (TDT075) | تمساراط Timerssat | 1  | 2  | 0.03 | Leaves | Infusion | Oral                | Heart, ulcer. |
| Ocimum basilicum L. (TDR096) | الميرامية Miramiya | 13 | 20 | 0.31 | Leaves | Decoction, infusion | Oral                | Anxiety, asthma, calming, cough, diabetes, high blood pressure, inflammation, influenza, migraine, rheumatism. |
| Origanum majorana L. (TDL048) | مردقوش Merdekouch | 5  | 11 | 0.17 | Leaves | Decoction, infusion | Oral                | Calming, cholesterol, colon, cough, depurative, hair loss, high blood pressure, influenza, obesity, prostate, rheumatism, stomach. |
| Rosmarinus officinalis L. (TDF039) | اكليل الجبل Iklil el jabal | 13 | 20 | 0.31 | Leaves | Decoction, infusion, paste | Oral, topical   | Analgesic, anorexia, anguish, calming, cholesterol, colon, depurative, hair loss, high blood pressure, inflammation, obesity, pregnancy, renal lithiasis. |
| Salvia officinalis L. (TDF004) | البارماد Salvia officinalis | 13 | 20 | 0.31 | Leaves | Decoction, infusion | Oral                | Cough. |
| Satureja calamintha (L.) Scheele TDS090) | النابطة Na‘baa | 1  | 1  | 0.02 | Leaves | Infusion | Oral                | Analgesic, diabetes, heart, ulcer, vomiting, wounds. |
| Teucrium polium L. (TDK051) | الخليابة Khiyata | 7  | 8  | 0.12 | Aerial parts | Decoction, infusion | Oral                | All reported ailments. |
| Thymus serpyllum L. (TDF033) | الزعتر البري Zaâter el bari | 9  | 77 | 1.20 | Aerial parts | Decoction, infusion | Oral                | Cholesterol, cough, influenza, strengthening. |
| Thymus vulgaris L. (TDF045) | الزعتر Zaâter | 14 | 16 | 0.25 | Aerial parts | Decoction, infusion | Oral                | All reported ailments. |
| **Lauraceae**                  |                 |    |    |    |            |                    |                       |                  |
| Cinnamomum verum J.Presl (TDF038) | الفرفة Qarfa | 11 | 15 | 0.23 | Barks | Decoction, infusion | Oral                | Alopecia areata, asthma, cancer, colon, cough, diabetes, obesity. |
| Laurus nobilis L. (TDF043) | الزرد 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) | زریعه التکن | 9 | 14 | 0.22 | Seeds | Infusion, paste, powder | Oral, topical | Allergy, anorexia, cholesterol, diabetes, hair loss, obesity. |
| **Lythraceae**               | Lawsonia inermis L. (TDT064) | الhana | 1 | 3 | 0.05 | Leaves | Decoction | Oral | Colon, hair loss, ulcer. |
| Punica graminatum L. (TDF030) | Romman | 10 | 10 | 0.16 | Barks, flowers, fruits | Decoction, infusion, mixture, powder | Oral | Ulcer. |
| **Malvaceae**                | Hibiscus sabdariffa L. (TDF034) | الكرکیه | 11 | 14 | 0.22 | Flowers | Decoction, infusion | Oral | Diabetes, high blood pressure, low blood pressure. |
| *Tilia cordata* Mill. (TDF082) | Zaizafoun | 1 | 1 | 0.02 | Leaves | Infusion | Oral | Anguish. |
| **Myrtaceae**                | Myrtus communis L. (TDF016) | الریحان | 11 | 14 | 0.22 | Leaves | Decoction, infusion, paste | Oral, topical | Colon, diabetes, dysuria, hair loss, stomach. |
| Syzygium aromaticum (L.) Merr. & L.M. Perry (TDT078) | Kronfol | 4 | 4 | 0.06 | Fruits | Maceration, raw | Oral, topical | Cough, toothache. |
| **Oleaceae**                 | Olea europaea L. (TDF028) | زیتون | 5 | 6 | 0.09 | Fruit oils, leaves | Infusion, raw | Oral, topical | Burns, diabetes, high blood pressure. |
| **Papaveraceae**             | Papaver rhoeas L. (TDT080) | بن نعمان | 1 | 1 | 0.02 | Flowers | Infusion | Oral | Asthma. |
| **Pinaceae**                 | Pinus halepensis Mill. (TDF074) | الصنوبر | 2 | 3 | 0.05 | Barks, seeds | Paste | Oral, topical | Burns, cough, osteoarthritis. |
| **Plantaginaceae**           | Globularia alypum L. (TDT102) | تسلاقة | 1 | 1 | 0.02 | Leaves | Infusion | Oral | Kidney. |
| *Plantago ciliata* Desf. (TDS091) | Lalma | 1 | 1 | 0.02 | Leaves | Inhalation | Nasal | Mouth infections. |
| **Poaceae**                  | Pennisetum glaucum (L.) R.Br. (TDK055) | البیشنة | 2 | 4 | 0.06 | Seeds | Infusion, powder | Oral | Anorexia, breastfeeding, osteoarthritis. |
| Zea mays L. (TDF037) | Dhera | 2 | 2 | 0.03 | Fruits | Infusion | Oral | Dysuria, renal lithiasis. |
| **Ranunculaceae**            | Nigella sativa L. (TDF024) | السنوج | 7 | 96 | 1.50 | Seeds | Infusion, inhalation, raw | Nasal, oral | All reported ailments. |
| **Rhamnaceae**               | Rhamnus alaternus L. (TDF021) | مليس | 14 | 14 | 0.22 | Aerial parts | Decoction, infusion | Oral | Anemia, hepatitis. |
| Ziziphus lotus (L.) Lam. (TDF008) | السدرة | 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 (TDA103)   | الزعرور         | 1  | 1  | 0.02 | Fruits     | Infusion            | Oral                   | Cephalalgia.      |
| Cydonia oblonga Mill. (TDK052)| السفرجل       | 1  | 1  | 0.02 | Barks       | Decoction           | Oral                   | Ulcer.            |
| Malus domestica Borkh. (TDK056)| النافأ        | 2  | 2  | 0.03 | Fruits     | Maceration          | Oral                   | Cholesterol, high blood pressure. |
| Prunus dulcis (Mill.) D.A. Webb (TDT077) | الزور         | 3  | 3  | 0.05 | Roots       | Decoction           | Oral                   | Anemia.           |
| Prunus persica (L.) Batsch (TDS088) | الالوجخ      | 2  | 2  | 0.03 | Leaves     | Infusion            | Oral                   | Cysts.            |
| **Rubiaceae**                 |                |    |    |    |            |                     |                        |                   |
| Rubia tinctorum L. (TDF011)   | الفوة          | 18 | 18 | 0.28 | Roots       | Decoction, infusion, powder, raw | Oral                | Anemia.           |
| **Salicaceae**                |                |    |    |    |            |                     |                        |                   |
| Populus nigra L. (TDT065)     | الصعف صعفا     | 1  | 1  | 0.02 | Leaves     | Infusion            | Oral                   | Colon.            |
| **Santalaceae**               |                |    |    |    |            |                     |                        |                   |
| Viscum album L. (TDR095)      | لنجبار         | 2  | 2  | 0.03 | Roots       | Infusion, powder    | Oral                   | Breastfeeding, obesity. |
| **Thymelaeaceae**             |                |    |    |    |            |                     |                        |                   |
| Daphne gnidium L. (TDF031)    | لازاز          | 4  | 4  | 0.06 | Leaves     | Infusion, paste     | Oral, topical         | Hair loss, sinusitis. |
| Thymelaea hirsuta (L.) Endl. (TDS089) | mieszkań     | 3  | 4  | 0.06 | Aerial parts | Inhalation, powder | Oral                 | Pregnancy, uterine fibroids. |
| **Urticaceae**                |                |    |    |    |            |                     |                        |                   |
| Urtica dioica L. (TDF036)     | الحريق         | 4  | 72 | 1.12 | Leaves     | Decoction, infusion, paste | Oral, topical         | All reported ailments. |
| **Verbenaceae**               |                |    |    |    |            |                     |                        |                   |
| Verbena officinalis L. (TDT066) | اللويزة       | 2  | 3  | 0.05 | Leaves     | Decoction           | Oral                   | Anguish, insomnia stomach. |
| **Xanthorrhoeaceae**          |                |    |    |    |            |                     |                        |                   |
| Asphodelus ramosus L. (TDT076) | بلوراز        | 2  | 2  | 0.03 | Roots       | Infusion            | Nasal                 | Otitis.           |
| **Zingiberaceae**             |                |    |    |    |            |                     |                        |                   |
| Curcuma longa L. (TDC093)     | الكركم         | 4  | 4  | 0.06 | Rhizomes   | Decoction, infusion, powder | Oral                | Antimicrobial, influenza, hepatitis. |
| Zingiber officinale Roscoe (TDF046) | الزنجبيل     | 16 | 27 | 0.42 | Rhizomes   | Decoction, infusion, powder | Oral, topical         | Antimicrobial, asthma, bloating, calming cholesterol, colon, cough, influenza, intoxications, obesity, rheumatism, vomiting, weight gain. |
| **Zygophyllaceae**            |                |    |    |    |            |                     |                        |                   |
| Peganum harmala L. (TDF099)   | الحرمَل         | 1  | 1  | 0.02 | Aerial parts | Powder              | Oral                  | Rheumatism.       |
| Zygophyllum album L.F. (TDF012) | العقافية     | 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.](image)

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, antidiysenteric, 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-Senousy 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 (Petrušová-Poracká et al., 2013; Toleuoe 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, matrine, 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 (Nejad et al., 2017). Ford et al. (2015) and Nejad 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 Apioaceae (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, Tetraclini 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 *Tetraclini 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), *Sonna alexandrina* (UV=0.52), *Atriplex halimus* (UV=0.5), *Matricaria chamomilla* (UV=0.48), *Bunium inerassatum* 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 FIC 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 FIC 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 FIC value (0.66) which could be attributed mainly to the high incidence of cancers in the region.

| Ailment                                      | Number of taxa | Use reports | FIC |
|----------------------------------------------|----------------|-------------|-----|
| *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     | 28             | 94          | 0.71|
| *Dermatological disorders*                   |                |             |     |
| Alopecia areata, burns, Eczema, hair loss, skin, vitiligo, wounds, wrinkles | 27             | 74          | 0.64|
| Osteoarticular diseases                      | 25             | 57          | 0.57|
| Gout, inflammation, osteoarthritis, rheumatism | 21             | 61          | 0.66|
| General disorders                            |                |             |     |
| Antimicrobial, depurative, fever, obesity, weight gain | 15             | 43          | 0.66|
| Cancer                                       |                |             |     |
Furthermore, to North Africa-Algeria, Northern and Central Sahara. Teucrium polium and Cuminum cyminum, respectively. Marrubium deserti and Pistacia atlantica are endemic species. Besides, the most frequently cited species are Senecio viridis, Atriplex halimus and Bunium incrassatum, Poeniculum 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, Senecio viridis, Atriplex halimus, Matricaria chamomilla, Bunium incrassatum and Poeniculum 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 gutsoniana, 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. Eczema. Diabetes, uterus cysts. Thyroid. | (Benarba et al., 2015) (Boudjelal et al., 2013) (Lakhdari et al., 2016) (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. Dental pain, gingivitis, leishmaniasis, thrush. Diabetes. | (Benderradji et al., 2014) (Chermat & Gharzouli, 2015) (Telli et al., 2016) |
| **Apiaceae**           |                      |                                  |            |
| *Ammi visnaga* (L.) Lam. | High blood pressure, thyroid disorders, vomiting. | Diabetes. Nephritic colic, sedative, urethral lithiasis, vasodilator. Kidney, respiratory. | (Azzi et al., 2012) (Bouzabata & Mahomoodally, 2019) (González-Tejero et al., 2008) |
| *Apium graveolens* L. | Anguish, renal lithiasis, strengthening. | Digestive system. Antispasmodic, carminative, diuretic. Hypertension. Diabetes. | (Boughrara & Belgacem, 2016) (Bouzabata, 2013) (Benarba et al., 2015) (Azzi et al., 2012) |
| *Bunium incrassatum* Amo | Asthma, cysts, thyroid disorders, tonsillitis. | Not reported. |            |
| *Cuminum cyminum* L. | Cholesterol, fever, influenza. | Infected wounds, skin infections. Abdominal pains, colon, stomach ulcer. Constipation, gases, kids cough, menstrual pain, stomachache. Analgesic, antispasmodic, cough, lactation, rheumatism, tranquilizer. | (Volpato et al., 2012) (Sarri et al., 2015) (Ouelbani et al., 2016) |
| *Daucus carota* L. | Colon, depurative, ulcer. | Respiratory, urinary or genital infections Cysts, urinary tract. | (Bouasla & Bouasla, 2017) |
| *Foeniculum vulgare* Mill | Anemia, hair loss, tonsillitis, wrinkles. | Antidiarrheal, antispasmodic, carminative. Antiemetic. Digestive, mental nervous, nutritional. Gastrointestinal system diseases. Acne, anti-infective, blood circulation, urinary infections. Diuretic, hypotensive. Diabetes. | (Lakhdari et al., 2016) (Sarri et al., 2015) (Meddour & Meddour-Sahar, 2016) (González-Tejero et al., 2008) (Benarba et al., 2015) (Bouasla & Bouasla, 2017) (Bouzabata, 2013) |
| *Petroselinum crispum* (Mill) Fuss | Cancer. | Gastrointestinal system diseases. Acne, anti-infective, blood circulation, urinary infections. Diuretic, hypotensive. 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.  
Female sterility.  
Cancer, cough, female sterility.  
Diabetes.  
(Benarba, 2016)  
(Benarba et al., 2015)  
(Azzi et al., 2012)  
(Ouelbani et al., 2016)

*Artemisia absinthium* L.

Dysuria, heart, uterine fibroids.  
Appetizer, hypertensive, vulnerary.  
Antiseptic, digestive disorders, wormer.  
Anti-inflammatory, antiseptic, aperitive, aromatic, bitter tonic, cholagogue, digestive, diuretic, vermifuge.  
Antidiabetic, antiseptic injury, diuretic, stomachic.  
(Meddour & Meddour-Sahar, 2016)

*Artemisia campestris* L.

Allergy, cholesterol.  
Analeptic, dandruff, healing, helminthiases, mycosis, spasms and aid to menstruation, stomach and liver diseases, vulnerary.  
Intestinal bloating, intestinal parasites.  
After childbirth, hair loss, digestive diseases, fever.  
Arterial hypertension.  
Analgesic, blood purification, cancer, respiratory system diseases.  
(Chermat & Gharzouli, 2015)  
(Ramdane et al., 2015)  
(Sari et al., 2012)  
(Ouelbani et al., 2016)  
(Hammiche & Maiza, 2006)

*Artemisia herba-alba* Asso

Hair loss.  
Antigastralgic, antispasmodic, emmenagogue, stomachic, vermifuge.  
Antigastralgic, antispasmodic, calming, digestive, emmenagogue, heart, hypertension, memory, sedative, spasms, tics, vermifuge.  
Arterial hypertension.  
Analgesic, blood purification, cancer, respiratory system diseases.  
(Ramdane et al., 2015)  
(Bouchikh et al., 2016)  
(Sari et al., 2012)  
(Ouelbani et al., 2016)  
(Rebbas et al., 2012)

*Cynara scolymus* L.

Cholesterol.  
Antidiarrheal, appetizer, blood purification, cholagogue, choleric, diuretic, energy, hypoglycemic, nutritious, stimulating.  
Digestive, urogenital diseases.  
(Boughrara & Belgacem, 2016)  
(Benderradji et al., 2014)

*Echinops spinosissimus* Turra

Cough, influenza, inflammation, cleaning the female genital apparatus after childbirth  
Depurative, hypoglycemic.  
Not reported  
(Bouzabata, 2013)
| 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) (Boughrara & Belgacem, 2016) (Bouzabata & Mahomoodally, 2019) |
| *Saussurea costus* Flueck. | Tonsillitis. | Diabetes. | |
| **Berberidaceae** | | | |
| *Berberis vulgaris* L. | Intestinal parasitosis. | Diabetes. | (Bouzabata and Mahomoodally, 2019) (Benarba et al., 2015) |
| **Brassicaceae** | | | |
| *Eruca vesicaria* (L.) Cav. | Rheumatism. | Fractures, stomachache, urinary infections. Elimination of dirt from eyes. Anemia, anemomintic, broken bones, fatigue, hair loss, hypoglycemic for women after childbirth Anemia, antibiotic, anti-hair loss, antioxidant, appetite, dermatological problems, diuretic, goiter, hypoglycemic, immune system, memory, rheumatism and bone problems, tonics, tumors. Respiratory tract diseases. | (Bouasla and Bouasla, 2017) (Volpato et al., 2012) (Sarri et al., 2014) (Benarba et al., 2015) |
| *Lepidium sativum* L. | Cholesterol. | | |
| **Oudneya africana** R. Br. | Thrombosis. | Skin diseases and lesions. Diabetes. | (Lakhdiri et al., 2016) (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. Digestive, muscular, nutritional. Diarrhea, hemorrhoids. Hemorrhoids, respiratory system diseases. | (Sarri et al., 2015) (González-Tejero et al., 2008) (Meddour & Meddour-Sahar, 2016) (Ouelbani et al., 2016) |
| **Cucurbitaceae** | | | |
| *Citrullus colocynthis* L. Schrad. | Eczema. | Antihypertensive, antitumor. Headaches, tinea, vitiligo. Diabetes. | (Boudjelal et al., 2013) (Hammiche & Maiza, 2006) (Azzi et al., 2012) |
| *Cucurbita moschata* Duchesne | Renal lithiasis. | Diabetes. Not reported. | |
| **Cupressaceae** | | | |
| *Tetraclinis articulata* (Vahl) Mast. | Ulcer. | Diabetes Hypoglycemic, hypotensive. | (Azzi et al., 2012) (Bouzabata, 2013) |
| **Cyperaceae** | | | |
| *Cyperus esculentus* L. | Dysuria. | Aphrodisiac, appetite, weight gain. Kids appetite | (Benarba et al., 2015) (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. | Diabets. 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, rhematism, 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, rhematism, spleen and liver pain, stomach pain, teeth cleaner. Bronchitis, cough, laryngitis. | (Lakhdari et al., 2016) (Benarba, 2016) |
| *Senna alexandrina* Mill. | Gout, rhematism, 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 afflications, 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.            | (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, rhematism. Respiratory and urinary infections, stomachache. Digestive problems, diseased hearts and circulatory problems. Arterial hypertension, fever. Diabetes, fever, jaundice, respiratory diseases, vascular hypertension. Eye treatment, hemorrhoids, stomach pain. | (Sarri et al., 2015) (Bouasla and Bouasla, 2017) (Meddour and Meddour-Sahar, 2016) (Ramdane et al., 2015) (Hammiche and Maiza, 2006) (Chermat and Gharzouli, 2015) |
| *Marrubium deserti* (Noë) Coss. | Rheumatism. |                                  | (Chermat and Gharzouli, 2015) |
| *Mentha × piperita* L. | Inflammation, influenza, pregnancy, rhematism, stomach, uterine fibroids. | Anxiety, diabetes, 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. Antidiabetic, antihypertensive, eczema, weight loss. Antiperspirant, antispasmodic, carminative, choleric, hypoglycemic, sedative nervous, stomachic, tonic. Antispasmodic, digestive, wormer. | (Meddour and Meddour-Sahar, 2016) (Boudjelal et al., 2013) (Benderradji et al., 2014) |
| Salvia officinalis L. | Depurative, hair loss, pregnancy, renal lithiasis. | | |
| 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. | (Sarri et al., 2015) (González-Tejero et al., 2008) |
| Lauraceae | | | |
| Cinnamomum verum J. Presl | Alopecia areata, cancer, colon, obesity. | Menstrual pain, respiratory and urinary infections. Diabetes. Menstruations. | (Bouaslal and Bouasla, 2017) (Telli et al., 2016) (Ouelbani et al., 2016) |
| Linaceae | | | |
| Linum usitatissimum L. | Anorexia, hair loss. | Allergy, cough, menstrual pains, respiratory. Anti-inflammatory, cancer prevention, headache, hypoglycemic and cholesterol, weight loss. Allergy, diabetes, digestive disorders, hypertension. | (Bouasla and Bouasla, 2017) (Ouelbani et al., 2016) (Benarba, 2016) |
| Lythraceae | | | |
| Lawsonia inermis L. | Colon, ulcer. | Diabetes. Kidney diseases. | (Azzi et al., 2012) (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. Asthma. Burns, cough, flu, inflammation of the skin, rheumatism, wounds. | (Chermat and Gharzouli, 2015) (Meddour and Meddour-Sahar, 2016) (Rebbas et al., 2012) |
| Family / Plant species | New therapeutic uses | Other uses in Algeria and Morocco | References |
|-----------------------|----------------------|----------------------------------|------------|
| **Poaceae**           |                      |                                  |            |
| *Pennisetum glaucum*  | Anorexia, breastfeeding, osteoarthritis. | Not reported. |            |
| (L.) R.Br.            |                      |                                  |            |
| **Ranunculaceae**     |                      |                                  |            |
| *Nigella sativa*      | 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. | (Benderradi et al., 2014) |
| L.                     |                      | Allergy, anemia, anxiety, flatulence, respiratory infections, skin care, allergy. | (Bouasla and Bouasla, 2017) |
|                       |                      | Cancer. Internals hemorrhoids, pharyngitis, tonsillitis. | (Benarba, 2015) |
| **Rhamnaceae**        |                      |                                  |            |
| *Ziziphus lotus*      | 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. | (Boudjelal et al., 2013) |
| (L.) Lam.             |                      | Abdominal pain, boils, burns, constipation, diabetes, diarrhea, fever, lips herpes, sores, tumors. | (Bouzabata, 2013) |
|                       |                      |                                | (Chermat and Gharzouli, 2015) |
|                       |                      |                                | (Hammmiche and Maiza, 2006) |
| **Rosaceae**          |                      |                                  |            |
| *Cydonia oblonga*     | Ulcer.               | Good breath.                    | (Bouasla and Bouasla, 2017) |
| Mill.                 |                      | Cardiovascular, sensory, skin care. | (González-Tejero et al., 2008) |
| *Malus domestica*     | Cholesterol, high blood pressure. | Not reported. |            |
| Borkh.                |                      |                                  |            |
| *Prunus dulcis*       | Anemia.              | Disorders, healing, pregnant women, skin allergy, vision. Kidney disease. | (Benarba et al., 2015) |
| (Mill.) D.A. Webb     |                      |                                | (Meddour and Meddour-Sahar, 2016) |
|                       |                      |                                | (Bouasla and Bouasla, 2017) |
| *Prunus persica*      | Cysts.               | Auditory duct’s infections, skin care, cancer. |            |
| (L.) Batsch           |                      |                                  |            |
| **Thymelaeaceae**     |                      |                                  |            |
| *Thymelaea hirsuta*   | Pregnancy.           | Sterility, cysts. Eczema, leishmanicidal, vermifuge. | (Ouelbani et al., 2016) |
| (L.) Endl.            |                      |                                | (Boudjelal et al., 2013) |
| **Urticaceae**        |                      |                                  |            |
| *Urtica dioica*       | 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) |
| L.                     |                      |                                | (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 newborn, 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) |