Ethnobotanical investigation on medicinal plants used by local populations in Tlemcen National Park (extreme North West Algeria)

Fayza Zatout1, Bachir Benarba2, Asmaa Bouazza3, Brahim Babali4, Nazli Nacer Bey4 & Abdelkader Morsli1

Received: 11 May 2020 / Accepted: 11 August 2020 / Publication online: 15 February 2021

Abstract. Medicinal plants are currently used by local populations to treat different diseases around the world. In the present study, the local knowledge of medicinal plants used by indigenous populations living in the Park of Tlemcen (North-West Algeria) has been documented. A total of 254 informants with a strong ethnomedical knowledge living in the national park of Tlemcen were interviewed by using a questionnaire. Data collected was analyzed using quantitative indices such as the ethnobotanicity index (EI), use value (UV), and Informant Consensus Factor (FIC). 109 species belonging to 54 families were identified and used by indigenous populations to treat different diseases. The most frequent families were lamiaceae (15.5%), asteraceae (11.9%), and rosaceae (5.5%). Roots, rhizomes or tubers were the most used part for medical care (37.6%), followed by leaves (33.6%), other aerial parts (16%), fruits (8%), flowers (1.6%), and seeds (3.2%). Regarding modes of preparation, we noticed that decoction (40.4%) and infusion (28.5%) were the most predominant. Moreover, Thymus lanceolatus (UV=0.96), Origon glandulosum (UV=0.96) and Ammoides verticillata (UV=0.94) were the most frequently used species. FIC values ranged from 0.65 to 0.98. The highest FIC were recorded for reproductive and sexual disorders (0.98), respiratory tract diseases (0.98), cardiovascular system disease and blood disorders (0.94), digestive disorders (0.93), and general health (0.93). A variety of species are used to treat several ailments. Recorded species with high UV should be prioritized for conservation and subjected to further phytochemical and pharmacological studies.

Keywords: Algeria; Ethnobotanical; Tlemcen; Plants; Phytotherapy.

How to cite: Zatout, F., Benarba, B., Bouazza, A., Babali, B., Nacer Bey, N., Morsli, A. 2021. Ethnobotanical investigation on medicinal plants used by local populations in Tlemcen National Park (extreme North West Algeria). Mediterr. Bot. 42, e69396. https://dx.doi.org/10.5209/mbot.69396

1. Introduction

For centuries, man used medicinal plants to treat several health problems, and still uses this ancestral knowledge despite the enormous progress made by modern medicine. According to the World Health Organization (WHO), more than 80% of the world’s population uses medicinal plants as a source for primary health care (Agisho et al., 2014). In recent years, an important increase has been observed regarding the use of medicinal plants owing to their abundance, cultural importance and low prices (Thomford et al., 2015). It has been found that about 28% of higher plant species are used for a therapeutic purpose while 74% of pharmacological principles are derived from plants, as a result of ethnomedical studies (Ncube et al., 2008). Even though the clinical use of a drug based on active principles derived from plants involves several disciplines such as botany, chemistry and pharmacology, so-called traditional medicine relating to the use of plants according to ancestral tradition and the ethnobotanical investigations among ethnic groups facilitate the search for these active principles (Rates, 2001; Radford et al., 2011). Owing to its diversified climate allowing an important development of medicinal plants, in coastal, mountainous and also Saharan regions, Algeria is considered one of the richest countries in flora. In fact, the Algerian flora consists of 4000 taxa with 131 families and 917 genera. The national endemic flora counts 464 Taxa (387 species, 53 subspecies and 24 varieties) (Radford et al., 2011). In spite of several ethnobotanical studies carried out to document the popular knowledge related to the use of medicinal plants in Algeria (Benarba et al., 2015a; Benarba et al., 2015b; Benarba, 2016; Benarba et al., Boudjelal et al., 2013, Ramdane et al., 2015, Azzi et al., 2012), The present study is the first comprehensive ethnobotanical investigation among indigenous populations living in the Park of Tlemcen (North-West Algeria).
2. Materials and methods

2.1. Study area

The Tlemcen National Park is located in northwestern Algeria, with an area of 8225.04 hectares (Figure 1). The climate is characterized by a summer drought as early as June (only 7.2 mm in summer, with an annual rainfall of 483 mm). The mean maximum temperature for the hottest month is 32.35 °C, the coldest month is 3.2 °C. Emberger’s precipitation index is 51.1. The altitude varies from 800 to 1418 m with a diversified relief.

![Location of the Tlemcen National Park](image)

Figure 1. Location of the Tlemcen National Park (Extreme North-West Algeria).

2.2. Data collection

The ethnobotanical investigation was carried out using a stratified sampling plan to establish an overview of traditional local uses and floristic diversity of the pharmacopoeia of this area. On the other hand, 254 informants with a strong ethnomedicinal knowledge living in the national park of Tlemcen were interviewed by using a questionnaire. Demographic characteristics of the informants are shown in table 1. The ethnobotanical survey was realized in two phases. The first phase consisted of open interviews with the local population, trying to reach all categories with ethnomedicinal knowledge (old, men, women, and young people). During the second phase, more specific information was requested from the traditional therapists through semi-structured interviews by using a questionnaire, to obtain more specific information on medicinal plants (the vernacular name including the nominations in Arabic and/or Amazigh of the plant, diseases treated, parts used, mode of preparation, etc.). Besides, a herbarium was established for all the plants harvested in the park. The plants were identified by the Botanical laboratory (University of Tlemcen, Algeria) and the Botanical Department of the National Higher School of Agronomy (ENSA, El-Harrach, Algeria). Plants collection and ethnobotanical investigations were carried out between 2017 and 2018.

| Demographical characteristics | (%) |
|------------------------------|-----|
| Gender                       |     |
| Male                         | 33  |
| Female                       | 67  |
| Age (years)                  |     |
| 15–30                        | 12  |
| 31–45                        | 17  |
| 46–60                        | 27  |
| ≥61                          | 44  |
| Education level              |     |
| Illiterate                   | 59  |
| Primary school               | 17  |
| Secondary school             | 17  |
| University                   | 7   |
| Profession                   |     |
| Unemployed                   | 60  |
| Employed                     | 11  |
| Retired                      | 16  |
| Student                      | 6   |
| Farmer                       | 7   |
2.3. Ailment categories

The ailments treated by the medicinal plants were grouped into 13 categories according to the use-reports reported by the informants (Table 2). Each citation of a particular part of a particular species was recorded as one use report. When a species was mentioned to be used to treat or manage different ailments in the same category, it was considered as a single use-report (Benarba et al., 2015).

Table 2. Studied ailment categories. In brackets category abbreviations; %, percentage of total reports.

| Category                                      | Ailments/disorders                                      | %     |
|-----------------------------------------------|--------------------------------------------------------|-------|
| Kidneys diseases (KD)                         | Stone, infections                                       | 1.6   |
| Gastro-intestinal diseases (GISD)             | Stomach ulcer, stomachache, dysentery, colic, gases,   | 18.3  |
|                                               | constipation, colitis, parasites, hydatid cyst, liver   |       |
|                                               | problems, hepatitis, biliary problems, diarrhea, and   |       |
|                                               | toothache.                                             |       |
| Skin diseases (SD)                            | Skin diseases, fungal infections, burns.                | 2.9   |
| Endocrine system diseases (ESD)               | Diabetes, goiter, weight loss.                         | 2.5   |
| Nervous system (NS)                           | Depression, anxiety, vertigo, migraine, dementia.      | 0.9   |
| Skeletal-muscular system disorder (SMSD)      | Rheumatism, arthritis, inflammation, body pain.        | 1.0   |
| Cancer (Can)                                  | Tumors, cancers, metastases.                           | 0.6   |
| Cardiovascular system disease and blood disorders (CSD) | Cholesterol, high blood pressure, heart problems, anemia, hemorrhoids, blood purification. | 2.2   |
| Haircare (HC)                                 | Hair loss, hair growth.                                | 0.3   |
| Respiratory tract diseases (RTD)              | Cold, cough, asthma, bronchitis, flu, allergy.         | 30.8  |
| General health (GH)                           | Body pain, tonic, psychopathic disorders, systemic     | 19.1  |
|                                               | healing, and systemic problems.                        |       |
| Sexual-reproductive problems (SRP)            | Menstrual cramps, infertility, sexual impotence,       | 18.4  |
|                                               | gynecological problems.                                |       |

2.4. Data analysis

Data analysis was carried out by calculating different indices as follows:

Use-value (UV): The UV of each species was calculated by using the following formula: \( UV = \frac{\sum U}{n} \), where \( U \) is the number of uses reported by each informant for a given species and \( n \) is the total number of informants (Prance et al., 1987; Rossato et al., 1999).

Informant consensus factor (\( F_{ic} \)): The \( F_{ic} \) was calculated according to the formula: \( F_{ic} = \frac{(Nur-Nt)}{(Nur-1)} \) where \( Nur \) is the number of use citations in each category and \( Nt \) is the number of species reported in each category (Tardio & Pardo de Santayana, 2008).

Ethnobotanicity index (EI): The EI expressed as a percentage, was calculated as follows: \( EI = \frac{n}{N} \), where \( n \) is the number of useful medicinal species and \( N \) is the number of all the species of the total flora in the area according to Porterès (1970). The EI reflects the importance of medicinal plants in an area (Sreekeesoon & Mahomoodally, 2014).

3. Results and Discussion

3.1. Botanical data

The total flora of the national park of Tlemcen consists of 917 inventoried species, representing 31.6% of the national flora, with 22 protected species (9.7% of the total national protected species) (Radford et al., 2011). The flora is also rich and diverse with 31 endemic species, 38 rare species and 27 very rare species. Our results (Table 3) showed that 109 species belonging to 54 families are used by local populations to treat different health problems. Moreover, the most frequent families were lamiaceae with 18 species (15.5%), asteraceae with 13 species (11.9%), and rosaceae with 6 species (5.5%) (Figure 2). Our findings are consistent with most of the previous ethnobotanical investigations carried out in Algeria and neighboring countries. Indeed, in a previous study realized in North-West Algeria (Mascara), we found that traditional healers used 141 medicinal plant species belonging to 54 families and 125 genera, with dominance of lamiaceae, asteraceae and apiaceae (Benarba et al., 2015b). In line with our results, lamiaceae and asteraceae were found to be the most predominant botanical families in different Mediterranean countries such as Algeria (Bendif et al., 2018; Benarba et al., 2015c; Sarri et al., 2015), Morocco (Bachar et al., 2016; Hamsas EL Youbi et al., 2016), and Spain (Parada et al., 2009). The same predominant families lamiaceae and asteraceae were reported in other regions of the world such as Bolivia (Cussy-Poma et al., 2017), Iran (Mosaddegh et al., 2012), or South America (Molares & Ladio, 2009). In most of the ethnobotanical studies around the world, lamiaceae, asteraceae, and rosaceae are the most predominant families (Quave et al., 2012). This predominance could be explained by the important occurrence of species belonging to these families which may result in large use and enhanced ethnomedicinal knowledge by local populations (Benarba et al., 2015b).
3.2. Parts used

According to our results, roots, rhizomes or tubers represented the most used part for medical care (37.6%). Leaves occupied the second position (33.6%), followed by other aerial parts such as stem and bourgeons (16%), fruits (8%), flowers (1.6%), and seeds (3.2%). Although a majority of recent ethnobotanical studies reported that aerial parts (leaves) are the most used part of the medicinal species (Tugume et al., 2016; Benarba et al., 2015a,b; Salhi et al., 2010), our findings are in consistence with those reporting that roots, rhizomes and tubers are the most commonly used plant part (Jin et al., 2018; Bisht & Adhikari, 2018; Kumar & Pandey, 2015). The frequent use of underground parts of the plants that are responsible for their multiplication and regeneration would be responsible for their disappearance. Indeed, during our collection of medicinal plants in Tlemcen Park, we found that these species are becoming increasingly rare.

3.3. Modes of preparation

The most common methods of preparation were: decoction (40.4%), infusion (28.5%), raw (17.4%), poultice (6.3%), dry (2.3%), juice (3.1%), maceration (0.7%), and fumigation (0.7%). Our findings corroborate those previously reported in Algeria (Madani et al., 2017; Benarba et al., 2016; Chahma and Djebar, 2008), Morocco (Abouri et al., 2012), Africa (Buwa-Komoren et al., 2019) or in South American countries (Tuler et al., 2014; Marcia et al., 2005). It is suggested that the use of decoction or infusion as frequent modes of preparation of herbal remedies would be explained by the fact that heating allows better extraction of the active principles, a reduction of the toxicity as well as disinfection of the plant (Benarba et al., 2015; Lahsissene et al., 2009).

According to our results, oral administration (82.7%) was the most frequent route prescribed by local populations in the national park of Tlemcen. Moreover, 14.5% of plant species are used via topical application. Our findings are in perfect consistency with those we previously reported in North-West (Benarba et al., 2015b) and South-West Algeria (Benarba et al., 2016). Similar findings were reported in most of the ethnobotanical investigations carried out in Algeria and its neighboring countries (Skalli et al., 2019; Boudjelal et al., 2013; Teixidor-Toneu et al., 2016; Telli et al., 2016). A high incidence of internal disorders, as well as cultural factors, may explain the predominance of the oral route as preferred administration mode as revealed in the present study (Benarba et al., 2016).

Moreover, our results showed that 46% of the cited species are administered with other plants. Out of them, 8 species are mixed with one plant, 12 species with two or three plants and 20 species are administered with more than three plants. The use of herbal mixtures in popular therapy may be explained by the search of a synergistic effect or the reduction of toxic effects of certain species (Bruschi et al., 2011). On the other hand, our results revealed that 64 species (59% of total cited plants) are mixed with honey, milk, olive oil or sugar. Bees honey was found to be the most added adjuvant (Figure 3).

Our findings are in line with those previously reported in Algeria. Benarba et al., 2016 reported that more than 50% of the cited medicinal plants used by traditional healers in South-West Algeria were administered with other plant species or non-plant-adjuvant. They found that honey was the adjuvant most added (53%) to medicinal plants used to treat several diseases. Similar findings were reported in different regions in Algeria (Bouasa & Bouasa, 2017; Ouelbani et al., 2016), and other parts of the world (Appiah et al., 2019; Bhutia et al., 2015), probably to soften the unpleasant taste of plants (Benarba et al., 2015b).
3.4. Ethnobotanicity index (E.I.)

Among the 917 plant species of the total flora, we identified 102 species used for medicinal purpose. Therefore, the calculated ethnobotanicity index was found to be 11.8%. This means that around 12.0% of the plant species are known to be useful as medicinal plants by local populations of the national park of Tlemcen. This finding is similar to those previously reported in the Mediterranean basin such as in Italy (Tuttolomondo et al., 2014), Spain (Menendez-Baceta et al., 2014), and Portugal (Novais et al., 2004). Nonetheless, when compared to EI estimated for Mediterranean regions with the same total flora (approximately 1000 species), the EI of the national park of Tlemcen is significantly lower than the reported in Spain (Martínez-Lirola et al., 1996) or Portugal (Camejo-Rodrigues et al., 2003).

3.4. Use value

Ranging from 0.01 to 0.96, the UV values allowed ranking the plant species according to the importance of their use by the local population of the Tlemcen national park. Our results (Table 3) showed that *Thymus lanceolatus*, *Origan glandulosum* and *Ammoides verticillata* were the most frequently used species with the highest UV values of 0.96, 0.96, and 0.94, respectively. Besides, these species were followed by *Echinops spinosus* (UV=0.88), *Mentha pulegium* (UV=0.84), *Anacyclus pyrethrum* (UV=0.84), *Daucus critinus* (UV=0.82), *Arenaria aggregata* (UV=0.81), and *Junipenus oxycedrus* (UV=0.66) (Table 3).

Species belonging to the genus *Thymus* were found to be the most frequently used medicinal plants in several ethnobotanical investigations in both Algeria (Bouredja et al., 2017; Benarba et al., 2016; Benarba et al., 2015b) and other countries (Axiotis et al., 2018; Rajaei & Mohamadin, 2012). In the present study, *T. lanceolatus* is used to treat respiratory diseases (flu, allergy, …) and several gastrointestinal problems (food poisonings, stomachache). The use of *Thymus* species to treat the respiratory diseases in the Mediterranean basin is well documented (Benarba et al., 2015b; Benarba et al., 2016; Leto et al., 2013; Teixidor-Toneu et al., 2016). Similarly, different *Thymus* species were reported to be used to treat several gastrointestinal disorders (Pant & Samant, 2010; Singh, 2012).

Recently, Nouasri et al. (2018) demonstrated that *T. lanceolatus* native of North-West Algeria was rich in phenolic acids, and had important antioxidant activity besides its antimicrobial effects against *Staphylococcus aureus* and *Umpelopsis ramaniana*. Furthermore, rosmarinic acid was the major compound of the fourteen identified. The ethanolic extract of *T. lanceolatus* exhibited a protective effect of human cells against oxidative damage (Caprioli et al., 2018). The use of *Thymus* species in the treatment of respiratory diseases could be attributed to their anti-inflammatory potential by targeting the NF-κB p65 and NF-κB p52 pathways resulting in a significant reduction pro-inflammatory cytokines (IL-1 beta and IL-8), and Muc5ac secretion (Oliviero et al., 2016).

In line with our results, *Origanum sipyleum* L. and *Thymus sipyleus* Boiss. were found to be the most frequently used species in Greek islands in North Aegean Region. These two species were mainly used to treat respiratory and gastrointestinal disorders (Axiotis et al., 2018).
Table 3. List of medicinal plants used by local populations in Tlemcen National Park. Abbreviations are: V. name, Vernacular name; V.N., voucher number (INA-19-); Parts, parts used; Admin., administration type; UV, use value. See Table 2 (Ailment categories) for abbreviations on Diseases treated.

| Name                                      | V. name                  | V.N. | Parts      | Diseases treated                                           | Preparation       | Admin. | UV   |
|-------------------------------------------|--------------------------|------|------------|-----------------------------------------------------------|-------------------|--------|------|
| Origanum majorana L. (Lamiaceae)          | نمطينة رتينغلا           | 001  | Aerial     | RTD: 200 (cold, allergy), GISD: 45 (stomachache, food poisoning). | Infusion          | Oral   | 0.964|
| Thymus lanceolatus Desf. (Lamiaceae)      | رجين رتينغلا              | 002  | Aerial     | RTD: 200 (cold, allergy), GISD: 43 (stomachache, food poisoning), SRP: 2 (menstrual cramps). | Infusion          | Oral   | 0.964|
| Anmoides pusilla (Brot.) Breistr. (Apiaceae)| دخون                  | 003  | Aerial     | RTD: 212 (cold, cough, flu), GH: 33 (body pain).            | Infusion, maceration | Decoction | Oral, inhalation | 0.944|
| Echinops bovei Boiss. (Asteraceae)         | غرسنات                  | 004  | Roots      | SRP: 205 (female sterility, menstrual cramp, gynecological disorders), GH: 20 (body pain, systemic problems). | Decoction,powder | Oral   | 0.880|
| Anacyclus pyrethrum (L.) Lag. (Asteraceae) | سيرننغلا                 | 005  | Roots      | SRP: 212 (gynecological disorders, infertility), NS: 1 (depression), RTD: 7 (bronchitis, cold), SMSD: 17 (rheumatism). | Decoction,powder | Oral   | 0.846|
| Mentha spicata L. (Lamiaceae)             | وثيلف                    | 006  | Aerial     | SRP: 25 (Menstrual cramps), RTD: 190 (cold).                | Infusion          | Oral   | 0.846|
| Daucus crinitus Desf. (Apiaceae)           | دومشوب                | 007  | Roots      | RTD: 3 (Bronchitis), SMSD: 50 (arthritis), GH: 137 (body pain), GISD: 20 (appetite). | Decoction, powder | Oral   | 0.826|
| Arenaria aggregata subsp. mauritania (Batt.) Maire (Caryophyllaceae) | يشعورولا            | 008  | Roots      | SRP: 150 (female sterility), GH: 57 (body pain).            | Decoction, powder | Oral   | 0.814|
| Juniperus oxycedrus L. (Cupressaceae)       | قظانلا                  | 009  | Roots      | SMSD: 120 (arthritis), GH: 50 (body pain).                  | Decoction         | Oral   | 0.669|
| Calamintha nepeta (L.) Savi. (Lamiaceae)    | قطبانلا                 | 010  | Aerial     | RTD: 120 (cold, cough, flu).                                | Infusion          | Oral   | 0.472|
| Dittrichia viscosa (L.) Greuter (Asteraceae)| نحومرقم                | 011  | Roots, leaves | GH: 46 (body pain), SD: 20 (wound), SRP: 9 (gynecological problems), SMSD: 45 (arthritis). | Decoction, poultice | Oral, topical | 0.472|
| Chamaerops humilis L. (Arecaceae)           | بودلا                     | 012  | Roots      | GISD: 98 (stomach ulcer, colon), GH: 17 (body pain).        | Decoction         | Oral   | 0.452|
| Rhamnus alaternus L. (Rhamnaceae)           | سينديليم               | 013  | Roots, leaves | GISD: 28 (hepatitis), CSD: 67 (blood purification).         | Decoction         | Oral   | 0.374|
| Crataegus monogyna Jacq. (Rosaceae)         | نفرق نزيغع                 | 014  | Roots, fruits | SMSD: 37 (inflammation), CSD: 32 (hypertension, hypercholesterolemia), CSD: 9 (blood purification), KD: 4 (renal disorders). | Decoction, powder | Oral   | 0.322|
| Anchusa undulata L. (Boraginaceae)           | رهوجم                     | 015  | Roots      | CSD: 45 (anemia), GISD: 45 (liver diseases), GH: 25 (body pain). | Decoction, powder | Oral   | 0.275|
| Atractylis macrophylla Desf. (Asteraceae)    | ضررلا غازورق            | 016  | Roots      | SMSD: 22 (arthritis), GISD: 20 (colon, appetite), GH: 13 (body pain), RTD: 13 (cold), Can: 2 (cancers). | Decoction, powder | Oral   | 0.275|
| Mentha rotundifolia (L.) Huds. (Lamiaceae)   | نارمخفط                 | 017  | Aerial     | GISD: 32 (colon), SRP: 13 (impotence, menstrual cramps, gynecological disorders), RTD: 18 (cold). | Infusion, poultice | Oral, topical | 0.248|
| Ballota hirsuta Benth. (Lamiaceae)           | توورم                     | 018  | Leaves     | ESD: 25 (hypertension), KD: 15 (fungal infections), SD: 15 (skin diseases). | Poulstice         | Topical | 0.216|
| Aloysia citriodora Palau. (Verbenaceae)      | نتوورم                    | 019  | Leaves     | GISD: 40 (colon, constipation).                            | Infusion          | Oral   | 0.177|
| Ziziphus lotus (L.) Lam. (Rhamnaceae)        | ترسنلا                  | 020  | Roots, leaves | GISD: 22 (stomachache, colon), GH: 12 (body pain), SMSD: 11 (arthritis). | Decoction         | Oral   | 0.177|
| Lavandula stoechas L. (Lamiaceae)            | نميازغللا                | 021  | Aerial     | CSD: 5 (hypertension), NS: 2 (sedative).                   | Infusion          | Oral   | 0.157|
| Tetracallis articulata (Vahl.) Mast. (Cupressaceae) | راجغللا             | 022  | Leaves, seeds | RTD: 40 (cough, flu).                                     | Decoction         | Oral, inhalation | 0.157|
| Name | V. name | V.N. | Parts | Diseases treated | Preparation | Admin. | UV |
|------|---------|------|-------|------------------|-------------|--------|----|
| *Cupressus symphorirens* L. (Cupressaceae) | نتوتَنَنا | ٠٠٣ | Leaves, seeds | RTD: 35 (Bronchitis). | Decoction | Oral | 0,137 |
| *Teucrium polium* L. (Lamiaceae) | نَكَسَنَة | ٠٠٤ | Leaves, roots | GISP: 20 (stomach ulcer, colon), ESD: 15 (diabetes). | Infusion | Oral | 0,137 |
| *Rhaphonticum aculeatum* L. DC. (Asteraceae) | نَزَوقَتَنَة | ٠٠٥ | Roots | GISP: 32 (stomach ulcer). | Decoction | Oral | 0,125 |
| *Salvia verbenaca* L. (Lamiaceae) | طَمَايَن | ٠٠٦ | Leaves | SD: 32 (wound). | Powder | Topical | 0,125 |
| *Aristolochia longa* L. (Aristolochiaceae) | سَبَنَة | ٠٠٧ | Roots | SD: 25 (wound), Can: 5 (cancers). | Powder | Oral, topical | 0,118 |
| *Bankium fontanum* (Pers.) Maire (Apiaceae) | قَرَح | ٠٠٨ | Roots | ESD: 26 (goiter), GH: 3 (body pain), SD: 1 (burns). | Powder | Oral | 0,118 |
| *Rubia peregrina* L. (Rubiaceae) | فَوَنوِنِا | ٠٠٩ | Roots | CSD: 25 (anemia), GISD: 25 (kid cough), GH: 5 (body pain). | Decoction, powder | Oral | 0,118 |
| *Urtica urens* L. (Urticaceae) | قَدِرَح | ٠١٠ | Leaves, roots | SMSD: 29 (rheumatism). | Poultice, decoction powder | Oral | 0,114 |
| *Globalaria alypum* L. (Plantaginaceae) | سَوْرُبَيْنَة | ٠٠١١ | Leaves | SRP: 22 (menstrual cramp), ESD: 4 (diabetes). | Infusion | Oral | 0,102 |
| *Verbascum sinnatum* L. (Scrophulariaceae) | راَمُيِلِ حَمِيْر | ٠٠١٢ | Roots, leaves | SMSD: 18 (inflammation), GH: 7 (body pain). | Decoction | Oral | 0,098 |
| *Arbutus unedo* L. (Ericaceae) | نِورِفَنَة | ٠٠١٣ | Roots | GISD: 11 (inflammation), GISD: 2 (colon), RTD: 2 (cold), GH: 1 (body pain). | Decoction | Oral | 0,078 |
| *Ajuga iva* (L.) Schreb. (Lamiaceae) | نَفْرُونِيِنَش | ٠٠١٤ | Leaves | CSD: 15 (hypertension). | Infusion, decoction powder | Oral | 0,059 |
| *Calicotome intermedia* C. Presl (Leguminosae) | نَدوْرُنَة | ٠٠١٥ | Roots | GH: 15 (body pain) | Decoction | Oral | 0,059 |
| *Genista tricuspidata* L. (Leguminosae) | نَفْرِبِنِا | ٠٠١٦ | Roots | GH: 13 (body pain), CSD: 2 (hypercholesterolemia). | Decoction | Oral | 0,059 |
| *Herniaria hirsuta* L. (Caryophyllaceae) | نَجْرِح | ٠٠١٧ | Aerial | SMSD: 20 (inflammation), GISD: 2 (colon), RTD: 2 (cold), GH: 1 (body pain). | Infusion, decoction powder | Oral | 0,062 |
| *Laurus nobilis* L. (Lauraceae) | دِرْنَلَا | ٠٠١٨ | Roots | GH: 15 (body pain) | Infusion | Oral | 0,059 |
| *Malva parviflora* L. (Malvaceae) | نَزَيْيُبِنْلا | ٠٠١٩ | Aerial | GISD: 15 (colon, constipation), GISD: 15 (heart disorders). | Infusion | Oral | 0,059 |
| *Myrtus communis* L. (Myrtaceae) | نَقُوْبُنَة | ٠٠٢٠ | Leaves | GH: 15 (body pain) | Infusion | Oral | 0,059 |
| *Pistacia lentiscus* L. (Anacardiaceae) | وَرَمْنِيَلا | ٠٠٢١ | Leaves | GH: 2 (body pain), GISD: 13 (stomachache). | Decoction | Oral | 0,059 |
| *Quercus ilex* subsp. *ballyota* (Desf.) Samp. (Fagaceae) | مُؤْوْيَنِا | ٠٠٢٢ | Roots | GISD: 15 (stomachache). | Decoction | Oral | 0,059 |
| *Rubus ulmifolius* Schott (Rosaceae) | نَقُوْدْعُنا | ٠٠٢٣ | Roots | CSD: 15 (blood purification). | Decoction | Oral | 0,059 |
| *Mentha pulegium* L. (Lamiaceae) | مْيَلِيْلا | ٠٠٢٤ | Aerial | NS: 13 (depression). | Infusion | Oral | 0,051 |
| *Arisorum sinorhinum* Durieu (Araceae) | نَقُوْبُنَة | ٠٠٢٥ | Roots | Can: 2 (cancers), ESD: 10 (goiter). | Powder | Oral | 0,047 |
| *Olea europea* L. (Oleaceae) | نَرْوْيِنَا | ٠٠٢٦ | Leaves, fruits | ESD: 10 (diabetes), CSD: 2 (hypertension). | Decoction, powder | Oral | 0,047 |
| *Ziziphus vulgaris* Mill. (Rhamnaceae) | مَفْرِيْسِس | ٠٠٢٧ | Roots, seeds | GISD: 2 (hypercholesterolemia), GISD: 9 (liver disorders). | Decoction | Oral | 0,043 |
| *Citrus limon* (L.) Osbeck (Rutaceae) | مَيْيُلِلَا | ٠٠٢٨ | Fruits | CSD: 10 (hypertension). | Juice | Oral | 0,039 |
| Name | V. name | V.N. | Parts | Diseases treated | Preparation | Admin. | UV |
|------|---------|------|-------|------------------|-------------|--------|----|
| Himantoglossum hircinum | (L.) Spreng. (Orchidaceae) | 053 | Roots | SRP: 3 (infertility, sexual impotence), GH: 5 (body pain), Can: 1 (cancers), GISD: 1 (weight loss). | Dry, powder | Oral | 0,039 |
| Prunus persica (L.) Batsch (Rosaceae) | | 054 | Leaves | Can: 10 (cancers). | Infusion, powder | Oral | 0,039 |
| Punicia granatum L. (Lythraceae) | | 055 | Fruits | GISD: 10 (stomach ulcer). | | | |
| Quercus suber L. (Fagaceae) | | 056 | Roots | GISD: 10 (stomach ulcer). | Decoction | Oral | 0,039 |
| Rosmarinus officinalis L. (Lamiaceae) | | 057 | Aerial | RTD: 7 (allergy), GISD: 3 (constipation). | Infusion, decoction | Oral | 0,039 |
| Salvia argentea L. (Lamiaceae) | | 058 | Leaves | RTD: 10 (bronchitis). | Poultice, Topical | | 0,039 |
| Silene vulgaris (Moench) Garcke. (Caryophyllaceae) | | 059 | Roots | GISD: 10 (constipation, intestine problems). | Decoction | Oral | 0,039 |
| Thymus ciliatus L. (Lamiaceae) | | 060 | Leaves | Can: 10 (cancers). | Infusion, decoction | Oral | 0,039 |
| Juglans regia L. (Juglandaceae) | | 061 | Roots | GISD: 8 (toothache). | Decoction | Oral | 0,039 |
| Onopordum macracanthum Schousb. (Asteraceae) | | 062 | Fruits | GISD: 8 (stomach ulcer). | Dry | Oral | 0,039 |
| Asparagus stipularis Forssk. (Asparagaceae) | | 063 | Roots | GISD: 4 (intestine problems). | Decoction | Oral | 0,039 |
| Clematis flammula L. (Ranunculaceae) | | 064 | Leaves | GH: 6 (body pain). | Infusion, decoction | Oral | 0,039 |
| Apium nodiflorum (L.) Lag. (Apiaceae) | | 065 | Roots, leaves | GH: 6 (body pain). | Decoction | Oral | 0,039 |
| Asphodelus ramosus L. (Xanthorrhoeaceae) | | 066 | Roots | GH: 4 (body pain). | Decoction | Oral | 0,039 |
| Hernia maritima L. (Plumbaginaceae) | | 067 | Leaves | GISD: 5 (stomach ulcer). | Powder | Topical | 0,039 |
| Prunus cerasus L. (Rosaceae) | | 068 | Roots | GISD: 5 (stomach ulcer). | Powder | Topical | 0,039 |
| Ruta angustifolia Pers. (Rutaceae) | | 069 | Leaves | GISD: 5 (stomach ulcer). | Powder | Topical | 0,039 |
| Thymus capitata (L.) Cav. (Lamiaceae) | | 070 | Leaves | GISD: 5 (stomach ulcer). | Powder | Topical | 0,039 |
| Artemisia arborescens (Vaill.) L. (Asteraceae) | | 071 | Leaves | GH: 6 (body pain). | Decoction | Oral | 0,039 |
| Cistus salvifolius L. (Cistaceae) | | 072 | Leaves | GH: 6 (body pain). | Decoction | Oral | 0,039 |
| Daphne gnidium L. (Thymelaeaceae) | | 073 | Leaves | GH: 6 (body pain). | Decoction | Oral | 0,039 |
| Heliotropium abbreviatum Rusby (Boraginaceae) | | 074 | Leaves | GH: 6 (body pain). | Decoction | Oral | 0,039 |
| Asphodelus bonvensis | | 075 | Leaves | GH: 4 (body pain). | Decoction | Oral | 0,039 |
| Cynara cardunculus L. (Asteraceae) | | 076 | Leaves | GH: 4 (body pain). | Decoction | Oral | 0,039 |
| Eriobotrya japonica (Thunb.) Lindl. (Rosaceae) | | 077 | Leaves | GH: 4 (body pain). | Infusion, decoction | Oral | 0,039 |
| Ficus carica L. (Moraceae) | | 078 | Roots | GISD: 5 (stomach ulcer). | Powder | Topical | 0,039 |

**V.N.** = Volume Number, **Admin.** = Administration Method, **UV** = Unspecified Value.
| Name                                                      | V. name                  | V.N. | Parts   | Diseases treated                           | Preparation | Admin. | UV  |
|-----------------------------------------------------------|--------------------------|------|---------|--------------------------------------------|-------------|--------|-----|
| Geranium purpureum Vill. (Geraniaceae)                    | 083                      | Leaves | GH: 4 (body pain)                           | Infusion    | Oral   | 0,015 |
| Rosa canina L. (Rosaceae)                                 | 084                      | Roots  | GH: 4 (body pain)                           | Decoction   | Oral   | 0,015 |
| Salvia officinalis L. (Lamiaceae)                         | 085                      | Leaves | GH: 4 (kids body pain)                      | Infusion    | Oral   | 0,015 |
| Agave americana L. (Asparagaceae)                         | 086                      | Leaves | HC: 3 (Hair loss)                           | Decoction   | Topical| 0,011 |
| Anemones mauritanicus (Poir.) T. Durand & Schinz (Poaceae) | 087                      | Roots  | GH: 3 (body pain)                           | Decoction   | Oral   | 0,011 |
| Geranium purpureum Vill. (Geraniaceae)                    | 083                      | Leaves | GH: 4 (body pain)                           | Infusion    | Oral   | 0,015 |
| Rosa canina L. (Rosaceae)                                 | 084                      | Roots  | GH: 4 (body pain)                           | Decoction   | Oral   | 0,015 |
| Salvia officinalis L. (Lamiaceae)                         | 085                      | Leaves | GH: 4 (body pain)                           | Infusion    | Oral   | 0,015 |
| Agave americana L. (Asparagaceae)                         | 086                      | Leaves | HC: 3 (Hair loss)                           | Decoction   | Topical| 0,011 |
| Amelodesmos mauritanicus (Poir.) T. Durand & Schinz (Poaceae) | 087                      | Roots  | GH: 3 (body pain)                           | Decoction   | Oral   | 0,011 |
3.5. Informant consensus factor (\(F_{IC}\))

As shown in Table 4, \(F_{IC}\) values ranged from 0.65 to 0.98. The highest \(F_{IC}\) were recorded for the reproductive and sexual disorders (0.98) with 10 species and 644 use reports, respiratory tract diseases (0.98), cardiovascular system disease and blood disorders (0.94), digestive disorders (0.93), and general health (0.93). Our findings are in agreement with those reported in nomadic populations in Algerian steppe revealing that reproductive and sexual disorders were the ailment category with the highest \(F_{IC}\) of 0.92 (Miara et al., 2018). Similar to our results, it has been found that cardiovascular diseases had the 3rd \(F_{IC}\) in two ethnobotanical studies carried out in two regions located in North-East Algeria (Miara et al., 2019; Bousala & Bousala, 2017). Likewise, Boughrara & Belgacem (2016) found that these ailments were ranked 3rd in the extreme east of Algeria. Moreover, in most of ethnobotanical investigations in Algeria and neighboring countries, digestive disorders were found to be associated with the highest \(F_{IC}\) (Eddouks et al., 2017; Menale et al., 2016; Benarba et al., 2015b; El-Hilaly et al., 2003).

Table 4. Informant consensus factor (\(F_{IC}\)) for commonly used medicinal plants. See Table 2 for abbreviations on Ailment. Other abbreviations: Nur, number of use-reports; Nt, number of taxa; \(F_{IC}\), Informant consensus factor.

| Ailment category | Nur | Nt  | \(F_{IC}\) |
|------------------|-----|-----|----------|
| SRP              | 644 | 10  | 0.98     |
| RTD              | 1077| 18  | 0.98     |
| CSD              | 265 | 15  | 0.94     |
| GISD             | 643 | 40  | 0.93     |
| GH               | 579 | 40  | 0.93     |
| SD               | 104 | 9   | 0.92     |
| ESD              | 89  | 8   | 0.92     |
| KD               | 59  | 7   | 0.89     |
| HC               | 13  | 3   | 0.83     |
| NS               | 33  | 7   | 0.81     |
| Can              | 23  | 6   | 0.77     |
| SMSD             | 36  | 13  | 0.65     |

4. Conclusions

The present study reports an important ethnobotanical knowledge possessed by local populations living in the living in the Park of Tlemcen (North-West Algeria). Indeed, 109 species from 54 families are traditionally used to treat different diseases and health problems. Among them, *Thymus lanceolatus*, *Origon glandulosum*, *Ammoideae verticillata*, *Echinops spinosus*, *Mentha pulegium*, *Anacysus pyrethrum*, *Daucus critinus*, *Arenaria aggregata*, and *Juniperus oxycedrus* had the highest UV and therefore should be considered for further phytochemical and preclinical studies to evaluate their biological activities and identify the lead bioactive compounds. Moreover, high consensus has been found regarding the treatment of reproductive and sexual disorders, respiratory tract diseases, cardiovascular system disease and blood disorders, digestive disorders, and general health.

References

Abouri, M., El Mousadik, A., Msanda, F., Boubaker, H., Saadi, B. & Cherifi, K. 2012. An ethnobotanical survey of medicinal plants used in the Tata Province, Morocco. Int. J. Med. Plants Res. 1(7): 99–123.

Agisho, H., Osie, M. & Lambore, T. 2014. Traditional medicinal plants utilization, management and threats in Hadiya Zone, Ethiopia. J. Med. Plant Stud. 2: 94–108.

Appiah, K., Oppong, C., Mardani, H., Omari, R., Kpabitey, S., Amoatey, C. & Fujiy, Y. 2019. Medicinal Plants Used in the Ejisu-Juaben Municipality, Southern Ghana: An Ethnobotanical Study. Medicines 6(1), 1.

Axiotis, E., Halabalaki, M. & Skaltsounis, L.A. 2018. An ethnobotanical study of medicinal plants in the Greek Islands of North Aegean Region. Front. Pharmacol. 9: 1–6.

Azzi, R., Djaziri, R., Lahfa, F., Sekkal, F.Z., Bennmhdhi, H. & Belkacem, N. 2012. Ethnopharmacological survey of medicinal plants used in the traditional treatment of diabetes mellitus in the North Western and South Western Algeria. J. Med. Plant Res. 6(10): 2041–2050.

Bachar, M., Zidane, L. & Rochdi, A. 2016. Ethnomedicinal and traditional Phytotherapy of plants used in Bouhachem National Regional Park “Rif of Morocco” -case of Tazroute district-. J. Mater. Environ. Sci. 7(11): 4175–4204.

Benarba, B. 2015a. Use of medicinal plants by breast cancer patients in Algeria. Excli J. 14: 1164–1166.

Benarba, B., Belabid, L., Righi, K., Bekkar, A.A., Elouissi, M., Khaldi, A. & Hammed, A. 2015b. Ethnobotanical study of medicinal plants used by traditional healers in Mascara (North West of Algeria). J. Ethnopharmacol. 175: 626–637.

Benarba, B. 2016. Medicinal plants used by traditional healers from South–West Algeria: An ethnobotanical study. J. Intercult. Ethnopharmacol. 5(4): 320.

Bendif, H., Miara, M.D., Harir, M., Merabti, K., Souilah, N., Guerrouj, S. & Lebza, R. 2018. Ethnobotany of Medicinal Plants of El Mansourah (West of Bordj Bou Arreridj, Algeria). J. Soil Plant Biol. 2018(1): 45–60.

Bhatia, H., PalSharma,Y., Manhas, R.K. & Kumar, K. 2015. Traditional phytoremedies for the treatment of menstrual disorders in district Udhampur, J & K, India. J. Ethnopharmacol. 160: 202–210.

Bisht, S. & Adhikari, B.S. 2018. Ethnobotanical Study of Traditional Medicinal Plants used by Banraji Community in Uttarakhand, West Himalaya. J. Ethnobiol. Trad. Med. 129: 1426–1441.

Bousala, A. & Bousala, I. 2017. Ethnobotanical survey of medicinal plants in northeastern of Algeria. Phytomedicine 36: 68–81.

Boudjelal, A., Henchiri, C., Sari, M., Sarri, D., Hendel, N., Benkhaled, A. & Ruberto, G. 2013. Herbalists and wild medicinal plants in M’Sila (North Algeria): An
ethnopharmacology survey. J. Ethnopharmacol. 148: 395–402.
Boughrara, B. & Belgacem, L. 2016. Ethnobotanical study close to the population of the extreme north east of Algeria: The municipalities of El Kala National Park (EKNP). Industr. Crops Prod. 88: 2–7.
Bouredja, N., Messaoudi, N. & Benyamina, K. 2017. Ethnobotanical and floristic study of medicinal plants in the region of Oued Tlefalt, Algeria. Int. J. Pharmaceut. Sci. Res. 8(3): 1199–1204.
Buwa-Komoren, L.V., Mayekiso, B., Mhlwana, Z. & Adeniran, A.L. 2019. An ethnobotanical and ethnomedical study of traditionally used medicinal plants in Seymour, South Africa: An attempt toward digitization and preservation of ethnec knowledge. Pharmaco. Mag. 15: 115–23.
Camejo-Rodrigues, J., Ascensao, L., Bonet, M.A. & Valles, J. 2003. An ethnobotanical study of medicinal and aromatic plants in the Natural Park of “Serra de São Mamede” (Portugal). J. Ethnopharmacol. 89(2–3): 199–209.
Caprioli, G., Maggi, F., Bendif, H., Miara, M. D., Cinque, B., Lizzi, A.R. & Celenza, G. 2018. Thymus lanceolatus ethanolic extract protects human cells from t-BHP induced oxidative damage. Food Funct. 9(7): 3665–3672.
Cussy-Poma, V., Fernández, E., Rondevaldova, J., Foffová, V., Caprioli, G., Maggi, F., Bendif, H., Hammou, M.A. & Teixidor-Miara, M.D., Bendif, H., Hammou, M.A. & Teixidor-Miara, M.D., Bendif, H., Hammou, M.A. & Teixidor.
Custodio, I. 2018. Ethnobotanical survey of medicinal plants in the Qampaya District, Bolivia. J. Ethnopharmacol. 192: 320–349.
Menale, B., De Castro, O., Cascone, C. & Muoio, R. 2016. Ethnobotanical investigation on medicinal plants in the Vesuvio National Park (Campania, southern Italy). J. Ethnopharmacol. 192: 320–349.
Molares, S. & Ladio, A. 2009. Ethnobotanical review of the Mapuche medicinal flora: Use patterns on a regional scale. J. Ethnopharmacol. 122(2): 251–260.
Mosaddegh, M., Naghibi, F., Moazzeni, H., Pirani, A. & Esmaeili, S. 2012. Ethnobotanical survey of herbal remedies traditionally used in Kohgiluyeh va Boyer Ahmad province of Iran. J. Ethnopharmacol. 141(1): 80–95.
Neube, N., Afolayan, A. & Okoh, A. 2008. Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods and future trends. J. Biotechnol. 7: 1797–1806.
Noouari, A., Krimat, S., Dahmane, D., Ksouri, A., Metidji, H. & Dob, T. 2018. Biological activities and chemical analysis of phenolic and flavonoid components of Thymus hirtus Willd. and Thymus lanceolatus Desf. extracts. Phytother. 16(6): 353–364.
Novais, M.H., Santos, I., Mendes, C. & Pinto-Gomes, C. 2004. Studies on pharmaceutical ethnobotany in Arrabida Natural Park (Portugal). J. Ethnopharmacol. 93: 183–195.
Oliviero, M., Romilde, I., Beatrice, M.M., Matteo, V., Giovanna, N., Consuelo, A., Claudia, C., Georgie, S., Filippo, M. & Massimo, N. 2016. Evaluations of thyme extract effects in human normal bronchial and tracheal epithelial cell lines and in human lung cancer cell line. Chem-Biol. Interact. 256: 125–133.
Ouelbani, R., Bensari, S., Mouas, T.N. & Khelifi, D. 2016. Ethnobotanical Investigations on Plants Used in Folk Medicine in the Regions of Constantine and Mila (North–East of Algeria). J Ethnopharmacol. 194: 196–218.
Pant, S. & Samant, S.S. 2010. Ethnobotanical observations in the Mornaula reserve forest of Komoun, West Himalaya, India. Ethnobot. Leafl. 2010(2): 1–8.
Parada, M., Carrió, E., Bonet, M.A. & Vallés, J. 2009. Ethnobotany of the Alt Empordà region (Catalonia, Iberian Peninsula). Plants used in human traditional medicine. J Ethnopharmacol. 124(3): 609–618.
Porterès, R. 1970. Ethnobotanique générale. Lab. Ethnobot. Ethnozool. Mus Nat. Hist. Nat., Paris.
Prance, G.T., Balée, W., Boom, B.M. & Carneiro, R.L. 1987. Quantitative ethnobotany and the case for conservation in Amazonian. Conserv. Biol. 1: 296–310.
Quave, C.L., Pardo de Santayana, M. & Pieroni, A. 2012. Medical Ethnobotany in Europe: From Field Ethnography to a More Culturally Sensitive Evidence-Based CAM? Evid-Based Compl. Alt. 2012, 156846. doi:10.1155/2012/156846.
Radford, E.A., Catullo, G. & Montmollin, B. 2011. Zones importantes pour les plantes en Méditerranée méridionale et orientale, sites prioritaires pour la conservation. UICN, Gland, Málaga. 134p.
Rajaei, P. & Mohamadin, N. 2012. Ethnobotanical study of medicinal plants of hezar mountain allocated in South East of Iran. Iran J. Pharm. Res. 11(4): 1153–1167.
Ramdane, R., HadjMahammed, M. & DidouHadj, M. 2015. Ethnobotanical study of some medicinal plants from Hoggar, Algeria. J. Med. Plants Res. 9(30): 820–827.
Rates, S.M. 2001. Plants as source of drugs. Toxicon 39: 603–613.
Rossato, S., Leitão-Filho, H.F. & Begossi, A. 1999. Ethnobotany of Caïçaras of the Atlantic Forest Coast (Brazil). Econ. Bot. 53(3): 377–385.
Sarri, M., Boudjelal, A., Hendel, N., Sarri, D. & Benkhaled, A. 2015. Flora and ethnobotany of medicinal plants in the southeast of the capital of Hodna (Algeria). Arab J. Med. Arom. Plant 1(1): 24–30.
Singh, K.N. 2012. Traditional knowledge on ethnobotanical uses of plant biodiversity: a detailed study from the Indian western Himalaya. Biodiv. Res. Conserv. 28: 63–77.
Skalli, S., Hassikou, R. & Arahou, M. 2019. An ethnobotanical survey of medicinal plants used for diabetes treatment in Rabat, Morocco. Heliyon 5(3), e01421.
Sreekeesoon, D.P. & Mahomoodally, M.F. 2014. Ethnopharmacological analysis of medicinal plants and animals used in the treatment and management of pain in Mauritius. J. Ethnopharmacol. 157: 181–200.
Tardio, J., Pardo de Santayana, M. 2008. Cultural Importance Indices: A Comparative Analysis Based on the Useful Wild Plants of Southern Cantabria (Northern Spain). Econ. Bot. 62: 24–39.
Teixidor-Toneu, I., Martín, G.J., Ouhammou, A., Puri, R.K. & Hawkins, J.A. 2016. An ethnomedicinal survey of a Tashelhit–speaking community in the High Atlas, Morocco. J Ethnopharmacol. 188: 96–110.
Telli, A., Esaun, M.A. & Khelil, A.O.E.H. 2016. An ethnopharmacological survey of plants used in traditional diabetes treatment in south–eastern Algeria (Ouargla province). J. Arid Env. 127: 82–92.
Thomford, N.E., Dzobo, K., Chopera, D., Wonkam, A., Skelton, M., Blackhurst, D., Chirikure, S. & Dandara, C. 2015. Pharmacogenomics implications of using herbal medicinal plants on African populations in health transition. Pharmaceuticals (Basel) 8(3): 637–663.
Tugume, P., Kakudidi, E.K. & Buyinza, M. 2016. Ethnobotanical survey of medicinal plant species used by communities around Mabira Central Forest Reserve, Uganda. J. Ethnobiol. Ethnomed. 12, 5.
Tuler, A.C. & da Silva, N.C.B. 2014. Women’s ethnomedicinal knowledge in the rural community of São José da Figueira, Durandé, Minas Gerais, Brazil. Rev. Bras. Farmacogn. 24(2): 159–170.
Tuttolomondo, T., Licata, M., Leto, C., Savo, V., Bonsangue, G., Gargano, M.L. & La Bella, S. 2014. Ethnobotanical investigation on wild medicinal plants in the Monti Sicani Regional Park (Sicily, Italy). J. Ethnopharmacol. 153(3): 568–586.