Ethnopharmacological and Ethnobotanical study of Medicinal plants in the High Atlas Central, Morocco

dالة الدراسات الإيثنوالفارمكولوجية والإثنوبيولوجية للنباتات الطبية في الأطلس المتوسط الكبير للمغرب.

Souad Belhaj, Jamila Dahmani, Nadia Belahbib, Lahcen Zidane

Databases and Inventories

Abstract

**Background:** This ethnobotanical and ethnopharmacological study was conducted in the High Atlas Central of Morocco. Its aim is to promote the use of medicinal plants through the realisation of an inventory of these plants and their therapeutic uses in this region.

**Methods:** The ethnopharmacological surveys conducted in the field from 2015 to 2017 have allowed filling 1192 questionnaires. Information was collected by an ethnobotanical and a floristic survey with using open-ended and semi-structured interviews. Data were analyzed using ANOVA and Student's t test; Quantitative ethnobotanical indices such as Fidelity Level (FL), Relative Citation Frequency (RCF) Frequency (F), and Family Importance Value (FIV) were also used to compare data. The medicinal plants were collected, identified and kept at the Biodiversity and Natural Resources Laboratory, Ibn Tofail University, Kenitra.

**Results:** The study identified a total of 248 medicinal plants used by the local population. They belong to 70 families from which the leading family was Asteraceae, represented by 30 species. Most of these species are used to treat gastrointestinal diseases such as *Thymus broussonetii* Boiss, *Ceratonia siliqua* L. and diabetic diseases such as *Anthemis nobilis* L., *Euphorbia resinifera* Berg. These diseases are mainly cured using leaves of the plants cited. The predominant preparation method is decoction.

**Correspondence**

Souad Belhaj1*, Jamila Dahmani2, Nadia Belahbib2, Lahcen Zidane1

1Department of Biology, UFR: Biodiversity and Natural Resources Laboratory, IbnTofail University, PB 133, 14000, Kenitra Faculty of Science, Morocco
2Department of Biology, Botanical, Biotechnology and Plant Protection Laboratory, IbnTofail University, PB 13314000, Kenitra Faculty of Science, Morocco

*Corresponding Author: souadbelhaj2050@gmail.com

Conclusions: This study showed that indigenous people in the High Atlas Central use the plants recorded for the treatment of various diseases. This wealth of plants for therapeutic uses is accompanied by knowledge and practices in phytotherapy acquired by the inhabitants of the High Atlas Central over the centuries. This study keeps a transcribed
trace of phytotherapy practices. The achieved results are a precious source of ethnomedicinal knowledge that allows the shifting of the researches towards phytochemistry and pharmacology.

Key words: Ethnomedicinal, Therapeutic uses, Medicinal plants, Biodiversity.

The High Atlas central of Morocco offers a bioclimatic variety, and a distinctly unique geography which is characterized by an altitude gradient (plain, piedmont and mountains) that permits the installation of a rich flora. Despite the richness in plant biodiversity, data about the plants of this region is scarce and fragmentary (El Alami & Chait 2017, El Alami et al. 2016). Ethnobotany and ethnopharmacology examine indigenous people's knowledge of the use of plants manage or cure diseases. Therefore it is important to keep up a written record of all phytotherapy practices, whose transmission to future generations, hitherto, is based on oral tradition. We present the results of the floristic study, ethnopharmacological and ethnomedical of medicinal plants used by local populations, as well as the study of the therapeutic diversity, the methods of preparation and use of plants, this work also records the list of all diseases treated.

Materials and Methods

Study area
Due to geographical position and its climate, the High Atlas Central of Morocco offers a tremendous ecological and floristic diversity. In addition, the indigenous population of the region has wide traditional phytotherapeutic knowledge. The study was conducted in the center of the atlas chain of Azilal North, Ouarzazate, and Tinghir South, in the High Central (Fig 1).

The communes of Tannant, Wawla, Aït Tamili, Aït Majden, Aït M'hamed, Zaouiat Ahansal, Tabant, Aït abbas, Aït blal, Sidi-boulkhalef, Tifni, Tildi-Fetouakka, Ouzoud, Aït Bou Oulli, belonging to the city of Azilal which is geographically located in the center of the Kingdom and belongs to the economic region of Beni Mellal-Khenifra, which was born from the 2015 regional division of the three former regions: Meknes-Tafilela, Chaouia-Ouardigha and Tadla-Azilal (Official Gazette, 2015). It covers an area of about 1 million hectares, all mountainous, with the exception of a tiny part of the Tadla plain.

Administratively, the Beni Mellal-Khenifra region comprises five provinces: Azilal, Beni Mellal, Fquih Ben Salah, Khenifra and Khouribga, 135 communes including 16 municipalities and 119 rural Communes (HCP, 2018).
Figure 1: Map situation of the study area: High Central Atlas (Realized by Belhaj according to the administrative division of 2015, Arcgis 10.3)

About 80% of the surface area of the Province is located at an altitude of more than 1000 m and 60% above 1500 m (Taibi et al. 1995).

The climate is generally Mediterranean and spreads over the four seasons. It is characterized by abundant rainfall during winter and spring and a very severe summer drought (Sauvage & Vindt 1952, Ouchbani & Romane 1995).

Geologically, the area of the province extends over nearly one million hectares and covers a large part of the high limestone Atlas of the secondary age (Pique 1994). Its population is 2520776 inhabitants, of which 1282037 are rural populations according to the national census of the population 2014 (HCP, 2018), which explains the high illiteracy rate, which is 52%. The main plant formations in the area are as follows: The Holm oaks, which occupy an area of 205,000 Ha or 57.59% of total forest area of the province followed by Junipers with 18.15%, while Maritime Pine is only represented by 0.29% and secondary species by 10.46%, although planted forests occupy 9149 ha or 2.61%.

In the southern slope, this work was carried out in the provinces of Tinghir, Ouarzazate belonging to the Draa-Tafilalet region, which was established like the 11 other regions of the Kingdom, in accordance with Decree of 20 February, 2015, and published in Official Bulletin No: 6340 of 05 March, 2015 (Bulletin officiel, 2015). It covers an area of 88,836 km: With a total area of 1,112,460 ha, the province of Ouarzazate is bordered to the north by the province of Azilal and Marrakech, to the east by the province of Tinghir, to the south by the province of Tata and Zagora and to the west by the province of Taroudant. It belongs to the arid bioclimatic zone with a continental tendency; the soils of this zone are 75% clayey-silt soils, with little evolution of alluvial inputs at 20% and skeletal inputs at 5 % (HCP, 2018).

Special crops in the province occupy small areas but still provide a substantial income for producer. This includes saffron, which occupies 85 hectares with an average annual production of 215 Kg (HCP, 2018).
-With a total area of 908,960 ha, Tinghir province is bordered to the north by the province of Azilal, to the east by the province of Errachidia, to the south and west by the province of Ouarzazate, it includes 2 circles, namely Tinghir, and Boumalne, 3 municipalities (Tinghir, Kelaa Mgouna and Boumalne Dadés) and 17 rural commons. It belongs to the arid bioclimatic stage with a continental tendency. The Total population of the province of Tinghir is 229666 inhabitants of whom 168,084 (73.19%) are rural. The soils of the two sub-basins, Todgha and Dades-Mgoun, are in most cases alluvial, undeveloped, deep, silty-sandy and sandy. These soils are 75% iso humic, 20% alluvial and 5% skeletal (HCP, 2018). Special crops in the province occupy small areas but still provide a substantial income to producers, particularly perfume roses, which have produced an average of 2743 tons over the past five years (HCP, 2018).

Data collection tools and procedures
Two surveys (ethnopharmacological and floristic) were carried out in the study area using semi-structured questionnaires, personal interviews and focus group discussion following the method of Martin (2004).

The field surveys were conducted between 2015 and 2017, by using 1192 questionnaires (Appendix A) administered to 824 residents and sellers of medicinal plants (herbalists and druggists) in the high central atlas of Morocco, the herbalists are a credible source of information, because they have a long expertise regarding the flora and fauna which helps gathering more information on these plants and how they are used. Field trips were also made to observe and collect the plant species, together with information about the vernacular names of the medicinal plants used in the area, types of treated diseases, parts of the plant used, methods of preparation and administration. Standard method was followed with regard to collection of plant materials, drying, mounting, preparation and preservation of plant specimens (Jain 1964). The taxonomic identification of these plants was done in the field and at the Laboratory of Biodiversity and Natural Resources (LBNR) Faculty of Science, Ibn Tofail University, and using available herbaria, directories and flora (Emberger & Maire, Y ear, Fennane et al. 1999, Fennane & Ibn Tattou 2005, Quezel & Santa 1962, 1963, Sauvage & Vindt1952). The identified plants were deposited in herbaria and reserved in our laboratory (LBNR).

Data analysis
The results obtained were analyzed using the descriptive and quantitative statistical method to compare the means between interviewed groups (ANOVA test and Student T test, The test is significant when (P ≤ 0.05); using the level of fidelity (FL), Frequency (F), Relative Citation Frequency (RFC) and Family Importance Value (FIV). All statistical analyses were performed using SPSS (version 21) and Microsoft Excel Package 2010.

Fidelity Level (FL)
Fidelity level (FL) index is used to indicate the plant species more ideal for the treatment of specific ailment (Musa et al. 2011). The FL index was calculated using the formula of Friedman et al. (1986): FL (%) = Np / N x 100. Where Np is the number of informants that claim a use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Relative Frequency of Citation (RFC) and Frequency (F)
Relative frequency of citation (RFC) is a quantitative method that demonstrates the relative importance of plant species known locally, was also evaluated according to the formula of Vitalini et al. (2013) and Vijayakumar et al. (2015): RFC = F / N with (0 < RFC < 1). Where F is the number of informants reporting use of a particular species and N is the total number of the informants.

The Family Importance Value (FIV)
FIV values show the importance of the plant families. It was calculated by using formula of Molares and Ladio, (2009): FIV = FCfamily / Ns. Where FCfamily = is number of families cited by informants and Ns is the total number of informants.

Results and Discussion
Socio-demographic characteristic of the participants
A total of 824 informants, including 427 women and 397 men, were interviewed at the High Atlas Centre in Morocco. Both sexes have a long history of using medicinal plants, but women (51.82%) have more knowledge about plant species and their medicinal uses than men (48.17%). There was no significant difference between the two sexes. (The Student's T test) (P = 0.375) (Table 1). This result can be explained by the attachment of women to the traditional component as well as by the ease of transmission of this information between them, and they are concerned with the treatment of themselves and their families. These results are in agreement with those reported in other regions of Morocco (El alami et al. 2017, Idm’hand et al. 2019, Ziyyat et al. 1997). (Table 1)

On marital status, 65.05% were married, 17.23% were single, 11.65% were widowed and 6.06% were widowed.
divorced. These results can be explained by the fact that married people take care of their health and that of their children, especially in rural areas, in order to minimize the material expenses of the doctor and the pharmacist, the difference between families status was statistically significant (P = 0.000). Other ethnobotanical works have been done in this regard (Benlamdini et al. 2014, El Yahyaoui et al. 2015). (Table 1)

48.42% of the participants were over 60 years old, while 24.51% were between 40 to 60 years old and 20.27% are aged 20 to 40 years old, however, among the informants the youth showed least interest for using the medicinal plants, they stay come in last position with only 6.79%. The difference between age groups and native informations was significant (P = 0.000). The accumulated experience with age is the main source of information locally for use of plants in traditional medicine, but we also noted a loss of medicinal plants information, especially the young people, who have tendency to no longer believe too much in this medicine traditional. This explains that the transmission of this information is currently in danger being it is not always ensured (Anyinam 1995). The results of our research are in conformity with precedent ethnobotanical works that were made in morocco (El hilah et al. 2015, Mehdioui et al. 2007, Tahri et al. 2012). (Table 1)

The majority (51.57%) of the participants were illiterate (29.97%) with a primary level (12.5%) have a secondary level, while those in university education rarely use medicinal plants (5.94%). As well, there is a significant difference among educational level and indigenous knowledge (P = 0.000). These results showed that the more the education level increases, the use of medicinal plants decreases, several studies confirm this result (Bouzid et al. 2017, Laadim et al. 2017, Rhatta et al. 2016). (Table 1)

In our study, it was found that the highest number of interviewees (54.85%) had a low socio-economic level, while (25.97%) were unemployed, 15.41% had an average level, and only 3.76% had a slightly higher level. there is a significant difference among income/month and indigenous knowledge (P =0.000), and this can be explained by the relative frequency of illiteracy in our study area, as well as the high cost of drugs and the average to low job performance of most respondents in this area. These values are in agreement with those reported in other regions of Morocco (Chaachouay et al. 2019, Douiri et al. 2007). (Table 1).

Table 1. Demographic profile of informants interviewed

| Variables      | Categories | Total | Percentages (%) | P-values |
|----------------|------------|-------|-----------------|----------|
| Gender         | Female     | 427   | 51.82           | 0.375    |
|                | Male       | 397   | 48.17           |          |
| Age groups     | < 20 years | 56    | 6.79            | 0.000    |
|                | 20-40      | 167   | 20.27           |          |
|                | 40-60      | 202   | 24.5            |          |
|                | > 60 years | 399   | 48.42           |          |
| Marital status | Married    | 563   | 65.05           | 0.000    |
|                | Single     | 142   | 17.23           |          |
|                | Divorced   | 50    | 6.06            |          |
|                | Widower    | 96    | 11.65           |          |
| Educational level | Illiterate | 425   | 51.58           | 0.000    |
|                | Primary    | 247   | 29.97           |          |
|                | Secondary  | 103   | 12.5            |          |
|                | University | 49    | 5.94            |          |
| Income/month   | Unemployed | 214   | 25.97           | 0.000    |
|                | 350 - 1500 DH | 452 | 54.85          |
|                | 1500 - 5000 DH | 127 | 15.41          |
|                | > 5000 DH  | 31    | 3.76            |          |

Floristic Analysis
Diversity of Medicinal plant species in the study area
At the end of the survey, 248 species were identified. These medicinal species belong to 203 genera and 70 botanical families, of which only one family (Equisetaceae) belongs to the Pteridophyta besides three of Gymnosperms, namely Cupressaceae with four species, Pinaceae with two species, and Taxaceae with only one species. The 240 remaining species are part of the Angiosperm branching with a clear dominance of the Dicotyledonous species (217 species) on the monocotyledons (23 species) (Table 2).
| Family          | Scientific name                  | Voucher number | Common name                  | Vernacular name | Used part | Mode of preparation | Therapeutic uses                 | FL  | FC  | RFC  | FIV  |
|-----------------|----------------------------------|----------------|------------------------------|-----------------|-----------|---------------------|----------------------------------|-----|-----|------|------|
| Aizoaceae       | *Carpobrotus edulis* (L.) N. E.Br | (LBNR1)        | Griffe de sorcier           | Charbabbou      | Leaves    | Friction            | Anti-eczema                      | 100 | 32  | 0.038| 0.038|
| Amaranthaceae   | *Beta vulgaris* L.               | (LBNR2)        | Betterave sucrière           | Chemandar       | Seeds     | Powder              | Against weight loss (with honey). | 86  | 56  | 0.067| 0.11 |
|                 | *Chenopodium Ambrosioides* L.    | (LBNR3)        | Anserine                     | Mkhinza         | Green part of the plant | Infusion Maceration | Antimigraine. Stomachic. | 100 | 146 | 0.177|
|                 | *Spinacia oleracea* L.           | (LBNR4)        | Epinard                      | Sabanikh        | Aerial part of the plant | Cooked                        | Stomachic | 91.5 | 71  | 0.086|
| Amaryllidaceae  | *Allium cepa* L.                | (LBNR5)        | Oignon                       | Lbassala/ Azalim | The whole of Onion | Poultice                    | Ear-pain. Anti-ulcer. Hair care. Dermatological affections Antidiabetic. | 96.2 | 85  | 0.103| 0.149|
|                 | *Allium sativum* L.              | (LBNR6)        | Ail                          | Touma/ Tishert  | Bulbs     | Suppository         | Anti-hemoroid. Antidiabetic. Lowers blood-pressure. Decrease respiratory affections. Tooth ache. Hair care. | 87.4 | 161 | 0.195|
| Anacardiaceae   | *Pistacia atlantica* Desf.       | (LBNR7)        | Pistachier de l’Atlas        | Lbtam.          | Leaves    | Decoction           | Calming ventral. Stomachic. Heals kidney diseases. Antiseptic | 80.16 | 103 | 0.125| 0.125|
|                 | *Pistacia lentiscus* L.          | (LBNR8)        | Drou                         | Lentisque       | Leaves    | Decoction Infusion Poultice | Anti-ulcer. Lowers blood-pressure Antidiabetic. Anti-diarrhea. Pressure tooth ache and gum. Anti-migraine | 53.4 | 122 | 0.148|
| LBNR | Plant Name                        | Common Name | Part Used | Method | Use                                                                 | Gastro-intestinal Disorders | Anti-Diarrhea | Other Uses                                                                 |
|------|----------------------------------|-------------|-----------|--------|----------------------------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------------------|
| 9    | Rhus pentaphylla (Jacq.) Desf.   | Sumac vernis | Leaves   | Decoction | Gastro-intestinal disorders. Anti-diarrhea.                         | 100                         | 86            | 0.104                                                                      |
| 10   | Ammi majus L.                    | Ammi commun | Seeds     | Maceration | Bucco infections. Emollient. Against intestinal pains.            | 89.6                        | 131           | 0.158                                                                      |
| 11   | Ammi visnaga (L.) Lam.           | Ammi visnaga | Seeds     | Decoction | Antidiabetic.                                                       | 100                         | 62            | 0.075                                                                      |
| 12   | Ammodaucus leucotrichus Coss & Dur. | Cumin Laineux | Fruits | Infusion | Stomachic. Calming belly pain (mixed with thymus satureioides).    | 69.2                        | 136           | 0.165                                                                      |
| 13   | Anethum graveolens L.            | Aneth       | Seeds     | Decoction | Stomachic. Diuretic.                                               | 83.8                        | 68            | 0.082                                                                      |
| 14   | Angelica Archangelica L.         | Angélique   | Stems     | Infusion  | Treat the intestinal spasms. Stomachic. Sedative.                  | 81.8                        | 99            | 0.120                                                                      |
| 15   | Apium graveolens L.              | Céleri      | Leaves    | Decoction | Diuretic. Antirheumatic.                                           | 95.2                        | 76            | 0.092                                                                      |
| 16   | Anethum graveolens L.            | Aneth       | Flowers   | Decoction | Calming stomach ache.                                              | 100                         | 88            | 0.106                                                                      |
| 17   | Carum carvi L.                   | Carvi       | Seeds     | Infusion  | Antidiabetic. Antirheumatic. Carminative                           | 84.09                       | 122           | 0.148                                                                      |
| 18   | Coriandrum sativum L.            | Coriandre    | Seeds     | Infusion  | Stomachic. Antidiabetic. Anti-diarrhea. Diuretic. Antirheumatic.    | 93.8                        | 95            | 0.115                                                                      |
| 19   | Daucus carota L.                 | Carotte     | Whole plant | Juice   | Calms intestinal and urinary inflammations. Stimulates the blood circulation | 94                          | 61            | 0.074                                                                      |
| 20   | Eryngium ilicifolium Lamk.       | Panicaut    | Whole plant | Powder  | Heals angina (mixed with honey)                                   | 100                         | 54            | 0.065                                                                      |
| Plant Name                        | Part Used      | Uses                                                                 | Code  | Code 2 | Code 3 |
|----------------------------------|----------------|----------------------------------------------------------------------|-------|--------|--------|
| *Foeniculum vulgare* Mill.       | Whole plant    | Aperitif. Laxative. Antidiabetic. Antiseptic. Antirheumatic. Diuretic. Against bowel pains. | 86.3  | 92     | 0.111  |
| *Ferula communis* L.             | Fruits         | Cooked Im[proves blood circulation.                             | 100   | 38     | 0.046  |
| *Petroselinum sativum* Hoffman.  | Leafy stems    | Soothes the urinary pains. Against kidney stones. Emenagenogue    | 85.8  | 116    | 0.140  |
| *Pimpinella anisum* L.           | Seeds          | Decoction Sedative. Antidiabetic.                                  | 91.1  | 102    | 0.123  |
| *Ridolfia segetum* Moris         | Seeds          | Decoction Powder Stomachic Antidiabetic.                           | 94.4  | 71     | 0.086  |
| *Smyrnium Olusatrum* L.          | Young shoots   | Cooked Powder Emmenagouge. Soothes and stops asthma attacks. Heals wounds. | 86.7  | 67     | 0.081  |
| *Thapsia garganica* L.           | Leaves, Roots  | Poultice Antirheumatic (with honey). Heals the hair.              | 89    | 119    | 0.144  |
| **Apocynaceae**                  |                |                                                                      |       |        |        |
| *Caralluma europaea* (Guss.) N.E.Br. |Snowshoe s  | Decoction Juice Powder Antidiabetic. Aperitif. Against cough and asthma Treats cysts of the genital tract (associated with honey) | 68.7  | 112    | 0.135  |
| *Nerium oleander* L.             | Leafy stems    | Infusion Poultice Fumigation Others Reduce dandruff. Treat eczema especially feet. Treat leprosy Antidiabetic | 96.9  | 72     | 0.087  |
| Family            | Species                          | Common Name                        | Part(s) | Preparation | Use(s)                                                                 | Code | Rating | Null  | Null  |
|-------------------|----------------------------------|------------------------------------|---------|-------------|----------------------------------------------------------------------|------|--------|-------|-------|
| Araliaceae        | *Hedera helix* L.                | Lierre rampant                      | Leaves  | Infusion    | Respiratory tract treatment. Anti cellulite. Antirheumatic. Antiulcer. Against toothache and ears. | 64   | 79     | 0.095 | 0.095 |
| Arecales          | *Chamaerops humilis* L.          | Palmier nain                        | Roots   | Cooked Raw  | Anti-diabetic. Stomachic.                                              | 89   | 48     | 0.068 | 0.061 |
|                   | *Phoenix dactylifera* L.         | Palmier dattier                     | Fruits  | Decoction   | Anti-diarrhea. Anti-diabetic. Lowers blood-pressure Stomachic.       | 82.6 | 54     | 0.065 | 0.037 |
| Aristolochiaceae  | *Aristolochia baetica* L.        | Aristoloche climatite               | Leafy   | Infusion Poultice | Stomachic. Antiseptic. Against bronchial inflammation for children. | 74.8 | 31     | 0.037 | 0.037 |
| Asparagaceae      | *Agave americana* L.             | Agave                              | Leaves  | Poultice Cream | Antirheumatic. Softens the hair. Heal syphilis (with honey).       | 96.2 | 32     | 0.038 | 0.05  |
|                   | *Asparagus albus* L.             | Asperge à tiges blanches            | Stems   | Decoction   | Against diseases of the kidneys. Antirheumatic. Diuretic.        | 46   | 69     | 0.083 |       |
|                   | *Drimia maritima* (L.) Stearn    | Scille maritime                     | Bulbs   | Grinding    | Heals eye pain.                                                     | 92.6 | 25     | 0.03  |       |
| Asteraceae        | *Achillea millefolium* L.        | Achillée millefeuille               | Aerial  | Infusion Poultice | Aperitif. Stomachic. Emmenagogue. Lowers blood-pressure. | 58.4 | 67     | 0.081 |       |
|                   | *Achillea Lipiophylla* M.Bieb.   | Achille                            | Leaves  | Decoction   | Antidiabetic. Stomachic.                                            | 98.2 | 81     | 0.098 |       |
|                   | *Achillea Santolinoides* L.      | Achille                            | Capitulum | Infusion   | Antidiabetic. Stomachic.                                            | 100  | 43     | 0.052 |       |
|                   | *Anacyclus pyrethrum* (L.) Link  | Pyrèthére d’afrique.               | Whole   | Decoction   | Treat the toothaches.                                                | 89   | 63     | 0.076 |       |
| Species                                      | Active Ingredient | Part Used           | Preparation | Main Uses                                                                 |
|----------------------------------------------|-------------------|---------------------|-------------|---------------------------------------------------------------------------|
| **Anthemis nobilis L.**                      | Camomille         | Flowers             | Infusion    | Antidiabetic. Against intestinal worms                                      |
| **Antennaria dioica (L.) Gaertn.**           | Pied de chat      | Leaves              | Poultice    | Antidiabetic. Against cough and pulmonary catarrh.                        |
| **Artemisia absinthium L.**                  | Absinthe          | Aerial parts        | Poultice    | Antiseptic. Anti-diabetic.                                                |
| **Artemisia campestris L.**                  | Armoise           | Aerial parts        | Decoction   | Antirheumatic. Against genitourinary diseases. Antidiabetic.              |
| **Artemisia Mesatlantica Maire**             | Armoise De montagne | Aerial parts        | Decoction   | Antidiabetic. Antispasmodic                                                |
| **Artemisia herba alba Asso.**               | Armoise blanc     | Roots               | Decoction   | Against intestinal worms. Stomachic. Anti-diabetic. Soothes the urinary pains. |
| **Atractylis gummifera (L.) Less.**          | Chardon a glu     | Roots               | Powder      | Astringent. Softens the hair. Facilitates delivery. Treats acne, and abscesses. |
| **Calendula arvensis L.**                    | Souci des champs  | Flowers             | Infusion    | Stomachic. Against eye fatigue. Heals inflammation of the gums.           |
| **Calendula Scariosus (Ball) oberpr and vogt**| Ormenis scariosa  | Leaves              | Raw Compress| Antulcer. Antiseptic. Against eye infections. Heals the healing of wounds. |

**Notes:**
- LBNR41: 0.097
- LBNR42: 0.058
- LBNR43: 0.111
- LBNR44: 0.091
- LBNR45: 0.123
- LBNR46: 0.165
- LBNR47: 0.108
- LBNR48: 0.065
- LBNR49: 0.095
| **Carthamus lanatus L.** | (LBNR50) | Nabta dihanna Flower heads Stems. | Powder | Hair care. (With olive oil). Fight the aging of the skin (with honey). | 98.2 | 53 | 0.064 |
| **Centauraea maroccana Ball.** | (LBNR51) | Tafgha Roots Powder | Analgesic. Stomachic. | 94.1 | 65 | 0.075 |
| **Chrysanthemum coronarium L.** | (LBNR52) | Hmessaou Flowers Decoction Infusion | Hepatic insufficiency treatment. Hypotensive Antidiabetic. | 82.5 | 47 | 0.057 |
| **Cladanthus arabicus L.** | (LBNR53) | Tafse Aerial parts Infusion | Soothes the urinary ailments. Antidiabetic. | 93.8 | 62 | 0.075 |
| **Cynara cardunculus L.** | (LBNR54) | Khorchof/taggua Capitulum Leaves Roots Raw Decoction Powder | Stomachic. Treats liver and gall bladder disorders. Antidiabetic. | 85.5 | 86 | 0.104 |
| **Cynara humilis L.** | (LBNR55) | Tagemmit Taymant Roots Decoction Powder | Antidiabetic. Heals burns. | 89.2 | 126 | 0.152 |
| **Echinops spinosus L.** | (LBNR56) | Tasekra Roots Decoction Infusion Fumigation | Stomachic. Soothes the urinary ailments. Against infection of the respiratory system. Facilitates delivery. | 78.4 | 99 | 0.120 |
| **Dittrichia viscosa (L.) Greuter** | (LBNR57) | Terhla Leaves Flower heads Roots Stems Poultice Decoction Infusion | Antiseptic. Anti-rheumatic. Soothes the urinary ailments. Emmenagogue. Antidiabetic. | 74 | 87 | 0.105 |
| **Inula viscosa L.** | (LBNR58) | Terhla The root Stems Decoction Infusion | Heals lung infections Promotes digestion Appetite stimulant Antidiabetic. | 67.4 | 129 | 0.156 |
| **Launaea mucronata (Forsk.) Muschl.** | (LBNR59) | Intrim Aerial parts Decoction | Laxative. Stomachic. | 95.2 | 61 | 0.074 |
| **Berbéridaceae** | **Boraginaceae** | **Brassicaceae** |
|------------------|-----------------|----------------|
| *Mantisalca salmantica* (L.) Briq. & Cavill. | *Matricaria chamomilla* L. | *Brassica oleracea* L. |
| (LBNR60) | (LBNR61) | (LBNR70) |
| Centaurée de Salamanque | La camomille | Chou commun |
| Thazmourh | Lbabounj | Mkwwar |
| Leaves | Rounded flowers | Fresh leaves |
| Infusion | Decoction | Poultice |
| Reduces gastrointestinal disorders. | Against the pain of the rules. Antidiabetic. Heals bowel pains in infants. | Antidiabetic. Antulcer. |
| 100 | 74.8 | 82.4 |
| | 113 | 27 |
| | 0.137 | 0.032 |
| | | 0.056 |
| | | 0.063 |
| *Onopordum acaulon* L. | *Pallenis spinosa* (L.) Cass. | *Brassica rapa* L. |
| (LBNR62) | (LBNR63) | (LBNR71) |
| Onopordon à feuilles d'acanthe | Pallénis épineux | Navet |
| Addad | Aerial parts | Roots |
| Roots | Decoction | Syrup |
| Decoction | Antianemic. Aperitif. | Cooked |
| Antianemic. Aperitif. | Against the pain of the rules. Antidiabetic. Heals bowel pains in infants. | Antidiabetic. (With the leaves of Brassica oleracea). |
| 92.6 | 86.9 | 87.3 |
| 93 | 131 | 71 |
| 0.112 | 0.158 | 0.082 |
| | | 0.063 |
| | | 0.056 |
| *Picris coronopifolia* (Desf.) DC. | *Scolymus hispanicus* L. | *Sonchus oleraceus* L. |
| (LBNR64) | (LBNR65) | (LBNR66) |
| Picride | Scolyme d'Espagne | laiteron maratcher |
| Lhaydwan | Taghdut | Tifaf |
| Whole plant | Roots Young shoots | Leaves |
| Decoction | Decoction | Decoction |
| Stomachic | Antidiabetic. Antulcer. | Antidiabetic. |
| 100 | 93.8 | 100 |
| 88 | 102 | 75 |
| 0.106 | 0.123 | 0.091 |
| | | 0.049 |
| *Pallenis spinosa* (L.) Cass. | *Berberis hispanica* Boiss & Reut | *Echium plantagineum* L. |
| (LBNR67) | (LBNR68) | (LBNR69) |
| Les berbéris | La bourrache | Vipérine annuelle |
| Argis/ izzirki | Lsan al ard | Awnnass |
| Leaves Fruits | Whole plant | Seeds |
| Infusion Decoction | Raw Poultice | Powder |
| Heal gastrointestinal and hepatic atony. Antidepressant Antidiabetic. | Antirheumatic. Calm rashes. | Against snake bites. (with honey) |
| 75.5 | 81 | 100 |
| 41 | 52 | 41 |
| 0.049 | 0.063 | 0.049 |
| | | 0.056 |
| *Brassicaceae* | *Brassicaceae* | *Brassicaceae* |
| *Borago officinalis* L. | *Brassica oleracea* L. | *Brassica oleracea* L. |
| (LBNR68) | (LBNR70) | (LBNR71) |
| La bourrache | Chou commun | Navet |
| Lsan al ard | Mkwwar | Left |
| Whole plant | Fresh leaves | Roots |
| Raw Poultice | Poultice Juice | Syrup |
| Antidiabetic. Antulcer. Against the flu. | Antidiabetic. Antulcer. Against the flu. | Heal the flu. Antidiabetic. (With the leaves of Brassica oleracea). |
| 81 | 82.4 | 87.3 |
| 52 | 27 | 71 |
| 0.063 | 0.032 | 0.082 |
| | | 0.063 |
| *Boraginaceae* | *Echium plantagineum* L. | *Brassica oleracea* L. |
| *Brassica rapa* L. | *Berberis hispanica* Boiss & Reut | *Brassica oleracea* L. |
| (LBNR69) | (LBNR67) | (LBNR70) |
| Vipérine annuelle | Les berbéris | Chou commun |
| Awnnass | Argis/ izzirki | Mkwwar |
| Seeds | Leaves Fruits | Fresh leaves |
| Powder | Infusion Decoction | Poultice Juice |
| Against snake bites. (with honey) | Heal gastrointestinal and hepatic atony. Antidepressant Antidiabetic. | Antidiabetic. Antulcer. Against the flu. |
| 100 | 75.5 | 82.4 |
| 41 | 41 | 27 |
| 0.049 | 0.049 | 0.032 |
| | | 0.056 |
| | | 0.063 |
| Plant Family | Species                                      | Description                  | Uses                                                                 | Percentage  |
|-------------|----------------------------------------------|------------------------------|----------------------------------------------------------------------|-------------|
| Brassica    | *Brassica nigra* (L.) W.D.J.Koch              | Moutarde noire Bu-hammou     | Leafy stems seeds Poultice Infusion Antirheumatic. Stomachic.         | 91.2        |
|             | *Capsella bursa pastoris* (L.) Medik         | Capselle bourse Tiffaf       | Leaves Decoction Infusion Hemostatic diuretic                         | 94          |
| Erucaceae   | *Eruca sativa* Miller                        | Roquette Al girjir Fresh plant Seeds Poultice Lotion Juice Powder Disinfects and heals wounds. Promotes hair growth. Diuretic. Antidiabetic. (added to milk Fermented and Lepidium sativum) | 78.1        |
|             | *Lepidium sativum* L.                        | Cresson alénois Hab rchad    | Seeds Decoction Powder Treats cough, asthma, and bronchitis. Effective in cases of infertility. Antidiabetic | 95.6        |
|             | *Nasturtium officinale* R.Br.                | Cresson de fontaine Germûne  | Leafy stems Cooked Prevent anemia Heals infections of the respiratory system. | 83          |
|             | *Raphanus sativus* L.                        | Radis cultivé Lefjel         | Seeds Rhizome Powder Raw Antidiabetic. Stomachic. Heals liver problems. | 96.4        |
|             | *Sisymbrium irio* L.                         | Roquette jaune Sibryan       | Leafy stems seeds Infusion Poultice Soothes the fever of typhoid and smallpox. Against coughing. Facilitates the healing of wounds. | 82.3        |
| Burseraceae | *Boswellia carterii* Birdy                   | Oliban/ encens vrai          | Salabane/ loubane Fruits Decoction Antidiabetic.                      | 100         |
| Buxaceae    | *Buxus sempervirens* L.                      | Buis commun Bakss            | Leaves Infusion Poultice Antiseptic Antirheumatic.                    | 89.7        |
| Cactaceae   | *Opuntia ficus indica* L. (Mll.)             | Figuier de barbarie Handiyya | Fruits Sap of the stems Raw Cream Decoction Soothes gastrointestinal pain Softens the hair. | 52.8        |
| Family          | Genus                  | Species                                      | Uses                                                                 | Preparation       | Antirheumatic. Heals bladder and prostate problems. | Carminative. Antitulcer. Diuretic. Anti-diarrhea. Antidiabetic. Heals infections of the respiratory system. | Antidiabetic. Heals infections of the respiratory system. | Antidiabetic. | Hemostatic. | Antidiabetic. Decrease sleep disorders | Antidiabetic. | Astringent. | Antidiabetic. |
|----------------|------------------------|----------------------------------------------|----------------------------------------------------------------------|-------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------|-------------|----------------------------------------------------------------------------------|---------------|-------------|---------------|
| Capparaceae    | Capparis spinosa L.    | (LBNR82) Cáprier Lkabbar                     | Leaves Roots Seeds Fruits                                            | Powder Decoction Infusion Powder                                 | 74.8 89 0.108 0.108                                                                                                           |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Caprifoliaceae | Sambucus nigra L.      | (LBNR83) Sureau noir Sembouqa                 | Leaves Fruits                                                        | Decoction Infusion Compress                                      | 96.2 22 0.026 0.026                                                                                                           |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Caryophyllaceae| Corrigoila telephifolia Pourret. | (LBNR84) Corrigiole à Feuilles de Téléphium Sarghina | Roots Powder                                                        | Heals infections of the respiratory system                      | 100 65 0.078 0.079                                                                                                           |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Herniaria hirsuta L. | (LBNR85) Hernia. Hernaie. Sarghina | (LBNR85) Herrass lehjar Whole plant Decoction Infusion | Against kidney stones. Reduce bladder stones.                       |                                                                 | 86.5 112 0.135                                                                                                                |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Caryophyllaceae| Paronychia argentea Lam. | (LBNR86) Paronyque Tahidourt Fruits Leaves Decoction | Heals heart disease.                                                 |                                                                 | 97.3 22 0.026                                                                                                                |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Cistaceae      | Cistus creticus L.     | (LBNR87) Ciste de crête Irgle                 | Leafy Stems Powder                                                  | Treat irritation of burns and heal stomachic. Against aging and loosening of the skin | 72.2 143 0.173 0.116                                                                                                           |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Cistus Ladanifer L. | (LBNR88) Ciste ladanifère Touzait | | Seeds Powder Infusion | Antidiabetic. Hemostatic.                                           | 98.5 79 0.095 0.116                                                                                                           |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Cistus Laurifolius L. | (LBNR89) Ciste à feuilles de peuplier Aguilid | | Seeds Powder Decoction | Antidiabetic. Decrease sleep disorders                              | 87.3 67 0.081                                                                                                                |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Convolvulaceae | Convolvulus arvensis L. | (LBNR90) Liseron des champs Lwayya Roots Powder | Astringent.                                                        |                                                                 | 100 85 0.103 0.103                                                                                                           |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Cucurbitaceae  | Bryonia dioica Jacq.   | (LBNR91) Bryone dioique Ineb-eddib Stems Fruits Decoction | Antidiabetic.                                                       |                                                                 | 100 61 0.074                                                                                                                |                                                                                                                  |                |              |                                                                                   |                |              |               |
| Plant Name                  | (LBNR) | Part Used | Preparation | Use                  | Percentage | Quantity | p-value | Antidiabetic |
|----------------------------|--------|-----------|-------------|-----------------------|------------|----------|----------|--------------|
| Citrullus vulgaris (L.) Schard. | (LBNR92) | Leaves | Decoction | Antidiabetic.         | 96         | 48       | 0.058    | 0.083        |
| Cucumis melo L.            | (LBNR93) | Fruits | Raw        | Antidiabetic.         | 93.4       | 26       | 0.031    |              |
| Cucumis sativus L.         | (LBNR94) | Seeds   | Powder     | Antidiabetic.         | 100        | 84       | 0.101    |              |
| Cucurbita maxima L.        | (LBNR95) | Pulp    | Powder     | Calming burns.        | 93.6       | 109      | 0.132    |              |
| Lagenaria siceraria (Molina) Standl. | (LBNR96) | Fruits | Fumigation | Migraine Therapy      | 82         | 86       | 0.104    |              |
| Cupressaceae                |         |          |            |                       |            |          |          |              |
| Juniperus communis L.      | (LBNR97) | Leaves  | Infusion Powder | Relieves stomach    | 86.3       | 26       | 0.031    | 0.032        |
|                           |         |          |            | colic. Against falling hair. |
| Juniperus oxycedrus L.     | (LBNR98) | Stems   | Decoction Infusion Maceration | Stomachic. | 85        | 41       | 0.049    |              |
|                           |         |          |            | Diuretic. Antidiabetic. |
| Juniperus Phoenicea L.     | (LBNR99) | Aerial parts | Maceration Decoction | Antirheumatic. | 94.2      | 19       | 0.023    |              |
|                           |         |          |            | Aperitif.             |
| Tetraclinis articulata (Vahl) Masters | (LBNR100) | Leaves  | Poultice Compress Maceration | Migraine Therapy. | 78.6      | 22       | 0.026    |              |
|                           |         |          |            | Antiseptic. Antirheumatic. \ Calm the pains of decayed teeth. |
| Cyperaceae                 |         |          |            |                       |            |          |          |              |
| Cyperus Longus L.          | (LBNR101) | Roots   | Maceration | Anti-inflammatory \ Dermal use \ Prevention of cardiovascular disorders. | 98.4       | 35       | 0.042    | 0.042        |
| Equisetaceae               |         |          |            |                       |            |          |          |              |
| Equisetum ramosissimum Des | (LBNR102) | Stems   | Decoction | Antidiabetic.         | 100        | 23       | 0.027    | 0.027        |
| Euphorbiaceae              |         |          |            |                       |            |          |          |              |
| Euphorbia echinus Hook.f. & Coss. | (LBNR103) | Stems   | Latex Powder | Treat eczema. Antidiabetic (mix with honey). | 92         | 202      | 0.245    |              |
| Family | Species | Common Name | Uses | Powder Uses | ATC Code | Prototypic Extracts |
|--------|---------|-------------|------|-------------|----------|---------------------|
| **Euphorbia helioscopia L.** | Euphorbe réveille-matin | Leafy stems | Heals burns and some dermal uses at children | | | 0.169 |
| **Euphorbia resinifera Berg** | Euphorbe résinifère | Stems, Fruits, Flowers | Heals venomous stings. Against paralysis (kneaded with flour or semolina and egg white). abortifacient. Antidiabetic. | | | |
| **Arbutus unedo L.** | Arbousier | Bark root, Leaves | Antidiarrheal. Relieves sore throats. Help to sleep. Antidiabetic. | | | 0.149 |
| **Gommer du Maroc** | Leaves, Barks | Heals wounds. Heals measles. | | | | 0.117 |
| **Anagyris foetida L.** | Anagyre fétide | Seeds, Leaves | Aperitif (mix with honey). Antidiabetic. | | | 0.107 |
| **Cassia à feuilles obustes** | Seeds | Antidiabetic. Diuretics. | | | | 0.083 |
| **Caroubier** | Fruits, Leaves | Anti-ulcer. Emetocathartic. Laxative. Antidiabetic. | | | | 0.305 |
| **Pois chiche** | Seeds | Antidiabetic. Stomachic. Diuretic and antispasmodic. | | | | 0.088 |
| **Harcot oléagineux** | Seeds | Antidiabetic. Increase the weight. | | | | 0.122 |
| **Réglisse** | Roots | Against stomach ulcers Antidiabetic. Soothes sore throats | | | | 0.074 |
| Plant Name                  | Common Name       | Species       | Part Used     | Preparation | Uses                                      | 89 | 53 | 0.064 |
|-----------------------------|-------------------|---------------|---------------|-------------|-------------------------------------------|-----|----|--------|
| *Lupinus albus* L.          | Lupin blanc       | *Lupinus albus* L. | Seeds         | Powder      | Antidiabetic                              | 89.3| 53 | 0.064 |
| *Lupinus luteus* L.         | Lupin sauvage     | *Lupinus luteus* L. | Seeds         | Decoction   | Antidiabetic. Emmenagogue                 | 94.2| 71 | 0.086 |
| *Medicago sativa* L.        | Luzerne           | *Medicago sativa* L. | Leaves       | Decoction   | Antidiabetic. Reduces cholesterol levels. | 73.5| 152| 0.184 |
| *Ononis spinosa* L.         | Arrête-bœuf       | *Ononis spinosa* L. | Whole plant   | Decoction   | Antidiabetic. Heals diseases of the bladder. | 87.3| 135| 0.163 |
| *Phaseolus vulgaris* L.     | Haricot Vert      | *Phaseolus vulgaris* L. | Gousse       | Raw         | Antidiabetic                              | 100 | 31 | 0.037 |
| *Retama monosperma* (L.) Boiss | Rétam blanc    | *Retama monosperma* (L.) Boiss | Stems, Roots, Leaves | Infusion, Decoction | Antidiabetic. Heals diseases of the gums. Anti-anemic. | 92.6| 69 | 0.083 |
| *Trifolium pratense* L.     | Trèfle rouge      | *Trifolium pratense* L. | Flower heads | Infusion, Poultice | Diuretic. Antispasmodic. Calms the itchy skin. Care of dermatitis and eczema. | 78.3| 84 | 0.101 |
| *Trigonella foenum-graecum* L. | Fenugrec        | *Trigonella foenum-graecum* L. | Seeds        | Maceration | Aperitif. Anti-anemic. Production of breast milk. Reduces gastrointestinal disorders. Antidiabetic. | 83.6| 231| 0.28  |
| *Vicia faba* L.             | Fève              | *Vicia faba* L. | Seeds         | Infusion    | Calms the pains of the kidneys. Heal the face (mix with honey). | 59  | 71 | 0.086 |
| *Quercus rotundifolia* Lam. | Chêne vert        | *Quercus rotundifolia* Lam. | Barks        | Powder      | Antidiabetic. Stomachic (mix with honey). Reduce hemorrhoids. | 92.4| 71 | 0.086 |
| Family            | Genus               | Species                  | Code       | Part(s)           | Preparations | Uses                                                                 | Reference 1 | Reference 2 | Reference 3 | Reference 4 |
|-------------------|---------------------|--------------------------|------------|-------------------|--------------|----------------------------------------------------------------------|--------------|-------------|-------------|-------------|
| Fumariaceae       | Fumaria             | officinalis L.           | (LBNR125)  | Roots             | Decoction    | Antidiabetic. Stomachic. Laxative. Heals skin. Treats eczema. Fight against nausea for pregnant women. | 56.3         | 43          | 0.052       | 0.052       |
|                   |                     | Fumeterre                | Lwarda D'Iard | Fresh plant    | Poultice     |                                                                      |              |             |             |             |
|                   |                     |                          |            | Infusion         |              |                                                                      |              |             |             |             |
| Gentianaceae      | Centaurium          | spicatum (L.) Fritsch    | (LBNR126)  | Whole plant      | Decoction    | Antidiabetic. Anti-hair loss. Treats gastrointestinal disorders. Aperitif. | 67.3         | 38          | 0.046       | 0.046       |
|                   |                     | Petit centaurée           | Gosset Et-hayya | Decoction        | Infusion     |                                                                      |              |             |             |             |
|                   |                     |                          |            | Powder           |              |                                                                      |              |             |             |             |
| Geraniaceae       | Pelargonium         | roseum l'Hér             | (LBNR127)  | Leaves           | Decoction    | Antidiabetic. Treats burns.                                          | 82.5         | 47          | 0.057       | 0.057       |
|                   |                     |                          |            |                  |              |                                                                      |              |             |             |             |
| Iridaceae         | Crocus sativus      | L.                       | (LBNR128)  | Stigmas          | Decoction    | Antidiabetic. Hypotensive. Stomachic. Sedative. Relieves toothaches | 94           | 114         | 0.138       | 0.138       |
|                   |                     |                          |            | Infusion         |              |                                                                      |              |             |             |             |
|                   |                     |                          |            | Massage          |              |                                                                      |              |             |             |             |
| Juglandaceae      | Juglans regia L.    |                           | (LBNR129)  | Barks            | Decoction    | Whiten the teeth. Antidiabetic. Heals scars and wounds.              | 86.2         | 82          | 0.099       | 0.099       |
|                   |                     |                          |            | Leaves           | Powder       |                                                                      |              |             |             |             |
| Lamiaceae         | Ajuga iva (L.)      | Schreb.                  | (LBNR130)  | Aerial parts     | Decoction    | Antidiabetic. Heals dental diseases. Antidiarrheal.                  | 92.8         | 84          | 0.101       |             |
|                   |                     |                          |            | Maceration       | Infusion     |                                                                      |              |             |             |             |
|                   | Calamintha          | officinalis Moench      | (LBNR131)  | Leafy stems      | Decoction    | Antidiabetic. Calm cough and painful spasms of the digestive tract.  | 76           | 118         | 0.143       |             |
|                   | Calamintha          | hirsuta Benth.           | (LBNR132)  | Flower heads     | Infusion     | Antidiabetic. Calm the intestinal pains. Heals the affections of the mouth. | 64.3         | 68          | 0.082       |             |
|                   | Calamintha          |                          |            | Aerial parts     | Poultice     |                                                                      |              |             |             |             |
|                   | Calamintha          |                          |            | Infusion         | Syrup        |                                                                      |              |             |             |             |
| Hyssopaceae       | Hyssopus            | officinalis L.           | (LBNR133)  | Flower heads     | Infusion     | Stomachic. Antiseptic. Sedative.                                     | 54.3         | 62          | 0.075       |             |
|                   |                     |                          |            | Leaves           | Poultice     |                                                                      |              |             |             |             |
| Plant Name                                    | Designation | Common Name                        | Part(s)                  | Uses                                                                 |
|-----------------------------------------------|-------------|------------------------------------|--------------------------|----------------------------------------------------------------------|
| Lamium amplexicaule L.                        | (LBNR134)   | Lamier à feuilles embrassantes     | Aerial parts Infusion Poultice | Anti-diarrhea. Antiseptic.                                            |
| Lavandula dentata L.                          | (LBNR135)   | Lavande à feuilles dentées         | Aerial parts Decoction Poultice Infusion | Antidiabetic. Treat eczema. Stomachic.                               |
| Lavandula maroccana Murb.                     | (LBNR136)   | Lavande marocaine                  | Flowers heads Decoction Infusion | Stomachic. Diuretic.                                                 |
| Lavandula multifida L.                        | (LBNR137)   | Lavande à feuilles divisées        | Flowers heads Decoction Poultice Infusion Others | Migraine Therapy. Sedative. Anti-rheumatic. Fight colds and coughs Heals bladder pain. |
| Lavandula Stoechas L.                         | (LBNR138)   | Lavande papillon                   | Inflorescence Decoction Infusion | Heals the mucous membranes of the respiratory. Anti-inflammatory. Antidiabetic. |
| Marrubium vulgare L.                          | (LBNR139)   | Marrube blanc                      | Whole plant Decoction Maceration Infusion Syrup | Antidiabetic. Hypotensive. Stomachic. Heals the nasal mucosa and sore throat. |
| Melissa officinalis L.                        | (LBNR140)   | Mélisse                            | Leaves Infusion Maceration | Antidiabetic. Against stress and insomnia.                            |
| Mentha pulegium L.                            | (LBNR141)   | Menthe pouliot                     | Aerial parts Decoction Poultice Maceration | Against the flu and cough. Antiseptic. Stomachic.                    |
| Species                        | (LBNR) | Part(s)    | Uses                                                                 | Antidiabetic | Antirheumatic | Antidiabetic | Antid. | Antid. |
|-------------------------------|--------|------------|-----------------------------------------------------------------------|--------------|---------------|--------------|--------|--------|
| Mentha suaveolens Ehrh.       | (LBNR142) | Aerial parts | Poultice, Infusion, Maceration, Decoction | Antirheumatic, Heals ailments of the throat and bronchitis. Against scars. Antidiabetic. | 96.4 | 189 | 0.229 |
| Ocimum basilicum L.            | (LBNR143) | Whole plant | Infusion, Decoction | Hypotensive, Antidiabetic. Decrease the pains of the rules. | 65.5 | 79 | 0.095 |
| Origanum compactum Benth.      | (LBNR144) | Leaves     | Decoction others | Antidiabetic. Antulcer. | 92.6 | 156 | 0.189 |
| Origanum majorana L.           | (LBNR145) | Leaves     | Decoction, Infusion, Gargle | Calm painful rules. Hypotensive. Sedative. Against sores affecting the mouth. | 56.3 | 82 | 0.099 |
| Rosmarinus officinalis L.      | (LBNR146) | Leaves     | Decoction, Infusion, Compress | Antidiabetic. Treat digestive and hepatic disorders. Against respiratory infections. Fight rheumatism and fatigue. | 100 | 74 | 0.089 |
| Salvia officinalis L.          | (LBNR147) | Leaves     | Infusion, Decoction | Antidiabetic. Emmenagogue. Calm sore throats. Hypotensive. | 98 | 102 | 0.123 |
| Salvia verbenaca L.            | (LBNR148) | Leaves     | Infusion | Against respiratory infections. Stomachic. | 88.5 | 81 | 0.098 |
| Teucrium polium L.             | (LBNR149) | Aerial parts | Decoction, Infusion | Antidiabetic. Antidiarrheal. Calm the gastrointestinal disorders. | 72.3 | 171 | 0.207 |
| Thymus broussonetii Boiss.      | (LBNR150) | Leaves     | Infusion, Decoction | Antidiabetic. Against respiratory infections. | 84 | 152 | 0.184 |
| Plant Name                      | Species Name                              | Compendial Name | Part Used | Preparation   | Properties                                                                                      | Code 1 | Code 2 | Code 3  |
|--------------------------------|-------------------------------------------|-----------------|-----------|---------------|-------------------------------------------------------------------------------------------------|--------|--------|---------|
| Thymus maroccansus Ball.       | Thym du Maroc Azuki                       | Leaves          | Maceration | Infusion      | Antidiabetic. Heals the affections of the mouth. Against hair loss (in olive oil). Against respiratory infections. Stomachic. | 89.3   | 128    | 0.155  |
| Thymus satureioides Coss. & Ball. | Thym-sarrayette du Maroc Azukni           | Leaves          | Decoction  | Infusion      | Antidiabetic. Heals bronchopulmonary affections. Antulcer. Antiseptic.                         | 98     | 214    | 0.259  |
| Thymus vulgaris L.             | Thym commun Zaitra                        | Leaves          | Decoction/Infusion | Antidiabetic. |                                                                                                 | 100    | 89     | 0.108  |
| Vitex agnus castus L.          | Arbre à poivre Anguirf                    | Flowers heads   | Infusion   |               | Regularize the menstrual cycle of women.                                                       | 100    | 52     | 0.063  |
| Lauraceae                      | Cinnamomum Cassia blum                    | Barks           | Decoction  | Infusion      | Heals liver diseases. Antidiabetic. Against menstrual pains.                                   | 89.9   | 89     | 0.108  |
| Laurus nobilis L.              | Laurier noble Ourak moussa                | Leaves          | Decoction  | Infusion      | Antidiabetic. Stomachic.                                                                       | 92.5   | 62     | 0.075  |
| Linaceae                       | Linum usitatissimum L.                    | Seeds           | Decoction  | Powder        | Antidiabetic. For weight gain (mixed with honey)                                              | 86.3   | 92     | 0.111  |
| Lythraceae                     | Lawsonia inermis L.                       | Leaves          | Powder     |               | Soften skin (mixed with black soap). Tint the scalp.                                           | 82.4   | 131    | 0.158  |
| Punica granatum L.             | Grenadier Rommane                         | Fruit barks     | Infusion   | Powder        | Heals bladder problems and gastrointestinal pain. (Mixed with fig and oleatral flowers). Antidiabetic. | 68     | 96     | 0.116  |
| Kingdom     | Species                          | Origin                  | Part                  | Preparation | Use                                                                 | % | No.  | p Value   |
|-------------|----------------------------------|-------------------------|-----------------------|-------------|----------------------------------------------------------------------|---|------|-----------|
| Malvaceae   | *Althaea Officinalis* L.          | (LBNR160)               | Guimauve Khatmiya Roots | Decoction   | Softens the hair (mixed with Lawsonia inermis).                       | 87.6 | 68   | 0.082     |
|             |                                  |                         |                       | Maceration  | Antulcer. Heals urinary disorders. Against pharyngeal inflammations. Antidiarrheal. |    |      | 0.076     |
|             |                                  |                         |                       | Infusion    |                                                                      |    |      |           |
|             | *Hibiscus Esculentus* (L.) Moench. | (LBNR161)              | Moench Lmlokiyya Flowers | Decoction   | Antiscorbose Antidiabetic. Treats bronchitis.                         | 82.4 | 52   | 0.063     |
|             |                                  |                         |                       | Infusion Gargle |                                                                      |    |      |           |
|             | *Hibiscus sabdariffa* L.          | (LBNR162)               | Thé rose Karkadil Flowers | Infusion   | Antidiabetic. Anti-inflammatory. Diuretic. Reduce menstrual pain.    | 56.2 | 71   | 0.086     |
|             |                                  |                         |                       | Decoction   |                                                                      |    |      |           |
|             | *Malva parviflora* L.            | (LBNR163)               | Mauve à petites fleurs Amzgra Aerial parts | Cooked Maceration | Laxative. Antianemic.                                                 | 96.6 | 63   | 0.076     |
|             |                                  |                         |                       |             |                                                                      |    |      |           |
| Moraceae    | *Ficus carica* L.                | (LBNR164)               | Figuier Karmouss Leaves | Maceration Evaporation | Antidiabetic. Treat cough, bronchitis and hypotensive (mixed with evaporated garlic and olive oil). | 89  | 116  | 0.140     |
|             |                                  |                         |                       |             |                                                                      |    |      | 0.140     |
| Myrtaceae   | *Eucalyptus globulus* Labill.     | (LBNR165)               | Eucalyptus Barks Leaves | Decoction Poultice Infusion | Antidiabetic. Treats coughs, flu and colds. Antiseptic.              | 84.2 | 286  | 0.347     |
|             |                                  |                         |                       |             |                                                                      |    |      |           |
|             | *Eugenia caryophyllata* Thunb     | (LBNR166)               | Girollier Qronfel Cloves | Decoction Maceration Infusion | Antidiabetic. Heals gum disease (associated with lavandula officinalis and juglans regia). Soothes the pain of the rules. | 69  | 146  | 0.177     |
|             |                                  |                         |                       |             |                                                                      |    |      | 0.165     |
|             | *Myrtus communis* L.             | (LBNR167)               | Myrite Rayhane Flowers | Decoction Maceration Infusion | Antidiabetic. Fight against dandruff and gives shine to the hair.    | 47.3 | 62   | 0.075     |
| Family            | Species                                | Common Name     | Part(s)       | Preparation | Uses                                      |
|-------------------|----------------------------------------|-----------------|---------------|-------------|-------------------------------------------|
| **Jasminum fruticans L.** (LBNR168) | Jasmin jaune                        | Yasmin          | Leaves, Flowers | Maceration, Infusion | Antidiabetic, Relieves intestinal cramps, Hypotensive, Heals cough, and flu. |
| **Peganum harmala L.** (LBNR169)   | Harmel                                | L-harmel        | Seeds         | Poultice, Fumigation, Infusion | Antirheumatic, Migraine therapy, Antidiabetic, Hypotensive. |
| **Oleaceae**      | *Fraxinus angustifolia* Vahl (LBNR170) | Frêne oxyphylle | Dillam, Bark of the twigs | Infusion, Maceration | Against urinary infections, Antirheumatic. |
| **Jasminum fruticans L.** (LBNR171) | Jasmin jaune                        | Yasmin          | Leaves, Flowers | Maceration, Infusion | Antiseptic, Relieves cramps, Hypotensive, Sedative. |
| **Olea europaea L.** (LBNR172)     | Olivier                              | Zaytoun          | Fruits, Leaves | Raw Decoction, Others | Antidiabetic, Against oral inflammation, Treat otitis. |
| **Olea oleaster** Hoffm. & Link. (LBNR173) | Oléaste sauvage                   | Jabouj           | Leaves         | Infusion, Decoction | Hypotensive, Antidiabetic. |
| **Paeoniaceae**   | *Paeonia corallina* Retz (LBNR174)    | Pivoine coralline | Flowers       | Infusion | Against coughing, Sedative. |
| **Papaveraceae**  | *Fumaria officinalis* L. (LBNR175)    | Fumeterre       | Roots, Fresh plant | Decoction, Poultice, Infusion | Antidiabetic, Stomachic, Laxative, Heals eczema, Fight against nausea for pregnant women. |
| **Papaver rhoes L.** (LBNR176)    | Pavot hybride                        | Belnaaman        | Seeds, Flowers | Decoction, Powder Infusion | Against dry cough, Calm stomach ache, Eliminate fatigue, Calm sore throat and cough in children. |
| **Pedaliaceae**   | *Sesamum indicum* L. (LBNR177)        | Sésame           | Seeds          | Decoction, Infusion Powder | Antidiabetic, Diuretics. |
| Family            | Genus                     | Species                     | Part(s)        | Preparation | Uses                                                                 | Uses Notes                                                                 |
|-------------------|---------------------------|-----------------------------|----------------|-------------|----------------------------------------------------------------------|----------------------------------------------------------------------------|
| Pinaceae          | Cedrus Atlantica          | Manetti ex (Endl.)          | Arz Barks      | Decoction   | Fights flu, coughs and bronchitis.                                    | Heals urinary tract infections.                                            |
|                   |                           | (LBNR178)                   |                | Infusion    | Sedative.                                                              | Against hair loss (in olive oil).                                         |
|                   |                           | Cèdre de l’Atlas            |                | Maceration  |                                                                      |                                                                            |
|                   |                           | Cèdre de l’Atlas            |                | Powder      |                                                                      |                                                                            |
|                   | Pinus halepensis Mill.    | Pin d’Alep                  | Snaoibar-Tayda | Leaves      | Infusion Powder                                                       | Soothes catarrhal affections of the respiratory system. Heals burns of the skin (with clarified butter). |
|                   |                           | (LBNR179)                   |                | Barks       |                                                                      |                                                                            |
| Plantaginaceae    | Globularia alypum L.      | Globulaire buissonnante      | Taslgha Flower heads | Decoction   | Antidiabetic. Antulcer                                                |                                                                            |
|                   |                           | (LBNR180)                   |                | Infusion    |                                                                      |                                                                            |
|                   | Plantago major L.         | Grand plantain              | Lmassas Whole plant | Poultice    | Heal eczema. Against asthma and eliminates bronchial mucous membranes. Promotes the healing of wounds. |
|                   |                           | (LBNR181)                   |                | Infusion    |                                                                      |                                                                            |
|                   | Plantago ovata Forsskal   | Ispaghul                    | Zriaat zrktouna | Seeds       | Diuretic. Hypotensive.                                                |                                                                            |
|                   |                           | (LBNR182)                   |                | Decoction   |                                                                      |                                                                            |
| Poaceae           | Arundo donax L.           | Canne de provence           | Ksab Roots     | Powder      | Against hair loss (in olive oil).                                     |                                                                            |
|                   |                           | (LBNR183)                   |                |             |                                                                      |                                                                            |
|                   | Avena sativa L.           | Avoine cultivée             | Achoufane Seeds | Infusion    | Antidiabetic.                                                          |                                                                            |
|                   |                           | (LBNR184)                   |                |             |                                                                      |                                                                            |
|                   | Avena sterilis L.         | Avoine                      | Askoune Fruits | Decoction   | Stomachic. Antidiabetic (mixed with the flowers of zea mays).          |                                                                            |
|                   |                           | (LBNR185)                   |                | Powder      |                                                                      |                                                                            |
|                   | Cynodon dactylon (L.) Pers.| Cynodon                    | Njem Roots     | Decoction   | Stops nosebleeds. Calms burns and heals wounds.                       |                                                                            |
|                   |                           | (LBNR186)                   |                | Powder      |                                                                      |                                                                            |
|                   | Hordeum vulgare L.        | Orge                        | Chaâir Seeds   | Maceration   | Antidiabetic (mixed with fenugreek powder).                            |                                                                            |
|                   |                           | (LBNR187)                   |                |             |                                                                      |                                                                            |
| Family          | Species                        | Common Name                  | Part Used        | Preparation | Medical Use                                      | A/B (%) | C (%) | D (%) |
|-----------------|--------------------------------|------------------------------|------------------|-------------|-------------------------------------------------|---------|-------|-------|
| Poaceae         | *Lolium perenne* L.            | Ivraie vivace                | Seeds            | Decoction   | Antidiabetic.                                    | 72.4    | 69    | 0.083 |
|                 | *(LBNR188)*                    |                              |                  | Infusion    |                                                  |         |       |       |
| Poaceae         | *Panicum miliaceum* L.         | Millet commun                | Seeds            | Decoction   | Antidiabetic. Promotes digestion.                | 92.6    | 81    | 0.098 |
|                 | *(LBNR189)*                    |                              |                  | Infusion    |                                                  |         |       |       |
| Poaceae         | *Pennisetum glaucum* (L.) R. Br | Millet                       | Seeds            | Powder      | Antianemic.                                      | 94      | 203   | 0.246 |
|                 | *(LBNR190)*                    |                              |                  |             |                                                  |         |       |       |
| Poaceae         | *Phalaris canariensis* L.      | Alpiste des canaries         | Seeds            | Powder      | Antidiabetic.                                    | 100     | 69    | 0.083 |
|                 | *(LBNR191)*                    |                              |                  |             |                                                  |         |       |       |
| Poaceae         | *Phragmites australis* (Cav) Steud. | Roseau                      | Leaves           | Decoction   | Against bronchitis. Anti-hair loss.              | 72.3    | 113   | 0.137 |
|                 | *(LBNR192)*                    |                              | Roots            | Powder      |                                                 |         |       |       |
| Poaceae         | *Triticum durum* Desf.        | Blé                          | Seeds            | Maceration  | Antidiabetic (mix with Coriandrum sativum and Trigonella foenum-graecum). Anti-hair loss. | 78.8    | 81    | 0.098 |
|                 | *(LBNR193)*                    |                              |                  |             |                                                 |         |       |       |
| Poaceae         | *Zea mays* L.                 | Mais                         | Stigma of corn   | Infusion    | Hair care. Against disorders of the bladder.     | 94      | 102   | 0.123 |
|                 | *(LBNR194)*                    |                              |                  | Decoction   | Antianemic.                                      |         |       |       |
| Portulacaceae   | *Polygala rupestris* Pourret   | Polygala des rochers         | Roots            | Decoction   | Heals asthma attacks. Laxative.                 | 100     | 101   | 0.122 |
|                 | *(LBNR195)*                    |                              |                  | Powder      |                                                 |         | 0.122 |       |
| Polygonaceae    | *Rumex bucephalophorus* L.     | Rumex tête de boeuf          | Whole plant      | Decoction   | Aperitif. Soothes the pain of the bladder.      | 89.6    | 89    | 0.108 |
|                 | *(LBNR196)*                    |                              | Infusion Compress|             | Antiseptic.                                      |         | 0.1   |       |
| Polygonaceae    | *Rumex pulcher* L.            | Oseil sauvage                | Whole plant      | Decoction   | Against bladder pain. Stomachic.                | 83.3    | 76    | 0.092 |
|                 | *(LBNR197)*                    |                              |                  | Infusion    |                                                 |         |       |       |
| Portulacaceae   | *Portulaca oleracea* L.        | Pourpier potager             | Aerial parts     | Infusion    | Laxative. Soothes the pain of the bladder.      | 72.2    | 102   | 0.123 |
|                 | *(LBNR198)*                    |                              |                  | Decoction   | Antidiabetic.                                    |         | 0.123 |       |
| Primulaceae     | *Anagallis arvensis* L.        | Mouron des champs            | Leaves           | Decoction   | Against kidney and bladder stones. Heals skin diseases. | 100     | 62    | 0.075 |
|                 | *(LBNR199)*                    |                              | Stems            | Poultice    |                                                 |         | 0.075 |       |
| Family          | Genus                 | Species                        | LBNR   | Type                | Part           | Use                           | Code 1 | Code 2 | Code 3  |
|-----------------|-----------------------|--------------------------------|--------|---------------------|----------------|-------------------------------|--------|--------|---------|
| Ranunculaceae   | Clematis              | flammula L.                    | (LBNR201) | Aerial parts       | Poultice       | Antirheumatic.                | 83.3   | 91     | 0.11    |
|                 |                       |                                |         |                     |                |                               |        |        |         |
|                 | Delphinium           | pentagynum Lam                 | (LBNR202) | Leaves             | Decoction Poultice | Antidiarrheal. Anti-lice (mixed with olive oil). | 96.2   | 71     | 0.086   |
|                 |                       |                                |         |                     |                |                               |        |        | 0.133   |
|                 | Nigella              | sativa L.                      | (LBNR203) | Seeds               | Powder          | Antidiabetic. Stomachic. Treats liver diseases (mixed with honey). | 78.5   | 87     | 0.105   |
|                 |                       |                                |         |                     |                |                               |        |        |         |
|                 | Ranunculus           | bullatus L.                    | (LBNR204) | Roots               | Decoction Poultice | Regulates the rules and hormones in women. Stomachic. Facilitates childbirth. | 64     | 131    | 0.158   |
| Resedaceae      | Reseda               | alba L.                        | (LBNR205) | Leaves             | Infusion        | Antidiarrheal. Diuretic.      | 100    | 101    | 0.122   |
|                 |                       |                                |         |                     |                |                               |        |        |         |
| Rhamnaceae      | Ziziphus             | lotus (L.) Lam.                | (LBNR206) | Fruits             | Powder Infusion | Antidiarrheal. Antulcer. Aperitif. Antidiabetic. Promotes the healing of wounds. | 87     | 131    | 0.158   |
| Rosaceae        | Crataegus            | monogyna Jacquin               | (LBNR207) | Flower heads.      | Powder Infusion | Against heart and respiratory problems (mixed with honey) Promotes the circulation of blood. | 78.6   | 99     | 0.12    |
|                 |                       |                                |         |                     |                |                               |        |        |         |
|                 | Cydonia              | oblonga Mill.                  | (LBNR208) | Leaves seeds       | Friction Gargle | Heals hemorrhoids. Heals sore throats. | 92.8   | 52     | 0.063   |
|                 |                       |                                |         |                     |                |                               |        |        | 0.126   |
|                 | Prunus               | amygdalus Batsh.               | (LBNR209) | Leaves             | Decoction Infusion | Antidiabetic. Laxative Soothes cough | 72.9   | 82     | 0.099   |
|                 |                       |                                |         |                     |                |                               |        |        |         |
|                 | Prunus               | armeniaca L.                   | (LBNR210) | Fruits             | Powders         | Antidiabetic. Antulcer.        | 94     | 71     | 0.086   |
|                 |                       |                                |         |                     |                |                               |        |        |         |
|                 | Prunus               | domestica L.                   | (LBNR211) | Leaves             | Raw             | Laxative. Diuretic.           | 89.2   | 26     | 0.031   |
|                 |                       |                                |         |                     |                |                               |        |        |         |
|                 | Prunus               | dulcis Mill. D.A.Webb          | (LBNR212) | Fruits             | Infusion Powder | Calm the cough. Laxative.      | 91.9   | 68     | 0.082   |
| Taxonomy | (LBNR) | Common Name | Part Used | Preparations | Uses |
|----------|--------|-------------|-----------|--------------|------|
| *Rosa canina* L. | LBNR213 | Eglantier | Leaves, Fruits, Flower buds | Infusion, Powder | Antidiarrheal, Antianemic. Heals burns (mixed with olive oil). |
| *Rosa centifolia* Mill | LBNR214 | Rosecentfeuilles | El ward | Dried buds | Decoction, Maceration | Stomachic, Treat the sores. |
| *Rosa damascena* Mill | LBNR215 | Rose rouge de Damas | El ward el beldi | Flowers | Compress, Powder | Antiseptic, Soften the hair. |
| *Rosa gallica* L. | LBNR216 | Rosa rubra | El ward | Flower buds | Infusion | Treats scars. Hemostatic. |
| *Rubus ulmifolius* Schott. | LBNR217 | Ronce | Fruits, Flowers, Leaves | Infusion, Decoction, Infusion | Antidiabetic, Anti-wrinkle. Against the pain of menstruation. |
| *Sanguisorba minor* Scop. | LBNR218 | Sanguisorbe | Aerial parts | Infusion, Gargle | Antidiarrheal. Heals gastrointestinal disorders. Fights gum infections and infectious tonsillitis. Relieves burn and heals eczema. |
| Rubiaceae | | | | Decoction, Cooked | Against jaundice and liver diseases. Antianemic. |
| *Rubia tinctorum* L. | LBNR219 | Garance | Roots | Decoction, Cooked | Against jaundice and liver diseases. Antianemic. |
| Rutaceae | | | | | |
| *Citrus aurantium* L. | LBNR220 | Oranger amer | Fruits, Flowers | Juice, Poultice | Antidiabetic. Promotes blood circulation. Heal the sunburns. |
| *Citrus limon* (L.) Burm.f. | LBNR221 | Citronier | Fruits, Barks | Gargle, Juice | Against angina. Heal the intestinal pain. |
| *Citrus limetta* | LBNR222 | Bergamia | Flowers | Infusion | Antidiabetic. Anti-migraine. |
| *Citrus sinensis* (L.) Osbeck | LBNR223 | Oranger doux | Fruits, Barks | Powder, Cooked | Treat acne (mixed with a Unsweetened natural yoghurt). Against the flu. |
| Species                        | Common Name                  | Part Used | Preparation            | Uses                                                                 | Strength  |
|-------------------------------|------------------------------|-----------|-------------------------|----------------------------------------------------------------------|-----------|
| *Ruta graveolens* L.          | Rue officinale               | Roots     | Decoction               | Antidiabetic. Relieves sciatic. Promote digestion                    | 91.5      |
| *Ruta Montana (L.) L.*        | Rue sauvage                  | Roots     | Decoction               | Stomachic. Heals liver diseases. Antidiabetic. Fight against lice (in vinegar). For the insomnia of children. | 51.7      |
| *Schisandraceae*              | *Ilicium verum* Hook. F      | Fruits    | Decoction               | Against digestive problems and in particular bloating. Migraine Therapy. | 74.2      |
| *Solanaceae*                  | *Capsicum annuum* L.         | Fruits    | Decoction               | Aperitif. Antiseptic. Diuretic. Antidiabetic                          | 86.3      |
| *Capsicum frutescens* L.      | Poivre de cayenne            | Fruits    | Decoction               | Vermifuge (in olive oil). Strengthens the hair (in apple vinegar).    | 82        |
| *Datura stramonium* L.        | Stramoine                    | Seeds     | Decoction               | Soothes the cough. Antiseptic. For weight gain (with couscous beans).  | 92        |
| *Hyoscyamus niger* L.         | Jusquiamne                   | Leaves    | Decoction               | Relieves sciatic or rheumatic pains. Treat eczema.                    | 94        |
| *Solanum dulcamara* L.        | Morelle                      | Stems     | Poultice                | Anti-rheumatic. Against chronic bronchitis (in milk). Migraine Therapy. | 83.5      |
| *Solanum lycopersicum* L.     | Tomates                      | Fruits    | Juice                   | Antianemic.                                                           | 100       |
| *Solanum nigrum* L.           | Morelle                      | Leaves    | Poultice                | Antulcer. Promotes the healing of wounds.                            | 73        |
| *Solanum tuberosum* L.        | Pomme de terre               | Tubers    | Poultice                | Antiseptic. Stomachic                                                 | 84.8      |

*Strength values are not specified in the original document.*
| Family          | Genus                  | Species                          | Description                                                                 | Antidiabetic | Antirheumatic | Antiulcer | Anti-Hemorrhoids | Antiulcer | Antimigraine | Antihemorrhoids | Antihemorrhoids | Antinudrier | Antiulcer | Sedative | Calming | Antimigraine | Calming | Antinudrier | Antiulcer | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifungal | Antifingular |
| FAMILY       | SPECIES                                                                 | COMMON NAME                          | PARTS      | PREPARATION | USE                                                                                              | VALUE  | IBU | ESTH |   |
|-------------|--------------------------------------------------------------------------|---------------------------------------|------------|-------------|--------------------------------------------------------------------------------------------------|--------|-----|------|---|
| Asphodelaceae | Asphodelus microcarpus Salzm & Viv.                                     | Asphodèle à petite fruit.             | Roots      | Maceration  | In olive oil to cure the problems of the ears. Clean the abscesses. Antidiabetic.                  | 77.3   | 73  | 0.088|   |
|             |                                                                          |                                       | Leaves     | Decoction   |                                                                                                  |        |     |      |   |
|             |                                                                          |                                       | Tubers     | Powder      |                                                                                                  |        |     |      |   |
| Zingiberaceae | Alpinia officinarum (L.) Willd.                                          | Le galanga khoulandjan                | Roots      | Decoction   | Antiemetic. Anti-inflammatory. Treat digestive disorders Aperitif.                                | 67     | 73  | 0.088|   |
|             |                                                                          |                                       |            | Powder      |                                                                                                  |        |     |      |   |
|             | Zingiber officinale Rosc                                                | Gingembre Skinjbir                    | Roots      | Decoction   | Antidiabetic. Heals rheumatic (in olive oil). Against the cold.                                  | 83.5   | 89  | 0.108|   |
|             |                                                                          |                                       |            | Poultice    |                                                                                                  |        |     |      |   |
|             |                                                                          |                                       |            | Infusion    |                                                                                                  |        |     |      |   |
| Zygophyllaceae | Zygophyllum gaetulum Emberger & Maire                                    | Zygophylle Aaggaya                    | Leaves     | Infusion    | Antidiabetic. Antiseptic Antispasmodic Anti-eczema.                                              | 85.1   | 108 | 0.131| 0.131

**Notes:**
- **LBNR245**: Asphodelus microcarpus Salzm & Viv.
- **LBNR246**: Alpinia officinarum (L.) Willd.
- **LBNR247**: Zingiber officinale Rosc
- **LBNR248**: Zygophyllum gaetulum Emberger & Maire
The families are presented in alphabetical order. For every identified species is assigned: a scientific name, the common name, the used part, the method of preparation appropriate by the interviewees and the therapeutic use of these plants in the given area of study also the data of FIV, RFC, FC and FL.

**Frequency of botanical families: the most used and their family use value (FIV):**
Among the 70 families, the dominant families were Asteraceae (30 species), Lamiaceae (25 species each), followed by Apiaceae (18 species), Fabaceae (16 species), Poaceae and Rosaceae (12 species each), Brassicaceae and Solanaceae (9 species each), Cucurbitaceae and Rutaceae (6 species each), the families of Cupressaceae, Euphorbiaceae, Malvaceae, Myrtaceae, Oleaceae, and Renonculaceae were represented in the area by 4 species each, Amaranthaceae, Anacardiaceae, Aspargaceae, Caryophyllaceae, Cistaceae, Papaveraceae, Plantaginaceae and Thymeleaceae were represented by 3 species each. These families alone represent 191 species or 77.02%. The remaining 55 botanical families hold only one or two species each (57 species used or 22.98%) (Fig. 2).

![Figure 2. Percentage of species used (according to family).](image.png)

Several ethnobotanical studies in Morocco revealed that Lamiaceae and Asteraceae were the most dominant (Mehdioui et al. 2007, Lahnissene et al. 2019).

Based on the FIV index, the 10 most cited families were Euphorbiaceae (FIV=0.169), Myrtaceae (FIV=0.165), Rhamnaceae (FIV=0.158), Rubiaceae (FIV=0.152), Ericaceae and Amaryllidaceae (FIV=0.149), Lamiaceae (FIV=0.147), Iridaceae (FIV=0.138), Lythraceae (FIV=0.137) and Ranunculaceae (FIV=0.133) (Fig. 3).

The abundance of these families may be explained by the geological nature in the study area, because the mountains offer a high availability of medicinal plants, which allow several species adapt easily to the climatic, geological and edaphic conditions from this region, for example *Euphorbia resinifera* (Euphorbiaceae), that exhibited a higher FIV (0.169) is at the same time an endemic species of the atlas of Azilal.

**RFC and FL plant species:**
The relative frequencies of citation (RFC) were used for evaluating the most used plant species by the interviewed. In this study RFC values ranged from 0.019 to 0.347, and the most cited species by participants were *Eucalyptus globulus* Labill (RFC=0.347) and *Euphorbia resinifera* Berg (RFC=0.33), because these plants were mentioned
by a large number of informants, these species should be taken into account in future studies, to properly determine their efficiency, and they can also be used for phytochemical and pharmaceutical analysis to identify their active constituents for any drug extraction (Vitalini et al. 2013). On the other hand, the species having lowest values of RFC, such as, Buxus sempervirens L. (RFC=0.025) and Paronychia argentea Lam (RFC=0.026), should not be abandoned, in order to be able to preserve the transcribed traces of phytherapeutic practices, the transmission of which is essentially oral. This makes it a treasure that is diminishing over time in a society where orality is still a modus vivendi vivace (Table 2).

Fidelity level (FL), is an ethnomedical quantitative tool used to select for each disease which is the most effective medicinal plant, in the present study, FL values varied between 46% to 100%. The calculation of the results showed that the most medicinal plants (140 species), had a high fidelity value (>80%), 33 species had a ( =100%), 55 medicinal plants had a FL>60%, and only the 18 remaining species show low fidelity values (< 60%) (Table2). These results show that the majority of the medicinal plants reported by the respondents have a high level of fidelity, that is to say a better healing potential, because they have been used to treat a single category of disease. In general, a FL of 100% for a specific plant indicates that all of the use-reports mentioned the same method for using the plant for treatment extraction (Srithi et al. 2009).

![Figure 3 Family Importance Value (FIV) of medicinal plants.](image)

**Parts of the medicinal plants used in the study area:**
The used parts of plants differed according to the plant itself, and the pathology treated. For example, the leaves of Pistacia lentiscus Desf are used for the treatment of gastric maladies, while its root is used to treat diarrhoea and the barks are antidiabetic. In contrast, only one part of the plant can be used for the treatment of different conditions, for example the roots of Cynaria humilis L. in powder are indicated for the treatment of the burns, and their decoction like anti-diabetic. The surveys carried out in the Central High Atlas make inferences to 16 parts: the leaves, the fruits, the seeds, the roots, the whole plant, the bark, the leafy stems, the aerial parts, the flowers, the flower heads, the stems, bulbs, young shoots, snowshoes, stigmas, nails. Results are illustrated in Fig 4.
Leaves are the most used parts in traditional medicine recipes with a percentage of 21.25%; also this high frequency of use of leaves can be interpreted by the ease and speed of their harvest (Bitsindou & Lejoly 1996). Then come fruits and seeds with respective rates of 11.8% and 11.15%. These two high percentages are probably related to the fact that these parts are accessible because they are apparent.

Figure 4. Percentage distribution of the different plant parts used

If taking the leaves as the most used organ of the plant into account, we noticed during our field prospections that the users remove the entire plant completely instead of looking only for the desired part (leaves). Since there is a clear relationship between the used part of the exploited plant and the effects of this exploitation on its being (Cunningham et al. 1997). This collecting method seriously compromises the sustainability of the medicinal species concerned, especially the bulbous ones.

So, it is therefore in the leaves that photosynthesis takes place and sometimes constitutes the storage of secondary metabolites that are responsible for the biological properties of plants (Bigendako-polygenis & Lejoly 1990), they are also characterized by their ease and rapid harvest (Bitsindou & Lejoly 1996), and this may explain the high rate of foliage used by the population of the region.

Methods of preparation:
The plants harvested by the interviewee were prepared by the users themselves, on the other hand, the plants obtained at purchase were in prepared form (dried and sometimes crushed), so the same plant can be prepared differently, depending on the part used and the disease treated, for example: Eucalyptus globulus Labill leaves in decoction are antiseptic, and in poultice treat cough, flu and cold, while the bark decoction is antidiabetic. The methods of preparation most used and most feasible have been classified in descending order of magnitude: decoction (31.62%), infusion (25.69%), poultice (14.58%), raw (5.9%), maceration (5.55%), cooked (3.29%), compress (2.61%), fumigation (1.73%). The rest consists mainly of preparation methods rarely mentioned by the population and representing a rate of 9.03% (Fig. 5).

This shows that decoction was the most common method of preparation in the study area. Similar results are obtained in other studies conducted in Morocco (Chaachouay et al. 2019, El Rhaffari et al. 2002, Lahsissene et al. 2009, Mehdioui et al. 2007, Slimani et al. 2016).

It should also be noted that the majority of these preparations (31.62%) are made by the herbal tea form (Fig. 6), because it is easily assimilated by the body, and it can collect the majority of active ingredients existing in medicinal plants, and by using the fresh parts of these plants (Fig. 7). Similar studies
have shown that herbal tea is the most usable form of herbal remedies (El Alami et al. 2015, Hachi et al. 2015 Slimani et al. 2016), and that fresh parts are the most recommended (Abdurhman 2010).

Figure 5. Percentage methods of preparation

Figure 6. Forms of preparation

Figure 7. Percentage conditions of preparation

**Methods of Administration**

Several methods of employment were mentioned during our investigation, including the oral route, massage, brushing, gargling and rinsing were the main modes of employment, other modes of administration were less cited (Fig. 8).
The respondents believed that the oral route is the most practical and safest way that facilitated the absorption of the active principles of medicinal plants, to transport them easily in the body, and consequently the cure of the target diseases. Similar findings indicated predominance of oral employment in Africa (Bousta et al. 2014, Cher-mat & Gharzouli 2015, El Rhaffari et al. 2002, Rhattas et al. 2016).

**Distribution of medicinal plants according to the group of diseases treated**

The ethnopharmacological analysis has shown that the populations of the central High Atlas use the medicinal plants to treat different types of diseases. Nevertheless, it should be noted that a single plant can be used for the treatment of several ailments, and a single disease condition can be treated by several plants. For example, *Artemisia herba-alba* Asso is widely used in the study area, for its properties: antidiabetic, antispasmodic, anti septics, anthelmintics, and hypertensive and to treat urinary ailments. While diabetic diseases can be treated by several plants, for example, *Euphorbia resinifera*, *Trigonella foenum*, *Salvia officinalis*, *Zygophyllum album*. This study revealed that most of the plants represented in our region are used to treat gastrointestinal diseases (18.76%), diabetic diseases (13.9%), genitourinary infections (9.49%), respiratory disorders (6.38%) and skin diseases (6.84%), while 5.29% of the species are used as antiseptic, 5.07% to treat rheumatological disorders, 4.63% for hair care, 4.42% to treat cardiovascular diseases and 3.53% facial treatments. Some plants are used to stimulate appetite (2.86%), others to treat neurological disorders (2.65%) and to treat burns (2.42%), Hepatic and haemostatic, ocular, auditory and anemic diseases are treated by less than 8% of the medicinal plants listed in the study area (Fig 9). Previous studies have shown that digestive diseases were the ailments most treated with medicinal plants (Daoudi et al. 2016, El Azzouzi & Zidan 2015, Salhi et al. 2010, Tahri et al. 2012).

**Figure 8. Percentage employment methods**

**Traditional knowledge acquisition modes**

During our field survey, it was found that 39.81% of respondents based their choice of appropriate medicinal plants on the experience of their ancestors, who hold the traditional knowledge of treating diseases, while 32.14% consulted herbalists, 24.2% were referred on their own experience, because of the presence of many medicinal plants in their environment, or by reading books on traditional Arab medicine, or from television and radio programmes, while a small minority acquire their traditional knowledge through a doctor. This knowledge in phytotherapy was acquired by the local populations over centuries and is transmitted from one generation to another, which will safeguard ancestral knowledge. Especially since accumulated experience with age constitutes the main source of information at local level about the use of plants in traditional medicine (Fig. 10).

**The reasons for choosing this herbal medicine**

Herbal medicine in this study was used for its low cost in most patients (54% of cases), and its effectiveness in 46% of cases. A study carried out in this area, in the Fès - Boulemane region in Morocco, had shown that phytotherapy is preferred by the local population for its low cost in most patients (54% of cases), and its effectiveness in 38% of cases (Jouad et al 2001).
The results of care
According to the ethnobotanical survey conducted in the Central High Atlas, we observed that 66.24% of people believed that medicinal plants help healing diseases, while 26.31% said that medicinal plants help only in improving health status, however, only 7.45% of the local population believed that medicinal plants can cause toxicities or may have side effects, if the user of these plants has not complied with the recommended dose and the technique of use (Fig. 11). Similar studies conducted in the Tafilalat region of south-eastern Morocco, indicated that 63% of people interviewed declared that modern medicine is the best (Eddouks et al. 2002). While in Guinea (in Black Africa), 85% of those participants were satisfied with the results of the use of medicinal plants (Balde et al 2006).
Figure 10. The reasons for choosing this herbal medicine

Figure 11. Results of care as a percentage

Conclusions
This study made it possible to determine the attachment of the population of the Central High Atlas of Morocco to the traditional heritage, and to collect information on the therapeutic uses practiced in this study area. Thus, the series of ethnobotanical and ethnopharmacological surveys revealed the region’s wealth of medicinal plants, which constitute a very rich reservoir of biodiversity.

In this region, older women have a greater knowledge of phytotherapy and play an essential role in the conservation of therapeutic traditions based on medicinal plants and pass it on to their descendants.

From an ethnobotanical and pharmacological point of view, foliage is the most widely used part and decoction is the most widely used galenical form. Similarly, of all the diseases treated, gastrointestinal disorders and diabetes are the most frequently cited.

In addition, this study showed that the local populations of the Central High Atlas use 218 belonging to 73 families for the prevention and treatment of diseases. This region is the source of a very large number of medicinal plants for the whole of Morocco. This wealth of plants for therapeutic use is accompanied by the knowledge and practices of phytotherapy acquired by the inhabitants of the Atlas over the centuries.

Moreover, these results constitute a source of information that contributes to the knowledge of the medicinal flora and to the preservation of a local popular know-how that is tending to disappear. It will also be a database for the valorisation of medicinal plants in order to discover new active principles that can be used in pharmacology.

Declarations
List of abbreviations: Not applicable
Ethics approval and consent to participate: The study was approved by University Research Degree
Committee of Kumaun University Nainital. All participants provided oral prior informed consent and signed in the questionnaire as their consent. 

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**Authors’ contributions:** SB: Carried out field survey in High Atlas Central, compiled the literature sources, analyzed the data collected, interpreted the results and wrote the manuscript. JD: Made a substantial contribution to data analysis and wrote the first draft of the manuscript. NB: provided help for data analysis and writing of the manuscript. LZ: Designed the research and identified the plant species. All the authors participated in writing and giving feedback on the manuscript and approved the final version of the manuscript.

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