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### Ethnobotanical study of Belezma National Park (BNP) plants in Batna: East of Algeria

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**Abstract:** *The present work focuses on an ethnobotanical study of medicinal plants in the Belezma National Park (BNP), which is located in Batna city. It was conducted to precise on the medicinal plants in the park and gathers all the information on the therapeutic practice used by the local inhabitants of the study area. Using 300 questionnaire cards, ethnobotanical surveys of BNP were conducted during two campaigns (2017 and 2018). The obtained results allowed us to identify 50 medicinal plants used by the population of the region, which are divided into 27 families and 46genus.*

*The obtained results show both leaves and stems are mostly used for diseases' treatment in the form of a decoction with a rate of 42.34%. For the treated diseases, the digestive disorders occupy the first place with a rate of 34.01%, followed by uro-genital diseases with a rate of 17.56%, 11.20% for respiratory diseases, 11.84%for orthopedic diseases and 6.23%for cardiovascular.*

*The founded results could be a database for research on phytochemistry and pharmacology for the national medicinal flora and the population of the BNP region. Also, they constitute a very valuable source of information.*

**Keywords:** Ethnobotanical, Traditional medicine, Belezma Park, Batna, Algeria

#### Introduction:

Throughout the world, especially in underdeveloped countries, plant medication is one of the traditional medicine forms that all cultures used. Man is always led to consume and use various plant species, which are often valued for their medicinal and nutritive qualities [1]. These plants play a key role in preserving the health and survival of humankind [2]. An estimated 80% of global populations rely on traditional medicine for the treatment of pain [3]. Algeria is a typical example, among Mediterranean countries with a veritable

medicinal tradition [4], and worthy traditional knowledge of medicinal plants [5]. Richness and biodiversity of the Algerian original flora constitutes a veritable phylogenetic reservoir. Batna National park with approximately 447 vegetable species and subspecies allows it to be classified among the parks whose population has a long medical tradition and traditional medicinal plant know-how [5]. Indeed, the herbal remedies occupy a good place in the traditions of the medication in Algeria even if there are among the Algerian medicinal flora species which remains unknown until our days.

The analysis of the Algerian medicinal bibliography shows that data related to regional medicinal plants are very fragmentary and scattered, just as the know-how is currently held by only a few people. In addition, natural areas that are destroyed either by man or by drought make it difficult to discover, exploit and safeguard potentialities of this type.

The present study, carried out in Batna Park aims to; contribute to the knowledge of medicinal plants, to produce a catalogue of these plants in the said region and to gather as much information as possible about the therapeutic usage practiced by the local population. . Indeed, it is very important to translate this traditional knowledge into scientific one in order to revalue, conserve and use it in a rational way.

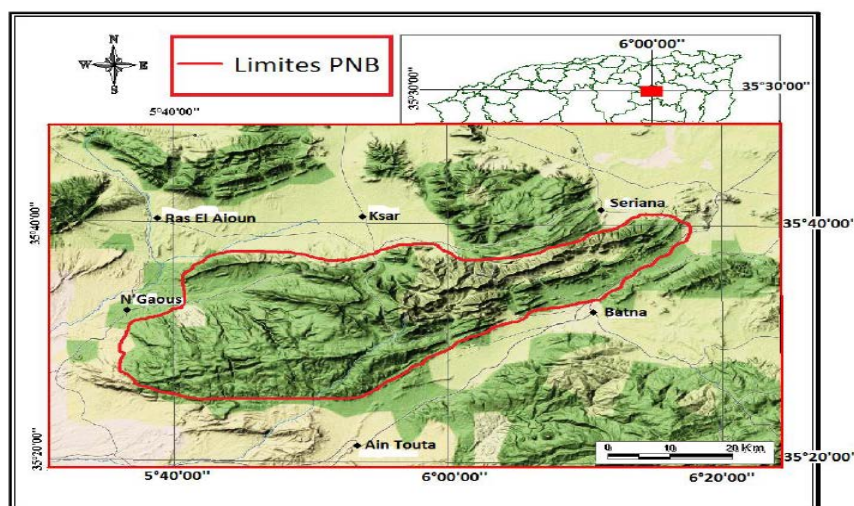
### Area of study

Belezma National Park is one of the richest vegetable parks in Algeria after El Kala Park. It is located about 7km North-West of Batna Province (Figure 1), bordered by the plain of Mérouana and from Ain Djasser to the North, the plain of El-Madher to the East, and to the West by the Oued Barika. Belezma Park is fed by two distinct river systems: Water courses on the North side are the tributaries of two main rivers: Oued Ketami (Mountain Maâgal and Mountain Tarkat) and Oued Hrakta (Mountain Tichaou, Bourdjemet Kef Chellala [6].

Belezma National Park occupies an estimated area of 26,250 ha of the forest of the massif located between 35 ° 32 '40 " and 35 ° 37 '46 "N, and 5 ° 55' 10" to 6 ° 10 '45 "E [7]. It was created by Presidential Decree N° 84/326 of November 3, 1984. Unesco in June 2015 classified the park as a biosphere reserve, this classification has been attributed to it due to the presence of large expanses of Cedar Atlas in an area of great Saharan and Mediterranean influences, also the presence of invaluable prehistoric and historic wealth and a mosaic of wetlands in the North-North East.

Climate is the main factor influencing the distribution of living organisms and the activity of biocenoses [8]. Rainfall recorded in the region of Batna seems low and the most abundant season in rain is the spring season (March, April and May). However, the maximum is recorded during January with 49.5 mm while the driest month is July with 6.1mm. Banta's region receives less than 30 days of snow per year spread over winters and spring. In Belezma Park, winds are moving in different directions, but they often take the South or East directions, especially the dry winds. These winds characterized by their velocities and directions; have a direct influence on temperatures, humidity, and activation of evapotranspiration.

The main sylvatic formations of Belezma Park are based on Atlas cedar (*Cedrus atlantica*) pure or mixed with Holly (*Ilex aquifolium*) or Holly oak (*Quercus ilex*), which is also present either in a pure form or mixed with Phoenician juniper (*Juniperus phoenicea*) or Thorny Ash (*Fraxinus dimorpha*). Note also the important presence of relict stands of Aleppo pine (*Pinus halepensis*) [9]. According to the head (chief) of the BNP species protection service, (Mohamed Bensaci 2016); Belezma National Park is characterized by the presence of a remarkable flora, composed of 447 plant species including, 18 protected species, 9 endemic species, 14 rare species, 21 rare species, 19 rare species, and 150 medicinal plants.



**Figure 1.** Vegetation chart of Belezma National Park

## Materials and methods

Our work is divided into three parts:

**Part 1:** A visit was made to Batna's region and to BNP similarly. Then, an interview was conducted with park officials to list the plants available there

**Part 2:** A first survey was carried out in order to see the study areas and the behavior of the population towards the survey and to obtain general information on the medicinal plants used by the population of this region. 50 Plants were gathered from BNP in April 2016, their local names were given by the people of this studied area, and the identification was given by Dr T. Hamel a botanist at the Department of Biology Badji Mokhtar Annaba University. Moreover, the determination of the scientific nomenclature was carried out at the species level, using as a reference the following documents:

- Quezel P. et Santa S., 1962 – Nouvelle flore de l'Algérie et des régions désertiques méridionales. Vol. 1, CNRS, Paris. 1–565.
- Quezel P. et Santa S., 1963 – Nouvelle flore de l'Algérie et des régions désertiques méridionales. Vol. 2, CNRS, Paris. 571–1091.

- Boudjema Boughrara, Legseir Belgacem, Ethnobotanical study close to the population of the extreme north east of Algeria: The municipalities of El Kala National Park. Industrial Crops and Products .2016. 88, 2-7.
- Aït Youssef M., Plantes médicinales de Kabylie, 2006. Ibis Press.349.
- Ali-Delille L., Les plantes médicinales d'Algérie, Berti, deuxième édition, 2008. 239.

The scientific names and authorizations of plants have been checked, and updated with the online website ([www.theplantlist.org](http://www.theplantlist.org)) accessed on 13/05/2019.

**Part 3:** A definitive survey was carried out in the period of 2017-2018 which is based on the filling of the form (Annex 1) and the reply to the questionnaire. With the help of 300 questionnaire forms (Annex 1) spread over the areas surrounding the BNP (Batna, Ain-Touta, Seriana, N'gaous, Ras El Aioun, Ksar). The number of surveys was attributed according to the population of each region

The surveys were conducted in Arabic and in French language both for French and Arabic speakers, in the presence of translators to ensure the translation of Berber words.

The time spent for each questionnaire was 60 to 90 min to collect all information, during each interview; we collected all data on the survey and the medicinal plants used by it.

The distribution of surveys according to the population of the region and areas surrounding Batna National Park is as follows: Batna surveys number 127 ,Ain Touta 52,N'Gaous 40 ,Seriana 32 ,Ras el Aioun 27,Ksar 22

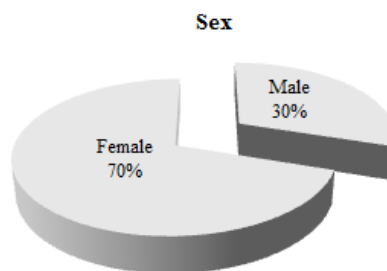
## Results and discussion

### *Frequency of use of medicinal plants*

#### *Sex*

Sex has a great influence on the use of medicinal plants, medicinal plants are used much more by women than by men, and in fact the results show that 70% of women use medicinal plants, whereas only 30% of men use them (**Figure 2**).

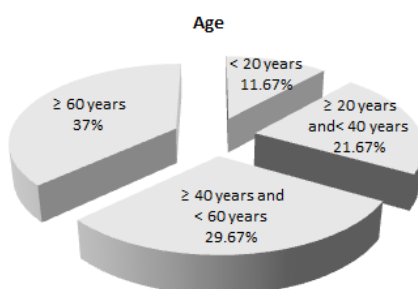
Women in general have a great know-how in the field of traditional herbal medicine, and also have a great responsibility as mothers and housewives. They give first aid to care especially within their families. Also, women are aware of responsibility they own in their families [10].



**Figure 2.** Distributions by sex of the plants use frequency in the B

#### Age

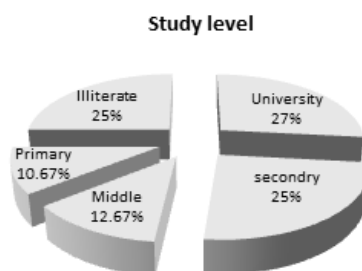
The use of medicinal plants in the region is wide spread in all age groups, the rate of usage is considerable for the age group above 60 years 37%, while for the age group 40 to 60 years we note a rate of 29.67%, for the age group of 20 to 40 years; a usage rate of 21.67% and for the lower age group at 20 years old rate of 11.67% (**Figure 3**). The obtained results show that people who belong to the age group 60 have more knowledge in medicinal plants compared to other age groups. The most reliable information for the use of medicinal plants in traditional medicine is given by the oldest people, because they have a good ancestral knowledge that is part of their oral tradition. It is noticeable that there is an information lack regarding young people that tend not to believe in this traditional medicine [11].



**Figure 3.** Distributions by age of the plants use frequency in the BNP.

#### Level of study

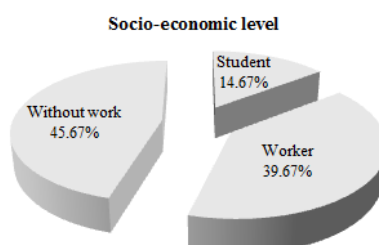
In the region, the users of medicinal plants are university students with a rate of 27%, this high rate is in direct proportion to the level of study of the local population, which is explained by the fact, that academics get their knowledge of grandparents who are illiterate on the one hand and on the other hand their cultural life, the secondary level and the illiterate have a usage rate of 25% each. While people who have a medium and primary level of education use little medicinal plants with rate of 12.67%, and 10.67% respectively (**Figure 4**).



**Figure 4.** Distributions by level study of the plants use frequency in the BNP.

#### *Socio-economical level*

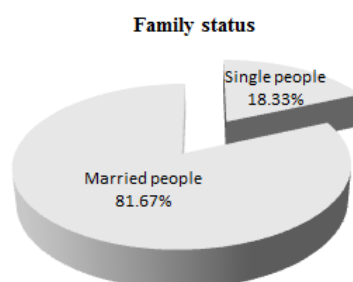
In our study area, the highest rate of users of medicinal plants is 45.67% for people without work while for people who work the rate is 39.67%, and the lower rate 14.67% was observed in the student users (**Figure 5**).



**Figure 5.** Distributions by Socio-economic level of the plants use frequency in the BNP.

#### *Family status*

According to the results shown in **Figure 6**, families' situation has a very important role on the use of medicinal plants: 81.67% of married people use plants to heal themselves against 18.33% of single people, this is explained by the fact that married people rely on themselves. Secondly, it is possible to reduce the burden of the doctor and the pharmacist [12].



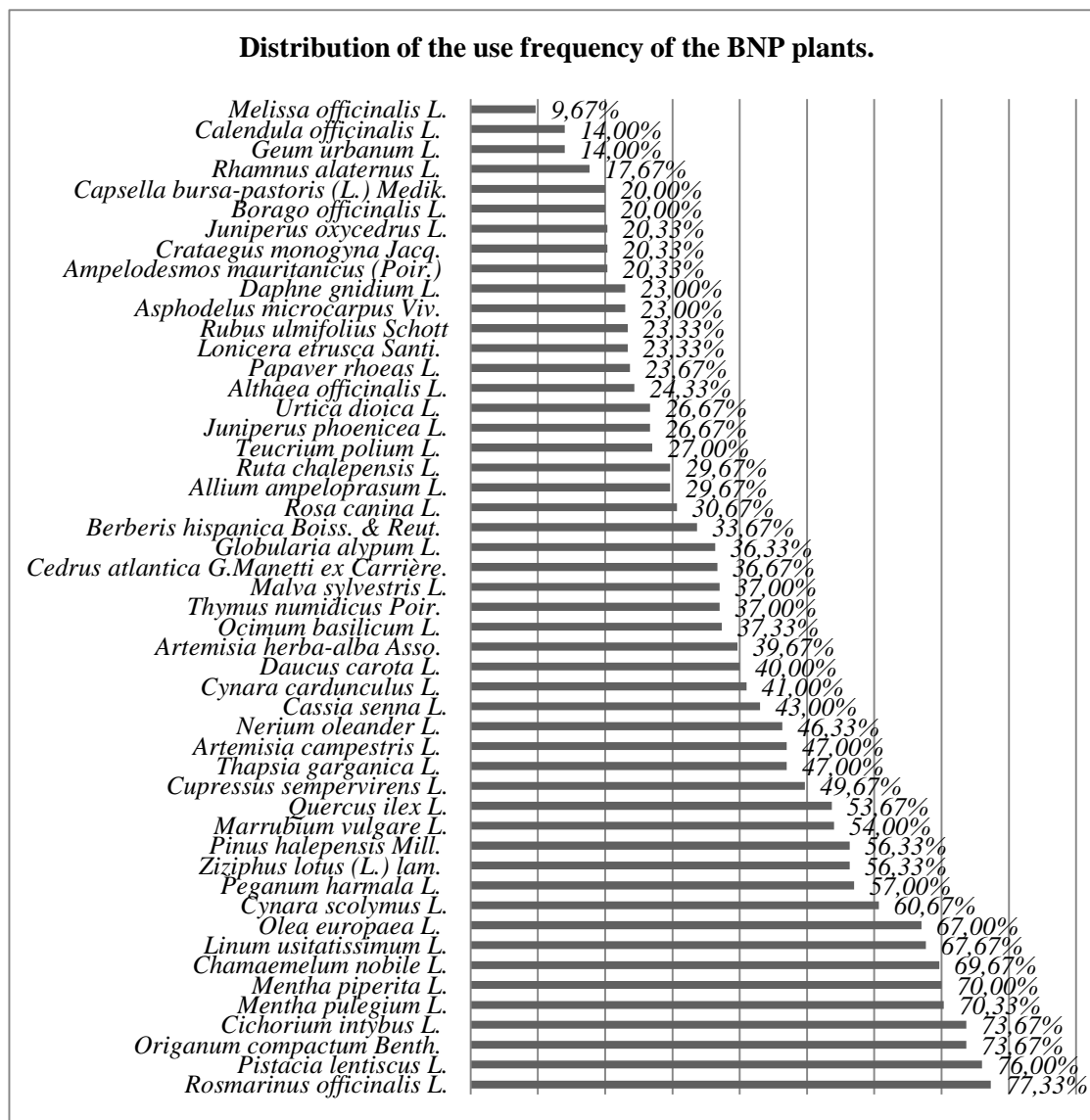
**Figure 6.** Distributions by Family status of the plants use frequency in the BNP.

#### *The most medicinal plant used*

This work, carried out with the aim of knowing the treated diseases by the plants of the region of the BNP, enabled us to list a number of diseases treated by medicinal plants, as well as the parts used and the



mode of use in **Table 1**. The founded results show that among the 50 extant species in BNP, used by the population in traditional medicine Rosemary, Mastic are the most widely used with a rate of 77.33% and 76% (**Figure 7**).

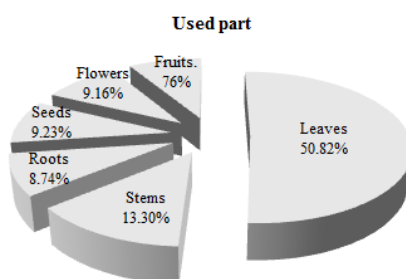


**Figure 7.** Distribution of the use frequency of the BNP plants

#### *Plants parts used in the therapeutic recipes preparation*

Generally, 6 parts of a plant are used in traditional medicine leaf, stem, root, seed, flower and fruit. The rate of use of its different parts shows that the leaves are the most used with a rate of 50.82%. Stems occupy a second place with a respective rate of 13.30%, Fruits occupy an average place with a rate of 8.76%, roots and seeds represent respectively a rate of 9.23% and 8% (**Figure 8**).The obtained results are in good

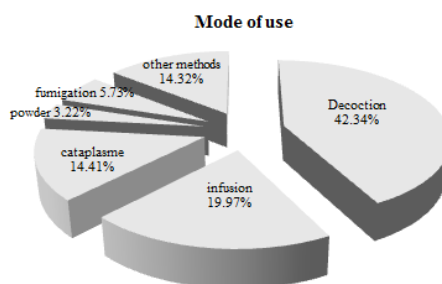
accordance with the literature, Leto et al. (2013) affirmed that leaves and stems are the most used parts in the recipes of traditional medicine [13].



**Figure 8.** Distributions of different part used from PNB plants.

#### *Preparation method of therapeutic recipes*

Several modes of preparation are used to simplify the administration of the active ingredient namely the decoction, the infusion, the cataplasme, the fumigation and the powder. **Figure 9** showed that the decoction is a mode mostly used with a rate of 42.34%, followed by the infusion and the cataplasme with respective rates of 19.97% and 14.41%, a rate of 14.32% is found for other methods of use (cold maceration example: Rosemary, Thapsie and the use of the oil of the plant example: Thym, Olivier, Mastic), and finally; the mode of use both fumigation and powder with respective rates of 5.73% and 3.22%. This is in accordance with the literature [14].

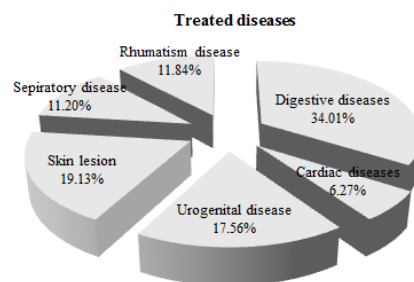


**Figure 9.** Distribution of different mode of the use of BNP plants.

#### *Diseases treated by the prepared therapeutic recipes*

34.01% of medicinal plants in the region are used for the treatment of digestive diseases; it is the case of Artemisia which used in decoction, 17.56% are used for uro-genital diseases; this is the case of the Asphodel roots, 19.13% for dermatological diseases; this is the case of Laurie rose, 11.20% for respiratory system this is the case of European pennyroyal, Thym, and Mastic, which has an anti-inflammatory effect [14], and 11.84% are used for orthopedic and rheumatism diseases it is the case of Thapsie, finally 6.27% for cardiovascular diseases (**Figure 10**)

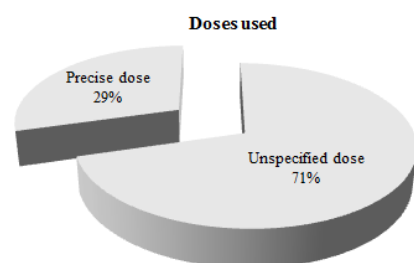




**Figure 10.** Distribution of BNP plants according to treat diseases.

#### Doses used

71% of medicinal plant users in Batna region use plants with unspecified doses, while 29% of the region's population uses plants with precise doses (**Figure 11**).



**Figure 11.** Distribution of BNP plants users according to the dose.

The Plant name, the family, the scientific name/voucher number, the Local name, the treated diseases, the used part and the Mode of use are shown in Table 1

**Table 1**

Plant name, family, scientific name/plant authorization, Local name, Treated diseases, Used part, Mode of use

N°	Familly	Scientific name / voucher number	Plant name	Local name	Treated diseases	Used part	Mode of use
1	Anacardiaceae	<i>Pistacia lentiscus</i> L./ (11 AB_2016)	Mastic	Eldarw	Respiratory	Leaf	Infusion
2	Apocynaceae	<i>Nerium oleander</i> L./ (19 AB_2016)	Laurie rose	Edefla	Skin- Rhumatism	Leaf	Infusion-Fumigation
3	Apiaceae	<i>Daucus carota</i> L./ (31 AB_2016)	Wild carrot	Eljazer	Digestive	Fruit	Decoction
4		<i>Thapsia garganica</i> L./ (26 AB_2016)	Thapsie	Ederiess bounafaa	Rhumatism	Root	Decoction

5	Asphodelaceae	<i>Asphodelus microcarpus</i> Viv./ (34AB_2016)	Asphodel	Al berrouagh	Urogenital	Roots	Cataplasme
6	Asteraceae	<i>Cynara scolymus</i> L./ (04 AB_2016)	Artichoke	Elgarnoun	Digestive	Fruit-Leaf	Decoction
7		<i>Cynara cardunculus</i> L./ (03 AB_2016)	Cardoon	Elkhorchef	Digestive	Strem	Decoction
8		<i>Cichorium intybus</i> L./ (25 AB_2016)	Common chicory	Tilfef	Digestive	Leaf	Other Methods- Decoction
9		<i>Chamaemelum nobile</i> L./ (32 AB_2016)	Roman chamomile	Babounje	Digestive-Skin	Flower	Decoction
10		<i>Artemisia campestris</i> L./ (18 AB_2016)	Artemisia	Tagouft	Digestive	Leaf	Decoction
11		<i>Artemisia herba-alba</i> Asso./ (17 AB_2016)	white wormwood	Chih	Digestive	Leaf	Decoction
12		<i>Calendula officinalis</i> L./ (27 AB_2016)	Marigold / Calendula	Jemra	Digestive	Leaf	Decoction
13	Berberidaceae	<i>Berberis hispanica</i> Boiss. & Reut. (01 AB_2016)	Barberry	Aaneb eljebel	Urogenital	Seed-Fruit	Decoction
14	Boraginaceae	<i>Borago officinalis</i> L./ (33 AB_2016)	Borage	Elharcha	Respiratory	Leaf	Decoction
15	Brassicaceae	<i>Capsella bursa-pastoris</i> (L.) Medik./ (23 AB_2016)	Shepherd's-purse	Kisset elrai	Skin	Leaf	Infusion
16	Caprifoliaceae	<i>Lonicera etrusca</i> Santi./ (28 AB_2016)	Honeysuckle	Chahmet elatrous	Skin	Leaf	Infusion
17	Cupressaceae	<i>Juniperus phoenicea</i> L./ (02 AB_2016)	Phoenicean juniper	Arrar ahmer	Digestive	Leaf	Decoction
18		<i>Juniperus oxycedrus</i> L./ (24 AB_2016)	Prickly juniper	Etaga	Digestive	Fruit	Decoction

19		<i>Cupressus sempervirens</i> L./(35 AB_2016)	Cypress	Sarwel	Cardiac	Leaf	Decoction
20	Fagaceae	<i>Quercus ilex</i> L./(12 AB_2016)	Holly oak	Ballot	Urogenital-Digestive	Fruit	Infusion-Decoction
21	Globulariaceae	<i>Globularia alypum</i> L./(40 AB_2016)	Globulaire	Tasselgha	Digestive	Leaf-Flower	Decoction
22	Lamiaceae	<i>Mentha pulegium</i> L./(05AB_2016)	European pennyroyal	Fliou	Rhumatism	Leaf	Decoction
23		<i>Mentha piperita</i> L./(06AB_2016)	Peppermint	Naanaa	Digestive-Cardiac	Leaf	Infusion
24		<i>Ocimum basilicum</i> L./(29 AB_2016)	Basil	Lahbek	Respiratory	Leaf	Infusion
25		<i>Melissa officinalis</i> L./(13 AB_2016)	Lemon balm	Millissa	Digestive	Leaf	Infusion
26		<i>Teucrium polium</i> L./(20AB_2016)	Felty germander	Jaaida	Digestive	Leaf	Decoction
27		<i>Rosmarinus officinalis</i> L./(30 AB_2016)	Rosemary	Ikil eljabel	Digestive	Leaf	Decoction
28		<i>Thymus numidicus</i> Poir./(41 AB_2016)	Thym commun	Zaitra	Digestive	Leaf	Infusion
29		<i>Origanum compactum</i> Benth./(07 AB_2016)	Thym	Zaater	Respiratory-Digestive	Leaf	Decoction
30		<i>Marrubium vulgare</i> L./(21 AB_2016)	horehound	Meriweth	Urogenital-Respiratory	Leaf	Infusion-Decoction
31	Liliaceae	<i>Allium ampeloprasum</i> L./(22 AB_2016)	Porrum (leek)	Koureth	Digestive-Cardiac	Stem-Leaf	Other Methods
32	Linaceae	<i>Linum usitatissimum</i> L./(42 AB_2016)	Flax / Linseed	Elkaten	Skin	Seed	Decoction
33	Leguminosae	<i>Cassia senna</i> L./(36 AB_2016)	Senna	Senna mekki	Digestive	Leaf	Decoction

34	Malvaceae	<i>Malva sylvestris</i> L./ (14 AB_2016)	mallow	Khobeiza	Digestive-Urogenital	Leaf	Infusion
35		<i>Althaea officinalis</i> L./ (39 AB_2016)	Marsh mallow	Sekkoum	Urogenital	Stem	Other Methods
36	Oleaceae	<i>Olea europaea</i> L./ (46 AB_2016)	Olivier	Zeitoun	Digestive	Leaf-Fruit	Cataplasme
37	Papaveraceae	<i>Papaver rhoeas</i> L./ (08AB_2016)	Red poppy	Ben nouaaman	Skin	Flower-Leaf	Decoction
38	Pinaceae	<i>Cedrus atlantica</i> G.Manetti ex Carrière./ (45 AB_2016)	Atlas cedar	Elarez elatlassi	Rhumatism	Root	Decoction
39		<i>Pinus halepensis</i> Mill./ (47 AB_2016)	Aleppo pine	Snawber	Respiratory	Root	Decoction
40	Poaceae	<i>Ampelodesmos mauritanicus</i> (Poir.) T.Durand & Schinz./ (43 AB_2016)	Mauritanian grass	Diss	Urogenital-Digestive	Leaf	Decoction
41	Rhamnaceae	<i>Ziziphus lotus</i> (L) lam./ (15 AB_2016)	Lotus jujube	Essedra	Skin-Digestive	Leaf	Infusion
42		<i>Rhamnus alaternus</i> L./ (37 AB_2016)	Alaterne	Amlillis	Rhumatisme-Digestive	Leaf	Cataplasm-Infusion
43	Rosaceae	<i>Rosa canina</i> L./ (09 AB_2016)	Eglantier commun	Nessrin	Digestive	Flower	Decoction-Infusion
44		<i>Geum urbanum</i> L./ (48 AB_2016)	Herbennet	Hchicha mabrouka	Digestive	Leaf	Decoction
45		<i>Rubus ulmifolius</i> Schott./ (50 AB_2016)	Elm-leaved bramble	Elaalaig	Skin	Leaf	Cataplasme
46		<i>Crataegus monogyna</i> Jacq./ (16 AB_2016)	Hawthorn	Boumkharri	Digestive	Fruit	Decoction-Infusion
47	Rutaceae	<i>Ruta chalepensis</i> L./ (49 AB_2016)	Fringed rue	Elfijel	Digestive	Leaf	Decoction

48	Thymelaeaceae	<i>Daphne gnidium</i> L./ (10 AB_2016)	Daphne gnidium	Lazzaz	Digestive	Leaf	Infusion
49	Urticaceae	<i>Urtica dioica</i> L./ (38 AB_2016)	Nettle	Elhouraig	Respiratory	Leaf	Infusion
50	Zygophyllaceae	<i>Peganum harmala</i> L./ (44 AB_2016)	Harmal	Elharmel	Rheumatism	Seeds	Decoction-Cataplasm

## Conclusion

Our ethnobotanical study showed us that the inhabitants of the BPN frequently use the 50 species of plants in a curative and nutritive way. For example, Cardoon, Wild carrot, Artichoke, and Porrum are used for food, Harmal is used to treat rheumatism diseases, and Thym is used as an antitussive agent for the respiratory system, Thapsie is used as a cataplasm to treat rheumatological diseases but for internal use is toxic. Women use medicinal plants more than men, the most used parts are leaves and stems. The forms of use various, with the infusion which is the most used mode. These plants covering a wide spectrum of diseases are a primary source of healing for this purpose, to validate their popular usages, these plants should be studied in the areas of phytochemistry and pharmacology to discover the active ingredients [15]. These plants are used in herbal medicine as basic drugs, and as there are sensitive species to degradation factors (pollution, fire) which results in their disappearance. So, it becomes a necessity and a must to preserve and save those unique plants.

## Annex 1: Survey of the medicinally plant use

### 1. Informant information:

- Gender: Male ☐ Female ☐
- Age: < 20 yeas ☐ ( $\geq 20$  years and < 40 years ) ☐ ( $\geq 40$  years and < 60 years ) ☐  $\geq 60$  years ☐
- Socioeconomic level: unemployed ☐ Employed ☐ Student ☐
- Level of study: Illiterate ☐ Primary ☐ Middle ☐ Secondary ☐ University ☐
- Family status: Single ☐ Married ☐

### 2. Plant information:

- The name of the plant:
- The diseases used: Digestive ☐ Respiratory ☐ Urogenital ☐ Cardiac ☐ Skin ☐ Rheumatism ☐
- The part used: Leaf ☐ Stem ☐ Root ☐ Seed ☐ Flower ☐ Fruit ☐
- The mode of use: Decoction ☐ Infusion ☐ Cataplasm ☐ Fumigation ☐ Powder ☐ Other methods ☐

- The doses used:                      Unspecified dose ☐                      Precise dose ☐

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