

CONTRIBUTION TO THE FLORISTIC AND ETHNOBOTANICAL STUDY OF SOME MEDICINAL PLANTS USED IN CERTAIN REGIONS OF THE ALGERIAN SAHARA "CASE OF TIMIMOUN, ADRAR and REGGANE"

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Abstract. This modest work is an attempt to give an overview of the importance of the medicinal plants used by the population in the wilaya of Adrar. To find out about these medicinal plants traditionally used by the population, ethnobotanical surveys were conducted during the 2015/2016 to 2017/2018 campaigns in the Adrar region. The purpose of this approach is the collection of data on the therapeutic uses practiced. We selected for this work sixty (60) species of medicinal plants belonging to thirty (30) botanical families, and also to show that: 1. leaves are the most used parts; 2. the decoction is the most used method; 3. the most frequent administration is the oral route; 4. the majority of species were involved in the treatment of digestive and respiratory diseases; 5. the most represented families are Asteraceae and Fabaceae.

Keywords: Ethnobotany study; herbal medicine; medicinal plants; Adrar region.

INTRODUCTION

Several studies have shown that over 80% of people around the world continue to use herbal medicines [16]. It has been shown that herbal medicine is still used in Africa and other countries where modern pharmacopoeia is poorly developed [28]. This shows that herbal medicine has always existed in the Mediterranean countries [26]. The word ethnobotany is defined by the contraction of ethnology and botany [23]. The ethnobotanical research axis focuses on the different aspects that bind humans to different species of medicinal plants. Ethnobotanical studies conducted by many researchers have highlighted the importance of herbal medicine in Africa and around the world [11]. Moreover, it has been proven that there is a great diversity of medicinal plants in Africa [7, 9]. Also in Africa, traditional healers used these plants very often and with very satisfactory results, this led to a development and reassessment of herbal medicine [1]. There are also numerous ethnobotanical studies in the Maghreb, conducted by several researchers such as: Hadjaidji-Benseghier in 2013 [13] or Hseini and Kahouadji in 2007 [14]. This is the perspective of our work in the Adrar region. In Algeria, many ethnobotanical studies have been carried out in different regions, in order to highlight the true potential of our knowledge accumulated over the centuries and which may disappear forever. In Algeria, many plants have been ethnobotanical studies [6, 27]. One of the main objectives of our work is to contribute to the identification and preservation of some of our knowledge in the field of traditional Algerian medicine. As well as to emphasize the importance of herbal medicine, in the region of Adrar. Then these species can also be used effectively in pharmaceutical industries [15]. The present ethnobotanical study consists in carrying out a series of ethnobotanical surveys in this region, the aim being to gather the

information related to this traditional herbal medicine and also:

- the identification of the different categories of users of these medicinal plants.
- the identification of medicinal plants and parts of plants used different types of diseases treated.

MATERIAL AND METHODS

The zone of the study (the wilaya of Adrar)

The wilaya of Adrar is located in the south-west of Algeria. It occupies an area of 427 971 km², almost 20% of the total area of the Algerian territory [10].

Geographic location

The wilaya of Adrar is located in the south-west of Algeria, it is delimited in the north by the wilaya of El-Bayad and in the northwest by the wilaya of Bechar, while in the northeast it is delimited by the wilaya of Ghardaia. The wilaya of Tamanrasset delimits it to the south-east, whereas the wilaya of Tindouf delimits it to the southwest. Finally to the south the wilaya of Adrar is delimited by Mali. The population of the Adrar wilaya is estimated at 431 270 inhabitants and the density at 1.01 inhabitants / km² [2]. Adrar includes eleven (11) dairas and twenty-eight (28) municipalities. It is divided into four major geographical zones, namely:

- The Gourara (four (04) daïra, Aougrou, Charouine, Timimoun, Tinerkouk);
- Touat (five (05) daïra, Tsabit, Adrar, Fenoughil, Zaouiet Kounta, Reggane);
- The Tidikelt (two (02) daïra, one daïra in the wilaya of Adrar "Aoulef" and a second daïra "In Salah" in the wilaya of Tamanrasset);
- The Tanezrouft (only one daïra, Bordj Badji Mokhtar) [20, 21] (Fig. 1).

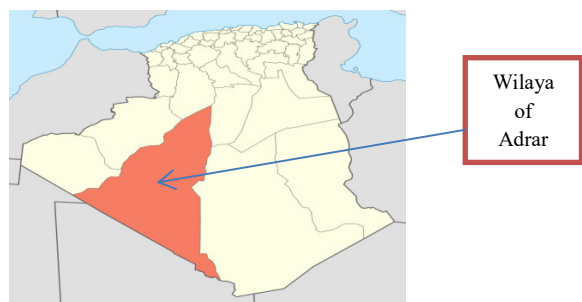


Figure 1. The wilaya of Adrar

Climatic synthesis of the Adrar region

The climate is the result of the combination of several meteorological parameters

• Gausson Ombrothèrmic Diagrams of the Adrar Region

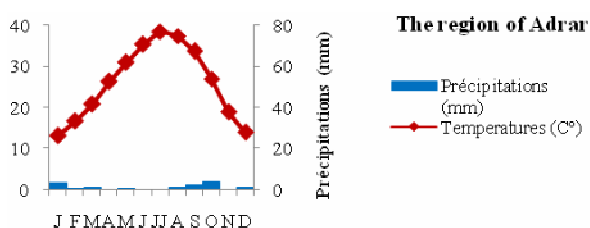


Figure 2. Ombrothèrmic Gausson Diagram of the Adrar Region (2007 to 2017).

According to the Gausson Ombrothèrmic Diagrams for the period from 2007 to 2017 (Fig. 2), we notice that the Adrar region is characterized by a dry period that spreads over the year. These results confirm all previous climate studies for which Adrar's climate is very hot, rare and irregular rainfall, violent sandstorms, and average annual rainfall do not exceed the 14 mm / year, and a temperature of the order of 26 °C, we find that the coldest month is January with average temperatures ranging from 5.6 °C to 21.3 °C, while the hottest is July with temperatures ranging from 29.3 °C to 46.3 °C. The climate is therefore Saharan type hyper arid [2].

Ethnobotanical study methods

The Ethnobotanical survey was conducted using a questionnaire. Users were interviewed in Arabic or Zenâtia. The surveys took place between 2015/2016 and 2017/2018. The investigations focused on the different medicinal plants and their modes of use in the study area.

The question sheet

We used a questionnaire proposed by Salhi and al in 2010, after having translated it from French to Arabic and adapted it to the objectives of our study. The answers give us information on the profile of the informant (age, gender, level of education, family situation), the local name of the medicinal plants studied, the part used, method of preparation, and the different types of diseases treated by these medicinal plants.

Survey Sites

For the realization of the surveys, we opted for the probabilistic stratified random sampling technique used by Daget and Godron in 1982 [7]. Our study area regroups three daïras distinct from the Adrar wilaya.; Which includes in the north the daïra of Timimoun and in the center the daïra of Adrar and in the south that of Reggan (Table 1).

Table 1. The list of daïras and communes studied

Daira	Number of towns	Towns
Timimoun	2	Ouled said, Timimoun
Adrar	3	Adrar, Bouda, Ouled Ahmed Temmi.
Reggan	2	Reggan, Sali

The overall study sample "N"

Our global sample is composed of three strata represented by a daïra. The number of people interviewed by daïra is equal to fifty people. Respondents are a representative sample of the population of the study area. The overall study sample "N" of the three strata; S1, S2, S3. (N = 150 people) (Table 2)

Table 2. Distribution of Surveys by Strata

Strata	Names of strata	Number of persons
S1	Timimoun	50
S2	Adrar	50
S3	Reggan	50
N	Global sample	150

Interviewees

The survey questionnaire was used to gather data on:

- Respondents.
- Species of the medicinal plants identified.

Identification of medicinal plants identified

The identification of different species of medicinal plants was carried out using certain documentation such as:

- Contribution to an Ethnobotanical study of medicinal plants in eastern Morocco [17];
- New flora of Algeria and the southern desert regions [24];
- Catalogues of vascular plants of Northern Morocco, including identification keys [29];
- Vascular flora of Morocco: inventory and chorology [12].

Calculation of (citation) quotation Frequencies (Fc) of all species of medicinal plants studied

The frequency of (citation) quotation (Fc) of one species of medicinal plant = (number of (citation) quotation of one species of medicinal plant / total number of (citation) quotation of all species of medicinal plants studies) x (100)

Data analysis and statistical processing

Data analysis was done using Excel (Microsoft Office).

RESULTS

The Ethnobotanical study in different daïras enabled us to obtain the following results concerning the respondents, which we presented by category.

Different categories of users of medicinal plants

• User category by age category

The users of the medicinal plants questioned are numerous, and for a better vision we classified them, first, by age categories:

Slices of age from 18 to 30 years, we have obtained a very low rate of about 13%.

Age range from 31 to 50 years, we observed a very high rate of about 33%.

For the other categories (Fig. 3)

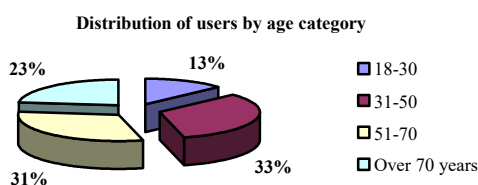


Figure 3. Users of medicinal plants by age category

• Category of users by gender category

In this gender category, there are 104 women (69%) and 46 men (31%).

• Users category by level of education

Our results showed us that among the people questioned:

- 63 users were illiterate; this represented the category that used the most medicinal plants with a rate of 42%.

- 11 users only, were university students representing a rate of 7%; this category had the lowest rate of use of medicinal plants, For the other categories, see Fig. 4.

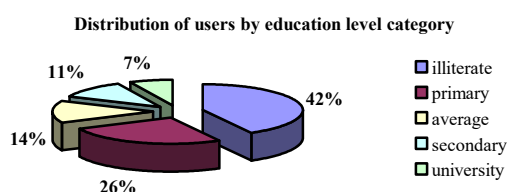


Figure 4. Users of medicinal plants by education level category

• User category according to family situation

Married people represent a rate of 92% and singles a rate of 8% among all respondents.

The list of medicinal plants selected for our study

At the end of the Ethnobotanical survey, we were able to establish the list of medicinal plant species selected for our study, as well as their specific natures by family (Table 3).

Floristic analysis

The fieldwork in this region allowed us to identify different species of medicinal plants used in local herbal medicine; we selected 60 species belonging to thirty (30) families (Table 3).

- *Asteraceae* and *Fabaceae* (5 species) with a rate of 8.33%;

- Monitoring of *Brassicaceae* and *Solanaceae* and *Lamiaceae* (4 species) with a rate of 6.66%;

- Following *Apiaceae*, *Poaceae*, *Zygophyllaceae*, *Apocynaceae*, (3 species) with a rate of 5%;

- Monitoring of *Verbenaceae*, *Tamaricaceae*, *Cucurbitaceae*, *Orobanchaceae*, *Liliaceae* (2 species) with the rate of 3.33%;

- In the last position *Euphorbiaceae*, *Rubiaceae*, *Caryophyllaceae*, *Asphodelaceae*, *Moringaceae*, *Linaceae*, *Lythraceae*, *Rutaceae*, *Rhamnaceae*, *Pedaliaceae*, *Primulaceae*, *Punicaceae*, *Ranunculaceae*, *Resedaceae*, *Chenopodiaceae*, *Sapotaceae*, (1 species) with a common percentage of 1.66% for each family.

• Frequency of (citation) quotation (Fc) and frequency of use of a species of medicinal plants studied

The frequency of (citation) quotation (Fc) of one species of medicinal plant = (number of (citation) quotation of one species of medicinal plant / total number of (citation) quotation of all species of medicinal plants studies) x (100)

The data presented here shows the Frequency of (citation) quotation (Fc) of a species of medicinal plants studied and Frequencies of medicinal plants most commonly used by the population (Table 3).

• The different parts of the medicinal plants used

The results of the Ethnobotanical surveys also gave us an idea about the use of different parts of medicinal plants. The most used parts were ranked in the following descending order:

- the leaves were the most used part with a rate of 47%;

- followed by Seeds with a rate of 23.33%;

- followed by Roots with a rate of 11.66%;

- followed by Fruits with a rate of 6.66%;

- followed by Flowers with a rate of 5%;

- and last plants and stems with the same rate which is equal to 3.33%.

• The different methods of preparation of the medicinal plants used

At the end of the Ethnobotanical surveys in our study area, we identified different methods of preparation of the medicinal plants used.

The results obtained showed the percentage of use of the various preparation methods, in descending order according to:

- The decoction with a percentage of 48.33%;

- Powder with a percentage of 26.66%;

- The infusion with a percentage of 8.33%;

- Oil with a percentage of 6.66%;

- Cooked with a percentage of 5%;

- Raw (uncooked) with a percentage of 5%.

• Different methods of administering medicinal plants used

Our survey showed that the oral method is the most cited method with a rate of 78.33% of cases, followed by whitewashing with a rate of 20% and finally fumigation with a rate of 1.66%.

Table 3. List and specific nature of the families and Frequency of (citation) quotation (Fc) and Frequency of use (Fu) of medicinal plants studied

Family	Specific nature (%)	Scientific name	Goup	Local name	Fc	Fu
Apiaceae	5	<i>Ammi visnaga</i> (L.) Lam.	1	El Khella	0.26%	04.66%
		<i>Ammodaucus leucotrichus</i> Coss.&Dur	1	Oum driga	2.42%	42.66%
		<i>Pimpinella anisum</i> L.	2	Habet-Hlawa	3.49%	61.33%
Apocynaceae	5	<i>Calotropis procera</i> (Aiton) W.T.Aiton.	3	El Kranka	0.26%	04.66%
		<i>Pergularia tomentosa</i> L.	3	Esselakha	0.11%	02.00%
		<i>Nerium oleander</i> L.	3	Edefla	0.30%	05.33%
Asphodelaceae	1.66	<i>Asphodelus tenuifolius</i> Cav.	1	Tazia	0.15%	02.66%
Asteraceae	8.33	<i>Hypochaeris radicata</i> L.	3	Elgram	0.30%	05.33%
		<i>Carthamus tinctorius</i> L.	1	Ez-Zaafour	1.32%	23.33%
		<i>Cotula cinerea</i> Delile	2	Gartofa,	0.26%	04.66%
		<i>Centaurea pungens</i> Pomel	3	Chouk lebyad	0.53%	09.33%
		<i>Matricaria pubescens</i> (Desf.) Schultz	1	Wazwaza	0.41%	07.33%
Brassicaceae	6.66	<i>Diplotaxis harra</i> (Forsk.) Boiss	1	El harra	2.04%	36.00%
		<i>Eruca sativa</i> Mill.	1	El-Jerjir	0.30%	05.33%
		<i>Lepidium sativum</i> L.	2	Hab-Erhad	3.64%	64.00%
		<i>Diplotaxis tenuifolia</i> (L.) DC.	1	Lamkar	0.34%	06.00%
Caryophyllaceae	1.66	<i>Silene lynesii</i> Norman	3	Mkhinza	0.68%	12.00%
Chenopodiaceae	1.66	<i>Halocnemum strobilaceum</i> (Pall.) MB	3	El-ressal	0.15%	02.66%
Cucurbitaceae	3.33	<i>Citrullus colocynthis</i> (L.) Schrad.	1	Elalkam	1.78%	31.33%
		<i>Cucurbita maxima</i> Duchesne	1	Kabouya	3.30%	58.00%
Euphorbiaceae	1.66	<i>Ricinus communis</i> L	3	Chehmetechgoug	1.59%	28.00%
Fabaceae	8.33	<i>Acacia arabica</i> Willd.	2	Neguire	0.22%	04.00%
		<i>Cassia angustifolia</i> Vahl.	1	Hgargar	0.15%	02.66%
		<i>Ceratonia siliqua</i> L.	1	Kheroub	0.07%	01.33%
		<i>Glycyrrhiza glabra</i> L.	1	Erg-Essouss	2.01%	35.33%
		<i>Trigonella foenum-graecum</i> L.	1	El Halba	5.31%	93.33%
Lamiaceae	6.66	<i>Marrubium vulgare</i> L.	1	Maryout	2.35%	41.33%
		<i>Mentha spicata</i> L.	1	Nanaa	5.16%	90.33%
		<i>Ocimum basilicum</i> L.	3	Lahbak	3.71%	65.33%
		<i>Ocimum tenuiflorum</i> L.	3	Lahbika	3.71%	65.33%
Liliaceae	3.33	<i>Allium cepa</i> L.	1	Etoum	4.51%	79.33%
		<i>Allium sativum</i> L.	1	Bassal	5.31%	93.33%
Linaceae	1.66	<i>Linum usitatissimum</i> L.	3	Zeriat Elketane	4.85%	85.33%
Lythraceae	1.66	<i>Lawsonia inermis</i> L.	1	Elhenna	5.50%	96.66%
Moringaceae	1.66	<i>Moringa oleifera</i> Lam.	1	Moringa	0.18%	03.33%
Orobanchaceae	3.33	<i>Cistanche tinctoria</i> (Forssk.) Beck	1	Denoune	0.30%	05.33%
		<i>Cistanche violacea</i> (Desf.) Hoffmanns & Link	1	Denoune	0.26%	04.66%
Pedaliaceae	1.66	<i>Sesamum indicum</i> L.	1	El- Jeljlane	1.74%	30.66%
Poaceae	5	<i>Cenchrus ciliaris</i> L.	1	Essbat	0.56%	10.00%
		<i>Cynodon dactylon</i> (L.) Pers.	3	Enjem	0.75%	13.33%
		<i>Polypogon monspeliensis</i> (L.) Desf.	3	Dil el far	0.11%	02.00%
Primulaceae	1.66	<i>Anagalis arvensis</i> L.	3	Oum lbina	0.72%	12.66%
Punicaceae	1.66	<i>Punica granatum</i> L.	1	Eroman	4.21%	74.00%
Ranunculaceae	1.66	<i>Nigella sativa</i> L.	2	Elhaba Sawda	4.13%	72.66%
Resedaceae	1.66	<i>Randonia africana</i> Coss.	3	Legudem	1.74%	30.66%
Rhamnaceae	1.66	<i>Ziziphus mauritiana</i> Lam.	3	Sedra	4.66%	82.00%
Rubiaceae	1.66	<i>Rubia tinctorum</i> L.	1	Fowa	2.42%	42.66%
Rutaceae	1.66	<i>Ruta tuberculata</i> Forssk.	2	El-fijel	1.59%	28.00%
Sapotaceae	1.66	<i>Argania spinosa</i> (L.) Skeels	3	Argane	0.07%	01.33%
Solanaceae	6.66	<i>Datura innoxia</i> Miller	2	Galbedjmel	0.72%	12.66%
		<i>Datura stramonium</i> L.	2	El hebala	0.49%	08.66%
		<i>Hyoscyamus muticus</i> L.	2	El btina	0.37%	06.66%
		<i>Solanum nigrum</i> L.	1	Anebedibe	1.36%	24.00%
Tamaricaceae	3.33	<i>Tamarix gallica</i> L.	1	Etila	0.18%	03.33%
		<i>Tamarix aphylla</i> (L.) Karst.	3	Ferssigue	0.15%	02.66%
Verbenaceae	3.33	<i>Aloysia citriodora</i> Palau	2	Meluisa	0.49%	08.66%
		<i>Vitex agnus-castus</i> L.	3	kherwaa el ma	0.56%	10.00%
Zygophyllaceae	5	<i>Peganum harmala</i> L.	3	El harmel	2.35%	41.33%
		<i>Zygophyllum album</i> L.f.	1	El-Agaia	3.03%	53.33%
		<i>Balanites aegyptiaca</i> (L.) Del.	1	Tabourag	0.07%	01.33%

* total number of (citation) quotation of all the medicinal plant species studies and given by all the people interviewed in the communes of TIMIMOUN, ADRAR and REGGANE = 2635.

• The different types of diseases treated by medicinal plants

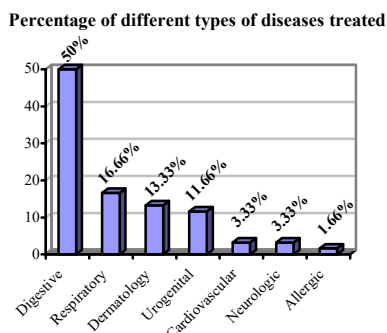


Figure 5. The different type of diseases treated

The results obtained following this Ethnobotanical study, allowed us to identify the different types of diseases treated by medicinal plants. The decreasing

ranking of the percentages of these medicinal plants gave us the following results:

- The highest rate of registered medicinal plant involved in the treatment of digestive diseases, with a rate of 50%.
- followed by respiratory diseases with a rate of 16.66%. For the other results, see Fig. 5.

Statistical treatment

Statistical treatment is a tool that can help us determine the relationships that may exist between the species of medicinal plants studying the different diseases treated.

Hierarchical ascending classification (CAH)

The results of the ascending hierarchical classification (CAH) analysis allowed us to classify all the medicinal plant species studied according to the different diseases they treat (Fig. 6). This analysis focused on 60 species of medicinal plants.

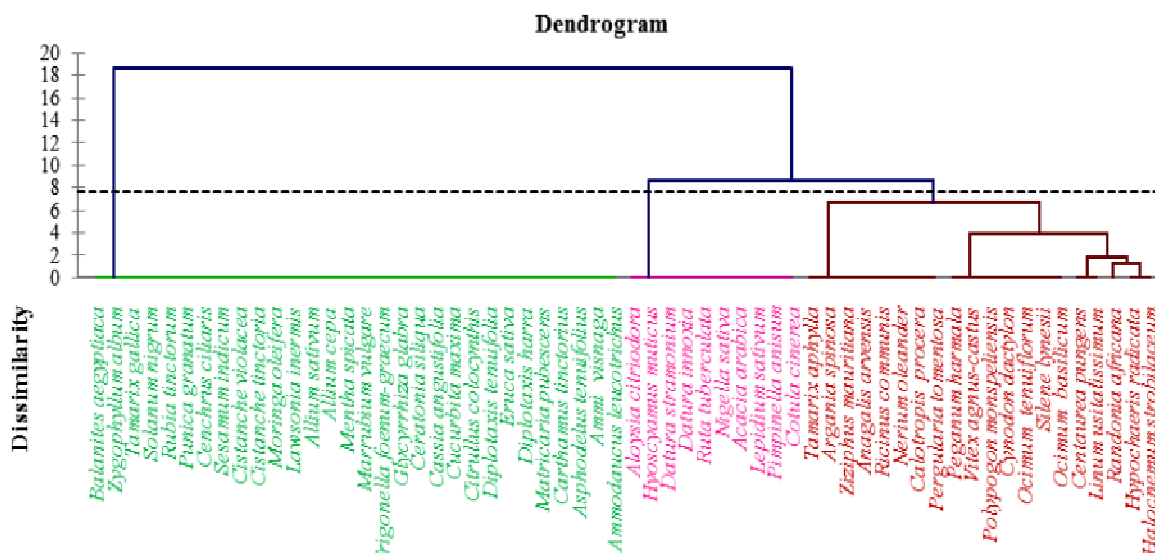


Figure 6. Dendrogram of classification of the medicinal plants studied

DISCUSSIONS

The results obtained for the different age categories revealed that the 18-30 age groups had little interest in the use of medicinal plants and local herbal medicine. The 31 to 50 age group has the highest user rate. A similar result was obtained in 2010 by Benknigue [3]. Regarding the results by category of sex, it is the women who use the most medicinal plants. This same result was obtained in 2007 by Mehdioui [18], or in 2014 by Bouallala [5]. However, for user categories by level of education, illiterate users represent the largest category with a rate greater than 60%, while academics represent the smallest category with a rate below 06%. The results obtained in the category of the family situation were already obtained in 2010 by Benknigue [3], but with different proportions. The result of our floristic study is different from the results obtained in 2010 by Monteiro [20], and that obtained in 2007 by Hseini in Morocco [14], and differ from that obtained

in 2010 by Etuk in Nigeria [11]. We observe that the results of floristic studies are generally different from one study to the next. Indeed, this disparity in the results is influenced by the geographical difference of the study areas and by the studied flora itself, which differs from one country to another. Regarding the different parts of the medicinal plants used, our study has shown that leaves are the most used parts. This has already been demonstrated by Sadou, for whom dried decoction leaves are the most used for treating gastrointestinal disorders [25], as well as by another study conducted in 2002 by Betti [4] or in 2010 by Monteiro [19] and also in 2011 by Dibong [9]. For the different methods of preparation of the medicinal plants used, our result shows that the decoction is the most used method of preparation. This result was different from those of Daoudi for whom the majority cures for treating diseases gastric, are prepared essentially by infusion [8]. Regarding the different methods of administration of preparations of medicinal

plants, our result is identical to that obtained in 2006 by Ouattara [22] but of course with different proportions. The results for the different types of diseases treated showed us that most of the identified medicinal plants are used in the treatment of diseases of the digestive system. This result confirms the results already obtained in 2010 by Monteiro [19]. The examination of the dendrogram obtained by the ascending hierarchical classification method (CAH), allowed us to note the existence of distinct groups (see Table 3). The first group (group1) exclusively includes species specialized in the treatment of digestive diseases. It brings together 30 species. By refining the classification, from the dendrogram, we can see that the most used parts are leaves with a percentage of 36.66%, followed by seeds and roots with the same percentage, equal to 16.66%, and the fruit at 13.33%, the flowers at 10% and finally, the stems and plants with a percentage of 3.33% for each. The second group (group2) comprises 10 species specialized in the treatment of respiratory diseases. The most used parts are the leaves with a percentage of 50% and the seeds of 50%. The third group (group3) includes 20 species that treat the remaining diseases (dermatology 40%, urogenital 35%, neurology 10%, cardiovascular 10%, allergic 5%). The parts used are the leaves with a percentage of 60%, followed by the seeds with a percentage of 20%, followed by the roots with a percentage of 10%, the rest of the parts, namely the stems, the plants have the same percentage which is equal to 5% for each part. Examination of the group classification dendrogram, obtained by the ascending hierarchical classification (CAH) method, of course makes it possible to highlight the existence of the three well-distinguished groups, and also that the leaves are the most used parts for each group, followed by seeds or roots.

The Ethnobotanical study carried out in our region of study allowed us to collect information concerning the use of medicinal plants in local herbal medicine. The floristic study has shown that the population continues to use medicinal plants. There are 60 species of medicinal plants belonging to 30 families whose main data are the Asteraceae and Fabaceae 5 species including the most represented families with a rate of 8.33%.

In light of comparative observations, we can say at this stage of our study that despite the availability and accessibility of medicine and modern pharmacology, the use of medicine plants occupies and will continue to occupy an important place in phytotherapy in our study area. We can give as example the *Cistanche tinctoria* and the *Cistanche violacea* which are always used to treat the digestive diseases and the genito-urinary diseases and also like aphrodisiac, like other example we can mention *Ammodaucus leucotrichus* whose seeds in powder are very used to treat digestive and respiratory diseases in the region of Adrar.

Acknowledgements. I extend my thanks to Dr. OULD-ESSAFI Mohammed of I.N.R.F-Adrar and Mr. KHARSI Mohammed of I.N.R.A-Adrar for their help.

REFERENCES

- [1] Badiaga, M., (2012): Etude ethnobotanique, phytochimique et activité biologiques de *Nauclea latifolia* Smith une plante médicinale africaine récoltée de Mali. Thèse de doctorat en chimie organique, université Bamako.
- [2] Benhamza, M., (2013): Aperçu hydrogéologique et hydrochimique sur le système de Captage traditionnel des eaux souterraines «foggara» dans la région d'Adrar. Mémoire De Magistère, Université Badji Mokhtar, Annaba.
- [3] Benkhniq, O., Zidane, L., Fadli, M., Elyacoubi, H., Rochdi, A., Douira, A., (2010): Etude ethnobotanique des plantes médicinales dans la région de Mechraâ Bel Ksiri (Région du Gharb du Maroc). Acta Botanica Barcinonensia. 53: 191-216.
- [4] Betti, J.L., (2002): Medicinal plants sold in Yaoundé markets, Cameroon. African Study Monographs, 23(2): 47-64.
- [5] Bouallala, M., Bradai, L., Abid, M., (2014): Diversité et utilisation des plantes spontanées du Sahara septentrional algérien dans la pharmacopée saharienne. Cas de la région du Souf. Revue El-Wahat pour les Recherches et Etudes, 7(2): 18-26.
- [6] Chermat, S., Gharzouli, R., (2015): Ethnobotanical Study of Medicinal Flora in the North East of Algeria - An Empirical Knowledge in Djebel Zdimm (Setif). Journal of Materials Science and Engineering A 5 (1-2): 50-59.
- [7] Daget, P., Godron, M., (1982): Analyse fréquentielle de l'écologie des espèces dans les communautés. Masson, Paris, 163 p.
- [8] Daoudi, A., Bammou, M., Zarkani, S., Slimani, I., Ibjibjen, J., Nassiri, L., (2015): Étude ethnobotanique de la flore médicinale dans la commune rurale d'Aguelmous province de Khénifra (Maroc). Phytothérapie, 17: 1-10.
- [9] Dibong, S.D., Mpondo, E., Ngoye, A., Kwin, M.F., Betti, J.L., (2011): Ethnobotanique et phytomédecine des plantes médicinales de Douala, Cameroun. Journal of Applied Biosciences, 37: 2496-2507.
- [10] Dubost, D., (2002): Ecologie et aménagement et développement agricole des oasis algériennes. Ed. CRSTRA, Biskra, 423 p.
- [11] Etuk, E.U., Bello, S.O., Isezuo, S.A., Mohammed, B.J., (2010): Ethnobotanical Survey of Medicinal Plants used for the Treatment of Diabetes Mellitus in the North Western Region of Nigeria. Asian Journal Of Experimental Biological Sciences., 1(1): 55-59.
- [12] Fennane, M., Ibn Tattou, M., (2005): Flore vasculaire du Maroc: Inventaire et Chorologie. Vol. I., Travaux de l'Institut scientifique. Série Botanique 37, 483 p.
- [13] Hadjajdi-Benseghier, F., Derridj, A., (2013): Relative importance of the exploitation of medicinal plants in traditional medicine in the Northeastern Sahara. Emirates Journal of Food and Agriculture., 25(9): 657-665.
- [14] Hseini, S., Kahouadji, A., (2007): Etude ethnobotanique de la flore médicinale dans la région de Rabat (Maroc occidental) Lazaroa 28: 79-93.
- [15] Iram, F., Maria, M., Sana, I., Zunaira, S., (2019): Ethno-medicinal uses of wild herbs and shrubs of tehsil yazman, punjab, pakistan. Pakistan Journal of Agricultural Sciences., 56(3): 735-741.

- [16] Jiofack, T., Fokunang, C., Guedje, N., Kemeuze, V., Fongnzossie, E., Nkongmeneck, B.A., Mapongmetsem, P.M., Tsabang, N., (2010): Ethnobotanical uses of medicinal plants of two ethnoecological regions of Cameroon. *International Journal of Medicine and Medical Sciences*, 2(3): 60.
- [17] Kahouadji, M.S., (1995): Contribution a une étude ethnobotanique des plantes médicinales dans le Maroc orientale. Thèse Doctorat 3eme cycle, Faculté des Sciences, Université Mohamed I, Oujda, Maroc.
- [18] Mehdioui, R., Kahouadji, A., (2007): Etude ethnobotanique auprès de la population riveraine de la forêt d'Amsittène: cas de la Commune d'Imi n'Tlit (Province d'Essaouira). *Bulletin de l'Institut Scientifique, Rabat, section Sciences de la Vie*, 29: 11-20.
- [19] Monteiro, J.M., Araujo, L.E., Amorim, E.L.C., Albuquerque, U.P., (2010): Local markets and medicinal plant commerce: a review with emphasis on Brazil. *Economic Botany*, 64(4): 352-366.
- [20] Moulay, M., (2014): Caractérisation écologique de peuplement de *Balanites aegyptiaca* (L.) Del. à oued Matriouane dans la région d'Aoulef Adrar. Thèse Master, Université de Tlemcen, Algérie.
- [21] Moussaoui, D.E., (2016): Contribution à l'étude morphométrique de *Leucaena leucocephala* (Lam.) dans la région d'Adrar. Thèse Master, Université de Tlemcen, Algérie.
- [22] Ouattara, D., (2006): Contribution à l'inventaire des plantes médicinales significatives utilisées dans la région de Divo (sud forestier de la Côte-d'Ivoire) et à la diagnose du poivrier de Guinée: *Xylopiya aethiopica* (Dunal) A. Rich. (*Annonaceae*). Thèse de Doctorat de l'Université de Cocody-Abidjan, UFR Biosciences, Laboratoire de Botanique, Côte-d'Ivoire.
- [23] Pelt, J.M., (2008): L'ethnobotanique savoirs d'hier médecine de demain, conférence enregistrée au magasin Botanic de Gaillard en Juin 2008.
- [24] Quézel, P., Santa, S., (1963): Nouvelle flore d'Algérie et des régions désertiques Méridionales. C.N.R.S., 1170 p.
- [25] Sadou, N., Seridi, R., Hamel, T., (2016): Chemical Composition and Antioxidant Activity of Essential Oils of *Thymus ciliatus* subsp. *coloratus* from Annaba Algeria. *International Journal of Pharmaceutical Sciences Review and Research*, 40(2): 180-185.
- [26] Scherrer, A.M., Mott, I.R., Weckerle, C.S., (2005): Traditional plant use in the areas of Monte Vesole and Ascea, Cilento National Park (Campania, Southern Italy). *Journal of Ethnopharmacology*, 97: 129-143.
- [27] Slimani, I., Najem, M., Belaidi, R., Bachiri, L., Bouiamrane, E., Nassiri, L., Ibjibjen, J., (2016): Ethnobotanical Survey of medicinal plants used in Zerhoun region Morocco. *International Journal of Innovation and Applied Studies*. 15: 846-863.
- [28] Tabuti, J.R.S., Lye, K.A., Dhillon, S.S., (2003): Traditional herbal drugs of Bulamogi, Uganda: plants, use and administration. *Journal of Ethnopharmacology*, 88: 19-44.
- [29] Valdes, B., Rejdali, M., Achhal el Kadmiri, A., Jury, J.L., Montserrat, J.M., (2002): Catalogues des plantes vasculaires du Nord du Maroc, incluant des clés d'identification. Vol 2, 1498 p.

Received: 24 May 2019

Accepted: 27 November 2019

Published Online: 30 November 2019

Analele Universității din Oradea, Fascicula Biologie
<http://www.bioresearch.ro/revistaen.html>

Print-ISSN: 1224-5119

e-ISSN: 1844-7589

CD-ISSN: 1842-6433

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