Egypt. J. Bot. **Vol. 63**, No. 3, pp. 1083-1100 (2023)

Egyptian Journal of Botany
http://ejbo.journals.ekb.eg/

Ethnobotanical Study of Spontaneous Medicinal Plants Gouraya's National Park (Bejaia- Algeria)

Thoraya Dahmane[1, 2]#, Zakia Kaci[1, 3], Nacera Hadj Mohamed[4, 5], Aicha Abed[1], Faiza Mebkhout[6, 7]

[1]Department of Agronomic Sciences, Faculty of Natural and Life Sciences and Earth Sciences, University of Djilali Bounaama, Khemis Miliana, Route de Thniet El Had, Khemis Miliana, Ain Defla (44000) Algeria; [2]Soft Technology Laboratory, Valorisation of Biological Materials and Biodiversity, M'hamed Bouguera Boumerdès University, Avenue de l'indépendance, Boumerdès (35000) Algeria; [3]Water, Rock and Plant Laboratory, Djilali Bounaâma University, Khemis Miliana, Route de Thniet El Had, Khemis Miliana, Ain Defla (44000) Algeria; [4]Department of Earth and Universal Sciences, Faculty of Natural and Life Sciences and Earth Sciences, University of Djilali Bounaama, Khemis Miliana, Route de Thniet El Had, Khemis Miliana, Ain Defla (44000) Algeria; [5]Laboratory of metallogeny and magmatism of Algeria, Houari Boumediene University of Science and Technology - BP 32 El Alia, 16 111 Algiers, Algeria; [6]Institute of Veterinary Sciences, University Saad Dahlab Blida 1, Street Soumaa, 09000, Blida, Algeria; [7]HASAQ Laboratory, National Superior Veterinary School, 16000, Algiers, Algeria.

SINCE ancient times, humans have used plants for medicine, food, and shelter. The trend towards the use of traditional medicinal plants is increasing in many developed and developing countries due to their local abundance, cultural significance, and low cost of procurement. In Algeria, phytotherapy is widespread and forms an integral part of the culture of the local population, but unfortunately, no traditional Algerian pharmacopoeia has been established. This ethnobotanical study was carried out in Gouraya's National Park (GNP) (Bejaia, Algeria), based on a survey of 50 indigenous men and women. The interviews focused on the profile (gender, age, level of education) and on the plants and their uses (botanical family, vernacular names, and mode of use). Results reveal the use of 24 plant species belonging to 18 families for the treatment of various diseases. The collected data were analyzed by calculating family important value, Lamiaceae is the most represented (FIV = 0.88), higher use value (0.96=UV), and the relative frequency of citation (RFC= 0.62) were reported for Olea europeae .44% of the respondents were illiterate. While those with higher education represented only 02% of the group. The majority (64%) of the local population in the study area has traditional knowledge of medicinal plants to treat various human ailments. Most plants had been involved in the treatment of digestive disorders (36%). This study also revealed that leaves are the most commonly used parts and that infusion is the most common mode of preparation in therapeutic treatment.

Keywords: Ethnobotanic, GNP (Algeria), Indigenous, Spontaneous medicinal plant, Traditional medicine.

Introduction

Plant resources have remained an integral part of human society throughout history. They has been used for food, shelter, and medicine for a long time (Pandey & Tripathi, 2017). Humans and plants have had a complex relationship throughout history. The use of aromatic and medicinal plants and their derivatives for food and therapeutic purposes has been very common worldwide since ancient times (Schaal, 2019). Medicinal plants possess great importance in providing health care to about 80%

#Corresponding author email: thoraya.dahmane@univ-dbkm.dz Tel.: 00 213 661 306 546
Received 27/03/ 2023; Accepted 26/07/ 2023
DOI: 10.21608/ejbo.2023.202565.2294
Edited by: Prof. Dr. Wafaa Amer, Faculty of Science, Cairo University, Giza, Egypt.

of the rural population (WHO, 2002; Shrestha & Dhillion, 2003). Plants have been an important source of precursors and products used in a variety of industries, including those of pharmaceuticals, food, cosmetics, and agrochemicals (Suffredini et al., 2004; Regnault-Roger et al., 2005).

Vegetates resources are used as a promising source of various bioactive compounds which constitutes the basis of a new drug where discovered due to ethnobotanical studies (Mc-Kenna et al., 1995; El-Hachlafi et al., 2020).

In recent decades, various methods/techniques have been used to assess the historical importance of known natural products while emphasizing their potential as a source of novel compounds that can be directly used as therapeutic agents, or even as inspiration for medicinal compounds Source chemist. Traditional knowledge is now a valuable resource for researchers in the pharmaceutical industry. Physicians, herbalists, and pharmacists understand the healing power of medicinal plants in making diseases more effective (WHO, 2002; Urso et al., 2016; Mongalo & Raletsena, 2022). It is currently proven that about 20% of the plant species growing worldwide have therapeutic or cosmetic properties, as they contain molecules or active principles with different biological properties. These active molecules are applied in various fields, in medicine, pharmacy, cosmetology and agriculture (Suffredini et al., 2004; Regnault-Roger et al., 2005).

A very rich and diversified flora used as medicinal plants, herbs, and aliments due to its geographical location and the significant diversity of its climatic conditions characterize Africa (Farombi, 2003).

According to Quezel & Santa (1962), Algeria possesses nearly 3,000 species of vascular plants belonging to many botanical families with 15% being endemic, but they have been poorly explored and valorized by researchers. Over 600 plant species are specially composed of medicinal and aromatic plants (Mokkedem, 2004; Beloued, 2005).

The edaphic and climatic diversity makes Algeria, in general, and its forests in particular, show a region of North Africa whose spontaneous flora is very varied in useful plants, in particular, the aromatic and medicinal plants very rich in plant species likely to provide natural substances and original flavors useful for the various agro alimentary, pharmaceutical, cosmetic industries, etc. The present study aims to document medicinal and aromatic plants used in traditional medicine in Gouraya's National Park (GNP) which is located in the Wilaya of Bejaia (northeast of Algeria) to contribute to saving local popular knowledge, to contribute to the realization of a traditional Algerian pharmacopoeia.

Materials and Methods

Study area

Gouraya's National Park (36° 46' N and 05° 06' E) occupies an estimated area of 2080 ha. The GNP is located in Bejaia city 250km East of Algiers at an altitude of approximately 672 meters above sea level. It is bordered by cliffs to the North and to the East, by Issoumar » and Taourirt-Ighil » towns to the west, and by Bejaia to the South. It is located entirely in the Wilaya and commune of Bejaia, 127km east of Tizi Ouzou, 110km northeast of Sétif, 96km west of Jijel, and 239km South-East of Constantine. Indeed, this park occupies 10.2% of the total area of Bejaia (Mahmoudi, 2020) (Fig. 1).

The Gouraya was integrated to the park by perfectible Decree N° 407/2001. In 2004, the GNP has been classifed as biosphere reserve by Conseil International of Coordination of Programme « *l'Homme et la biosphère »* UNESCO, Paris.

Vegetal material

Vegetal material is essentially composed of medicinal species (with therapeutic interest only) harvested in the study area.

Data collection

To complete the current ethnobotanical study, we carried out a local field study listing most of the medicinal plants was used to treat various diseases in the BSP region of northeastern Algeria. Ethnobotanical data were collected from respondents by providing a questionnaire based on supervised fieldwork and interviews. The informers included farmers, homemakers, shepherds, and farmers. The questionnaire is based on personal interviews with residents (50 indigenous people). Responses included information on medicinal plant use, such as original name, treatment of common zoonotic diseases, ingredients used, formulations, and route of administration (Faruque et al., 2019). The taxonomic identification of plant species was carried out with the help of the GNP researchers.

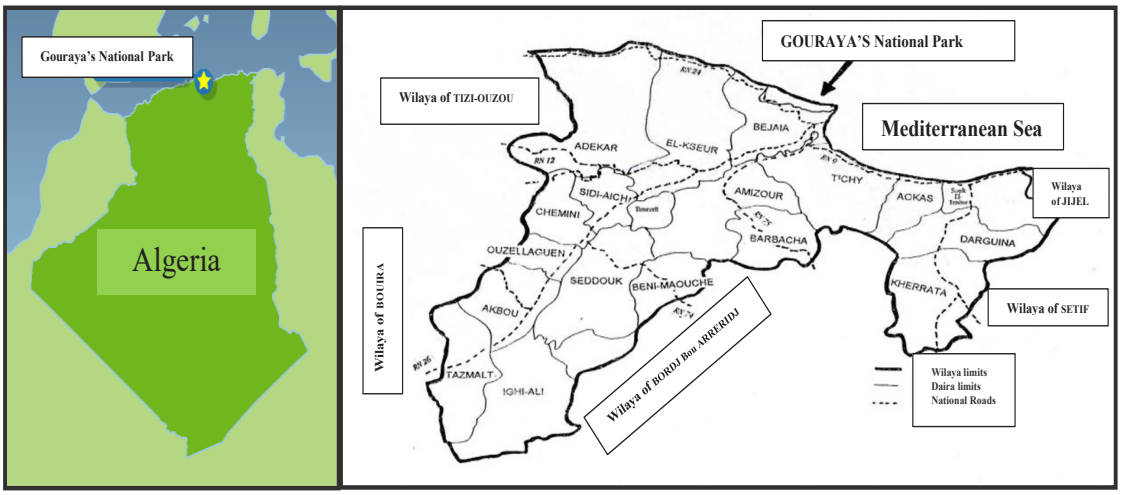

Fig. 1. Geographical situation of Gouraya's National Park (GNP)

Data analysis

The collected ethnobotanical data were analysed and summarised by descriptive statistical methods such as frequency distributions, percentages, tables, and graphs using Microsoft Excel (2013). The relative frequency of citation (RFC), the family importance value (FIV), and the use value (UV) were determined.

Relative frequency of citation (RFC) is calculated as the sum of informants that cite a use for the plant species, as follows (Vitalini et al., 2013; Vijayakumar et al., 2015):

RFC = F/N avec (0 < RFC < 1)

where, F: represents the number of requested using a specie and N: total number of informants.

Family Importance value (FIV): According to Molares & Ladio (2009), the family importance value indicate the importance of plant families used plants. It was calculated using the following formula:

FIV = NFC/NF

where, NFC: represent the number of families cited by requested and N: total number of interviewees.

Use value (UV) is a quantitative method that can be used in order to prove the relative importance of the plant species known locally. The Equation to determine the UV is given below (Tardío & Pardo-De-Santayana, 2008).

$UV = \sum Ui / N$

where, Ui: represents specific plant species declared pharmaceutically important by the informers and N: represents the total number of individual species interviewed or reported

Results

A total of 24 medicinal plant species, belonging to 18 families were used by the local communities to treat human diseases. The presented data are the general results of the ethnobotanical survey conducted at Gouraya's national park. Recorded plant species with their botanical family, vernacular names (French, Arabic, and Kabyle), parts used, active ingredients, forms of use, therapeutic effects, type of diseases treated, as well as the relative frequency of citation (RFC), family importance value (FIV) and use value (UV) are listed in Table 1.

The results obtained show that the FRC values vary from 0.24 (Phillyrea angustifolia) to 0.96 (Olea europeae) representing the most used species.

Based on RFC values and FIV, the most cited species generally belong to the most cited families as well. The highest values are in the Lamiaceae family (presented by three species) with an FIV of 0.88. On the other hand, we noted the presence of only one species per family, but the latter remains widely appreciated by the respondents, such as *Pistacia lentiscus* with an RFC of 0.96.

TABLE 1. Diversity and therapeutic properties of medicinal species in GNP

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
01	*Pistacia lentiscus* L.	Anacardiaceae	**French :** Pistachier lentisque, Arbre à mastic **Arabic :** Daroue **Kabyle :** Tidikth	Leaves Fruits Mastic	Essential oil Oleoresin Resin : Masticoresins Pinenes: Tannins Mastichic acid	Infusion Vegetable oil Cataplasm Essential oil	Antiseptic Astringent Expectorant/Cough Suppressant/Escalants Cicatrisant/Vulnerary Hemostatic	Microbial diseases Bronchitis Cicatrisante Influenza and Colds	0.96	0.96	0.57
02	*Asparagus verticillatus* L.	Asparagaceae	**French :** Asperge sauvage **Arabic :** Hilyoun **Kabyle :** Sekkoum, Iskimen	Baies Roots	Polyphenols : tannins, saponins Glucosides Amino acids : asparagine Carbohydrates : rhamnose Mineral salts Vitamins A and B	Decoction Infusion Maceration	Diuretic Depurative/Laxative Remineralizing/Tonic/ Aperitif Stomachic	Constipation Food supplements Gastric troubls	0.36	0.36	0.17
03	*Calendula arvensis* L.	Asteraceae	**French :** Souci des jardins, Souci des champs **Arabic :** Dj'mir, Djamra **Kabyle :** Djamir, Djemra	Flowers	Essential oil Mucilage Resin Acids Polyphenols : flavonoids, tannins	Infusion Decoction Cataplasm	Antiseptic Antispasmodic Astringent Calming Healing Emmenagogue	Rheumatic diseases Infectious diseases Dermatological diseases Menstrual troubls Influenza and Colds	0.68	0.76	0.39
04	*Inula viscosa* L.		**French :** Inule visqueuse **Arabic :** Mersit, Magrammane **Kabyle :** Amagraman	Leaves Flowers Stems	Essential oil Polyphenols : tannins, saponins Resins	Maceration Infusion Cataplasm	Analgesic Antiseptic/Healing Diuretic Hemostatic Dewormer Hypoglycemic	Dermatological diseases Rheumatic diseases Gastric troubls Abdominal pain Diabetes Headache	0.84		0.51

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
05	*Borago officinalis* L.	Boraginaceae	**French :** Langue de bœuf, Bourache **Arabic :** Bouchenaf, Cheikh lobqoul **Kabyle :** Ilas Ufu-Naz, Tirizoua	Leaves Fruits Suc	Mucilage Resin Potassium nitrate Allantoin Polyphenols : anthocyanins, saponins, tannins Alkaloids : pyrrolizidine	Infusion Cataplasm Decoction	Sugar and leaves: Softening/Emollient Expectorant/ Becalming Depurative/Laxative Sudorific Flowers: Softening/ Emollient Laxatives	Respiratory diseases Rheumatic diseases Gastrointestinal troubls	0.56	0.56	0.28
06	*Opuntia ficus indica* L.	Cactaceae	**French :** Figuier de barbarie **Arabic :** Kermous en'sara, Hendi **Kabyle :** Amizour	Leaves Flowers Seeds Fruits	Mucilage Sures Lipids Gums Ascorbic Acid Calcium Oxalate Polyphenols : flavonoids, Anthocyanins, tannins	Infusion Cataplasm Vegetable oil Decoction	Antidiarrheal Emollient Nutritif Anti-oxydants	Circulatory diseases Dermatological diseases Food supplements Diabetes	0.7	0.7	0.41
07	*Lonicera implexa* L.	Caprifoliaceae	**French :** Chèvrefeuille **Arabic :** Soltan el ghaba, Zahr el-açel **Kabyle :** Tiski, Annaref	Leaves Flowers Barks	Essential oil Mucilage Salicylic acid Polyphenols : tannins, anthocyanins, glucosides	Infusion Decoction Cataplasm	Antiseptic Antispasmodic Astringent Sedative Sudorific Febrifuge	Respiratory diseases Rheumatic diseases Infectious diseases Gastrointestinal troubls	0.8	0.8	0.44

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
08	*Cupressus sempervirens* L.	Cupresaceae	**French :** Cyprès **Arabic :** Sarouel, Bestan Kabyle : Tidi, Azimba	Leaves Fruits Barks	Mucilage Resin Acids Polyphenols : flavonoids, tannins	Decoction Infusion	Anti-diarrheal Antiseptic/Anti-microbial/Healing Anti-hemorrhoidal Bechic Scalp tonic Dewormer	Microbial diseases Dermatological diseases Infectious diseases Healing Gastrointestinal troubls	0.84	0.84	0.53
09	*Euphorbia hélioscopia* L.	Euphorbiaceae	**French :** Herbe-aux-verrues **Arabic :** Halib-edziba **Kabyle :** Tanahut	Leaves Seeds	Latex Polyphénols : tanins, saponins	Cataplasm Infusion	Purgative Homeopathy against psoriasis Rheumatic pains	Rheumatic diseases Dermatological diseases	0.52	0.52	0.22
10	*Ceratonia siliqua* L.	Fabaceae	**French :** Caroubier, Pain de Saint Jean-Baptiste **Arabic :** Kheroub **Kabyle :** Akharoub	Fruits Seeds Barks	Mucilage : Galacto mannan “ 88% “ in the gum Carbohydrates : glucose, pectin, fructose, sucrose	Decoction Infusion Maceration	Astringent Laxative/Purgative Treats jaundice	Food supplements Gastrointestinal troubls	0.82	0.82	0.53

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
11	*Laurus nobilis* L.		**French :** Laurier noble, Laurier commun, Laurier d'Apollon, Laurier sauce **Arabic :** Rand harami, Rend, Ouarak el ghar, Ouarak Moussa **Kabyle :** Rend	Leaves Fruits Branches Berries	Polyphenols : tannins, saponins. Essential oil. Acids : lauric, loleic, palmitic, linoleic	Decoction Infusion, Maceration Fumigation	Antispasmodic Antirheumatic. Antiviral/Antifungal Anti-inflammatory Relieves coughing Clears the respiratory tract	Respiratory diseases Gastrointestinal troubls Psychological disorders Anxiety	0.8		0.55
12	*Lavandula stoechas* L.	Lamiaceae	**French :** Lavande **Arabic :** Halhal **Kabyle :** Amezire	Leaves Flowering tops	Polyphénols : flavonoides, tanins, anthocyanines, coumarines, saponines. Hétérosides cardiaques Huile essentielle	Decoction Infusion Cataplasm	Antispasmodic Stomachic Sedative/Headache Sudorific Diuretic Chronic bronchitis Cicatrisant	Infectious/microbial diseases Dermatological diseases (Eczema, psoriasis) Healing Otitis Vulvovaginitis	0.9	0.88	0.52
13	*Rosmarinus officinalis* L.		**French :** Rosemarine, Rosemarais, Romarin des troubadours, Herbe aux couronnes, Encensier **Arabic :** Eklile **Kabyle :** Azir, Iazir	Leaves Flowering tops	Polyphenols : Flavonoids : tannins, anthocyanins Essential oil	Decoction Infusion	Antispasmodic Abdominal pain Bloating Coughing	Microbial diseases	0.96		0.56

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
14	*Malva sylvestris* L.	Malvaceae	**French :** Mauve **Arabic :** Khobbeiza **Kabyle :** Medjir	Leaves Flowers	Uronic mucilage Carbohydrates : glucose Polyphenols : tannins, anthocyanins Glucosides Vitamins A, B and C	Decoction	Antitussive Laxative Antispasmodic	Bronchitis Constipation Anxiety Colds and Influenza	0.84		0.44
15	*Myrtus communis* L.	Myrtaceae	**French :** Myrte **Arabic :** Rihan, Mersin **Kabyle :** Chelmoum, Asselmoum	Berries Leaves	Essential oil Polyphenols : tannins, flavonoids Acids : citric, malic	Decoction Infusion Maceration Cataplasm	Antiseptic/Detergent Astringent Expectorant Hypoglycemic Stomachic/ Carminative	Microbial diseases Infectious diseases diabetes Sinusitis	0.78		0.35

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
16	*Olea europaea* L.	Oleaceae	**French :** Olivier **Arabic :** Zeitoun **Kabyle :** Azemmour	Leaves Fruits Vegetable oil	Mineral salts : calcium, phosphorus, silica, sulfur, magnesium, sodium, iron, potassium, chlorine Heterosides Oleuropeoside Oleside Mucilages Resins Vegetable oil Organic acids (malic, tartaric, glycolic, lactic) fatty acids, oleanic acids, alcohols Polyphenols : tannins, flavonoids, saponins	Decoction Infusion Maceration Cataplasm	Diuretic Hypotensive Astringent Expectorant/Cough suppressant Hypoglycemic Laxative Heart rhythm disorders, Palpitations Cholesterol	Arterial hypertension Cardiovascular diseases Infectious diseases Diabetes Healing Bronchitis	0.98	0.67	0.62
17	*Olea silvestris* L.		**French :** Oléastre **Arabic :** Zit rikabi, Zit essenhadja, **Kabyle :** Azebboudj	Barks Leaves	Polyphenols : tannins, Flavonoids, saponins, glucosides Lactones Choline	Decoction Infusion	Astringent Diuretic Febrifuge Tonic Hypotensive	Arterial hypertension Cardiovascular diseases	0.8		0.47
18	*Phillyrea angustifolia* L.		**French :** Filaire **Arabic :** Halib edziba **Kabyle :** Tamtouala	Leaves Flowers	Polyphénols : tanins, Flavonoids, saponins	Cataplasm Infusion	Antiseptic Analgesic Febrifuge Diuretic	Headaches Lesions	0.24		0.16

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
19	*Pinus halepensis* L.	Pinaceae	**French :** Pin **Arabic :** Snouber **Kabyle :** Taida, Azoumbei	Barks Leaves Fruits	Résins Essences Polyphénols : tanins, saponins	Infusion Maceration Syrup Decoction Fumigation Inhalation Resin ointment Cataplasm	Antirheumatic Expectorant	Rheumatic diseases	0.82	0.82	0.50
20	*Rosa sempervirens* L.	Rosaseae	**French :** Eglantier, Rosier des chiens **Arabic :** Ouerd enesrine Nesrine **Kabyle :** Thighfert	Flowers Fruits Roots	Vitamins: C, A, B, E and K organic acids Polyphenols: tannins,saponines	Infusion Syrup	Astringent Dewormer Insomnia	Nervous troubls Anxiety Hemorrhages	0.74	0.76	0.47
21	*Rubus ulmifolius* L.		**French :** Aronce, Mûrier sauvage, Mûrier de renard, Mûrier des haies, Catimuron **Arabic :** Toute El Alayag **Kabyle :** Inijel	Leaves Flowers Fruits Roots	Polyphenols : Gallic tannins Catechic tannins	Decoction Infusion Cataplasm	Chronic diarrhea Angina Hemorrhoids Cicatrisant/Eczema/ Abscesses	Dermatological diseases Gastric troubls	0.78		0.49
22	*Ruta chalepensis* L.	Rutaceae	**French :** Rue **Arabic :** El fidjla **Kabyle :** Awarmi	Leaves Flowering tops	Essential oil Polyphenols : tannins, Saponins, coumarins, Flavonoids, rutosides Alkaloids	Cataplasme Infusion	Antirheumatic Antiseptic Dewormer	Rheumatic diseases Gastric dtroubls	0.86		0.56

TABLE 1. Cont.

æN°	Scientific name	Family	Vernacular name	Used parts	Principal actifs	Mode of use	Thérapeutic effects	Treated diseases	FRC	VIF	VU
23	*Smilax aspera* L.	Smilacaceae	**French :** Salsepareille Salsepareille d'Allemagne **Arabic :** Inab el Kilab, El Awssadj **Kabyle :** Tizorine gouchene	Roots	Polyphenols: saponins Mineral salts Choline	Decoction Infusion	Anti-inflammatory Depurative Fortifying/Stimulates sexual functions in men Stimulates the immune system	Inflammatory diseases Immune system diseases Food supplements	0.32		0.11
24	*Solanum nigrum* L.	Solanaceae	**French :** Morelle noire **Arabic :** Aneb edib, Meghnenou **Kabyle :** Touchanine	Leaves Fruits	Alkaloids: solanine, solasonine, solanidine, solaniargine Solasodine Polyphenols: saponins, Rutin, asparagine	Cataplasm Maceration	Antispasmodic/ Analgesic/Narcotic Emollient Resolutive	Rheumatic diseases Dermatological diseases	0.66		032

The UV varied between 0.11 (*Smilax aspera*), 0.16 (*Phillyrea angustifolia*) and 0.57 (*Pistacia lentiscus*), 0.56 (*Ruta chalepensis* and *Rosmarinus officinalis*), *Olea europeae* has enregisted the highest UV (0.62).

Frequency of use of medicinal plants

According to the sex

Gender has a significant impact on the use of medicinal plants, women use medicinal plants much more frequently than men. The results do show that 76% of women use medicinal plants, compared to only 24% of men (Fig. 2). Women often have great expertise in the field of traditional herbal medicine, as well as great responsibilities as mothers and homemakers. The Kabylians knew about medicinal plants and their uses. This is due to the region's rich diversity of medicinal plants.

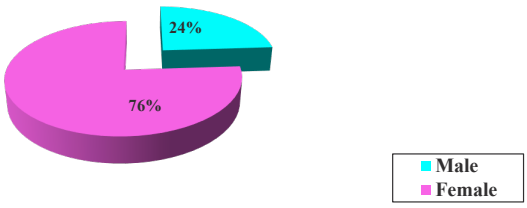

Fig. 2. Distributions by sex of the plants use frequency in the GNP

According to the age

The ethnobotanical data showed that the younger generation had less knowledge about the use of local plants compared to people aged, who had the most knowledge.

The use of medicinal plants in this region is wide spread in all age groups. However, we notice that this use increases with age of the investigated. The rate of usage is considerable for the age group above 50 years 32%, while for the age group 40 to 50 years we note a rate of 28%, for the age group of 30 to 40 years; a usage rate of 24% and for the lower age group at 20 to 30 years old rate of 16% (Fig. 3).

The oldest provide the most reliable information on the use of medicinal plants in traditional medicine because they have good ancestral knowledge. There is a distinct lack of information among young people, who often do not trust this traditional medicine.

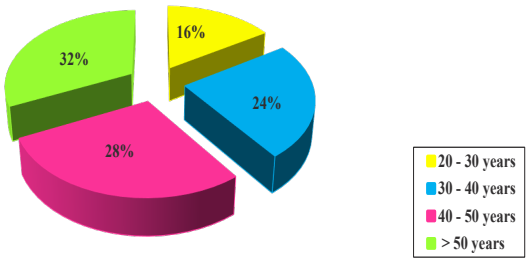

Fig. 3. Distribution of the frequency of medicinal plants use by age group

According to the educational level

The use of medicinal plants in the area of study concerns all educational levels, from the illiterate to the academic scholar. 44% were illiterate, followed by people who have a primary level of education (32%) while medium (14%), secondary (8%) and only 2% have a university degree (Fig. 4).

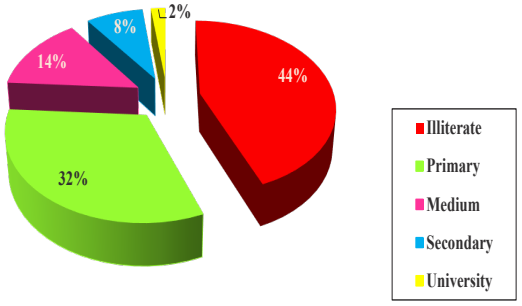

Fig. 4. Distributions by level study of the plants use frequency in the GNP

Importance of traditional medicine

A study on medicinal plant utilization in area revealed that 64% of the population of this park uses use medicinal plants for maintaining their primary healthcare. While it is less important for 36% of the natives interviewed (Fig. 5).

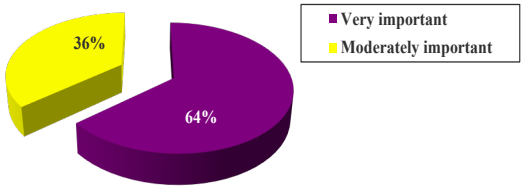

Fig. 5. Classification of medicinal plants by importance of use

Diseases treated by the prepared therapeutic recipes

The results of our ethnobotanique survey have permitted to evaluate in percent the use of medicinal plants for each pathology (Fig. 6).

- 36% of medicinal plants are used for the treatment of digestive diseases ;
- 24% are used for antidiuretics ;
- 24% are used to treat various diseases (vomiting, rheumatism, nausea ...) ;
- 16% are used as antidiabetics.

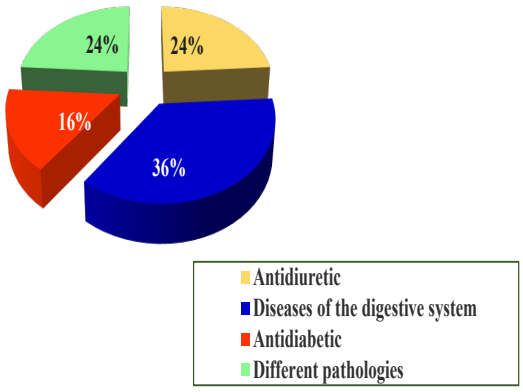

Fig. 6. Distribution of GNP plants according to treat diseases

Preparation method of therapeutic recipes

Several modes of preparation are used to simplify the administration of the active ingredient namely the infusion, the decoction, the maceration and the use in the form of powder. Fig. 7 showed that the infusion is a mode mostly used with a rate of 48%, followed by the decoction and the maceration with respective rates of 20% and 16%, and finally; the mode of use both powder and other methods (cataplasm, inhalation, fumigation.....), with rate of 8%.

Used parts of medicinal plants

The realized investigation on the medicinal plants of the area showed that the different parts of the plant (leaves, stems, roots, fruits) are used in therapeutic preparations, but with, however, some preference for the leaves (54%), followed by flowers with 23%, then stems and roots with 14%, and fruits with 9% (Fig. 8).

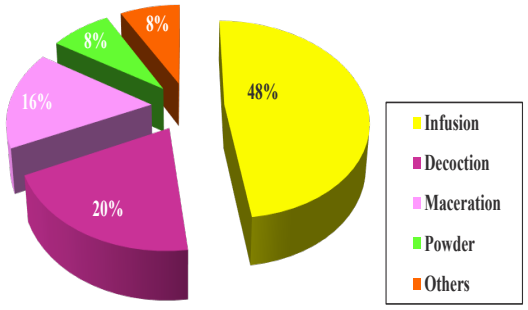

Fig. 7. Modes of preparation used by indigenous practitioners

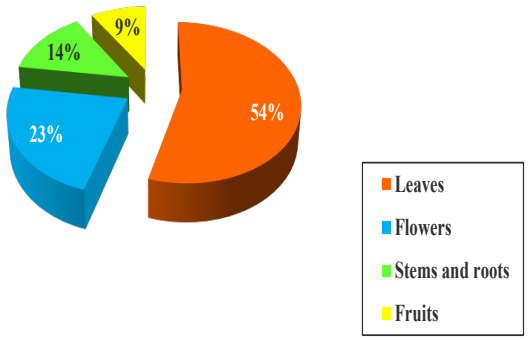

Fig. 8. Distribution of the various parts medicinal plants used

The harvesting of medicinal plants

We note here that the natives harvest the medicinal plants by season, first in the spring (24%), summer (20%), autumn, and winter (8%) and (4%) respectively. The majority of requested (44%) confirmed that medicinal plants are harvested throughout the year (Fig. 9).

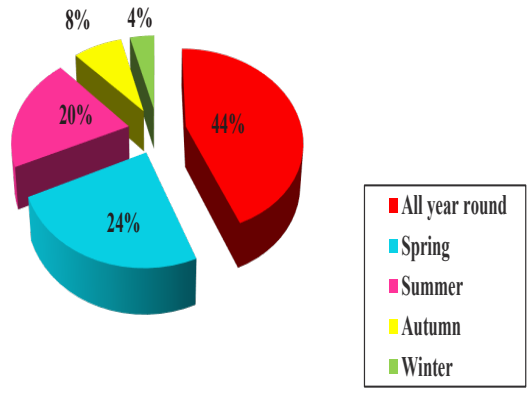

Fig. 9. Stage of collection of medicinal plant

Discussion

The current study aims to investigate and document the use of medicinal plants in GNP (Bejaia, Algeria). Data collected included requested details (sex, age, and study level) and plants used (vernacular name, part used, medicinal use, and method of preparation).

The findings indicate that both men and women use the Park's therapeutic plants, while women use them more frequently. These results concur with those that other authors have already verified. In Algeria, M'sila records a high proportion of female use of medicinal plants (Benderradji et al., 2014). The percentage in Italy is 69.5% (Vitalini et al., 2013). Similar findings were obtained in Morocco (Eddouks et al. (2016). Belhaj et al. (2020) indicated that women from the high atlas (Morocco) have more awareness about the usage of medicinal plants (51.82%) than men (48.17%).

The age of the community also had an impact on ethnobotanical knowledge. According to the distribution of informants by age class, 32% of the informants examined for this study belonged to the 50-age group. According to Mikou et al. (2016), the group aged 50 to 70 represented the highest percentage (59%) of medicinal plant users, with 25% being between the ages of 30 and 50 and 16% being under 30. Miara et al. (2019) explain a somewhat comparable result, stating that 50.98% of cases occur in the 46–65 age range. Ousseini et al. (2021) obtained the same result with 51.47%. This age range is the most common, from 41 to 60.

According to a study done in Sidi Belabbes, Algeria, by Belkessam et al. (2022), people who are older than other age groups have a greater grasp of local medicinal knowledge, with a rate of 51.02% of respondents who are between the ages of 40 and 60.

Ethnomedicinal knowledge is concentrated in the elderly persons of the local population; they are responsible to transfer their knowledge to the young generation.

One factor that affects how medicinal plants are used is education level. According to the academic level, the research area's uneducated population knows more about plants (44%), followed by those with primary-level education

(32%). Our findings corroborated those from Boughrara & Legseir (2016) at the National Park of El Kala, where 32% of the population was illiterate, and Rhattas et al. (2016) at the National Park of Talassemtane, where 50% of the indigenous population was illiterate (Occidental Rif, Morocco).

The relevance of ethnobotany, according to the respondents, is based on its efficacy, availability, simplicity, and accessibility (quality/price), as well as the fact that it is non-toxic. Belkessam et al. (2022) report that many responders support the use of these plants, which have no negative side effects, to treat urinary tract infections. Due to its lower cost, the majority of patients prefer herbal medication.

According to Mikou et al. (2016), respondents who use herbal medicine depend on the effectiveness of the species used, with 45% believing that traditional remedies result in a complete cure, 35% saying that using medicinal plants only helps them feel better, and 20% finding that doing so helps prevent diseases.

Our survey's findings indicated that the majority of medicinal species are used to treat digestive issues and have diuretic and anti-diabetic properties.

Several writers (Tahri et al., 2012; Boughrara & Legseir, 2016; Rhattas et al., 2016; Idm'hand et al., 2020; Singh et al., 2022) have confirmed the effects of several medicinal species from various geographical regions on digestive diseases.

Several modes of preparation are used to simplify the administration of the active ingredient namely the infusion, the decoction, the maceration, the cataplasm, and the use in the form of powder. Infusion and decoction were found to be the preferred methods. Similar results were found in previous ethnobotanical studies (Boudjelal et al., 2013; Benderradji et al., 2014; Benarba et al., 2015; Chermat & Gharzouli, 2015; Eddouks et al., 2016; Ouelbani et al., 2016; Rhattas et al., 2016; Bulut et al., 2017; Lee et al., 2018; Faruque et al., 2019; Miara et al., 2019; Jonathan et al., 2022; Kaci et al., 2022).

Different parts of plants are used in traditional herbal therapy, including leaves, stems, fruits, flowers, and more. Yet, depending on the usage, not all of their proportions are the same. According to the findings of this investigation, leaves account for more than 54% of all therapeutic formulations. Our findings are consistent with the majority of earlier ethnobotanical investigations (Boughrara & Legseir, 2016; Eddouks et al., 2016; Ouelbani et al., 2016; Kidane et al., 2018; Miara et al., 2019; Nguyen et al., 2019; Yebouk et al., 2020; Behera et al., 2021; Doumbia et al., 2021; Kaci et al., 2022; Singh et al., 2022).

In contrast, Hu et al. (2020) found that 33.46% of preparations in India are made from whole plants.

We discovered from our poll that people prefer to gather therapeutic herbs in the springtime. The favorable environmental conditions and the various organs' phases of development are both major contributors to this. The outcome is completely consistent with that mentioned by Boughrara & Legseir (2016), who showed that spring provided the ideal environment for the growth of plants. The spring season is typically distinguished by mild weather with a combination of cloudy, sunny, and humid days.

Conclusion

In this ethnobotanical study, we find that 24 medicinal plants belonging to 18 families are still being used in GNP medical practices. The most cited families were the lamiaceae (*Rosmarinus officinalis, Laurus nobilis*, and *Lavandula stoechas*) and the oleaceae (*Olea europaea, Olea silvestris, and Phillyrea angustifolia.* This is due to the park's residents' traditions, as the original habitants are well known for their love of olive oil and herbs in their traditional cuisine.

The leaves are the component of the plant that is most frequently utilized, and an infusion is the most popular way to prepare the remedies. In this region, self-medication using herbal remedies is highly well known, notably for digestive issues, diuretics, and anti-diabetics. Some plants are also ingested by knowledge and expertise and utilized to treat various disorders.

This study showed us the variety and richness of the medicinal flora, which represents a vast repository of knowledge and resources endowed with remarkable curative abilities. In addition, this legacy may serve as a foundation for natural

medicine in the future, with positive consequences on both the environment and human health in particular.

Because it reflects a tight connection to the past, this ancestral information deserves to be conserved, valued and utilized more.

To create an Algerian pharmacopoeia and create sensible and successful phytomedicines, it is unquestionably required to take advantage of these findings by implementing a program of plant censusing.

Today, the success of phytotherapy is founded on the technical and scientific mastery of numerous disciplines, including agronomy, chemistry, and pharmacology, which create effective and therapeutic galenic forms. Also, phytotherapy seems to be the best and most effective treatment for the various illnesses of the century, including various malignancies, stress, insomnia, obesity, etc.

Conflict of interests: The authors confirm that there is no conflict of interest to disclose

Authors contributions': Dr. Zakia Kaci participated in the fieldwork and general revision of the manuscript; Dr Nacera Hadj Mohamed participated in the translation of the manuscript; Dr Aicha Abed participated in the calculations and the bibliographic research; Dr F. Mebkhout participated in verifying the therapeutic effects of medicinal plants.

Ethical approval: Not applicable.

References

Behera, K., Mandal, U., Panda, M., Mohapatra, M., Mallick S.K., Routray S., et al. (2021) Ethnobotany and folk medicines used by the local healers of Bhadrak, Odisha, India. *Egyptian Journal of Botany*, **61**, 375-389.

Belhaj, S., Dahmani, J., Belahbib, N., Zidane, L. (2020) Ethnopharmacological and ethnobotanical study of medicinal plants in the High Atlas Central, Morocco. *Ethnobotany Research and Applications*, **20**, 1-40.

Belkessam, N., Messafeur, A., Merad, Y., Labiad, N., Aidoud, I.A., Taleb, M. (2022) Etude ethnobotanique des plantes médicinales utilisées dans le traitement traditionnel des infections urinaires à l'Ouest Algérien. *Algerian Journal of Natural Products*, **10**, 918-933.

Beloued, A. (2005) *" Plantes Médicinales d'Algérie"*. Office des Publications Universitaire, Algérie, 277p.

Benarba, B., Belabid, L., Righi, K., Bekkar, A., Elouissi, M., Khaldi, A., Hamimed, A. (2015) Ethnobotanical study of medicinal plants used by traditional healers in Mascara (North West of Algeria). *Journal of Ethnopharmacology*, **175**, 626-637.

Benderradji, L., Rebbas, K., Ghadbane, M., Bounar, R., Brini, F., Bouzerzour, H. (2014) Ethnobotanical study of medicinal plants in Djebel messaad region (M'sila, Algeria). *Global Journal of Research on Medicinal Plants and Indigenous Medicine*, **3**, 445-459.

Boudjelal, A., Henchiri, C., Sari, M., Sarri, D., Hendel, N., Benkhaled, A., Ruberto, G. (2013) Herbalists and wild medicinal plants in M'Sila (North Algeria) : an ethnopharmacology survey. *Journal of Ethnopharmacology*, **148**, 395-402.

Boughrara, B., Legseir, B. (2016) Ethnobotanical study close to the population of the extreme north east of Algeria : The municipalities of El Kala National Park (EKNP). *Industrial Crops and Products*, **88**, 2-7.

Bulut, G., Haznedaroğlu, M.Z., Doğan, A., Koyu, H., Tuzlac, E. (2017) An ethnobotanical study of medicinal plants in Acipayam (Denizli-Turkey). *Journal of Herbal Medecine*, **10**, 64-81.

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*, **5**, 50-59.

Doumbia, H.O.Y., Assi, B.D., Koman, S.R. (2021) Etude ethnobotanique de plantes médicinales utilisées dans le traitement de l'anxiété et de la dépression à M'berie et à Arraguie (Agboville, Sud-Ouest De La Cote D'ivoire). *Journal Of Pharmacy and Biological Sciences*, **16**, 01-12.

Eddouks, M., Ajebli, M., Hebi, M. (2016) Ethnopharmacological survey of medicinal plants used in Daraa-Tafilalet region

(province of Errachidia), Morocco. *Journal of Ethnopharmacology*, **198**, 516-530.

El-Hachlafi, N., Chebat, A., Soulaymani-Bencheikh, R., Fikri-Benbrahim, K. (2020) Ethnopharmacological study of medicinal plants used for chronic diseases treatment in Rabat-SaleKenitra region (Morocco). *Ethnobotany Research and Applications*, **20**, 1-23.

Farombi, E.O. (2003) African indigenous plants with chemotherapeutic potentials and biotechnological approach to the production of bioactive prophylactic agents. *African Journal of Biotechnology*, **2**, 662-671.

Faruque, M.O., Feng, G., Khan, M.N.A., Barlow, J.W., Ankhi, U.R., Hu S., et al. (2019) Qualitative and quantitative ethnobotanical study of the Pangkhua community in Bilaichari Upazilla, Rangamati District, Bangladesh. *Journal of Ethnobiology and Ethnomedicine*, **15**, 1-29.

Hu, R., Lin, C., Xu, W., Liu, Y., Long, C. (2020) Ethnobotanical study on medicinal plants used by Mulam people in Guangxi, China. *Journal of Ethnobiology and Ethnomedicine*, **16**, 1-50.

Idm'hand, E., Msanda, F., Cherifi, K. (2020) Ethnobotanical study and biodiversity of medicinal plants used in the Tarfaya province, Morocco. *Acta Ecologia Sinica*, **2**, 134-144.

Jonathan, J., Aiah, L., Richard, W. (2022) Ethnobotanical survey of medicinal plants utilized by forest edge communities in southern Sierra Leone. *Journal of Medicinal Plants Research*, **16**, 11-25.

Kaci, Z., Tirchi, N., Dahmane, T., Berraï, H., Holgado, R., Boubekeur, S., et al. (2022) First ethnobotanical study relating to usage of medicinal plants in province of Ain Defla region, South-West of Algeria. *Indian Journal of Ecology*, **49**, 655-664.

Kidane, L., Gebremedhin, G., Beyene, T. (2018) Ethnobotanical study of medicinal plants in ganta afeshum district, eastern zone of tigray, northern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, **14**, 1-19.

Lee, C., Kim, S.Y., Eum, S., Paik, J.H., Bach, T.T., Darshetkar, A.M., et al. (2018) Ethnobotanical study on medicinal plants used by local Van Kieu ethnic people of Bac Huong Hoa nature reserve, Vietnam. *Journal of Ethnopharmacology*, **231**, 283-294.

Mahmoudi A. (2020) "*Plan de Gestion du Parc National de GOURAYA*". République Algérienne Démocratique et Populaire, Ministère de l'Agriculture et du Développement Rural, Direction Générale des Forêts, Algérie

Mc-Kenna, D.J., Luna, L.E., Towers, G.N. (1995) Biodynamic constituents in Ayahuasca admixture plants : an uninvestigated folk pharmacopoeia. *Ethnobotany : Evolution of a Discipline*, **1**, 349-361.

Miara, M.D., Bendif, H., Rebbas, K., Rabah, B., Hammou, M.A., Maggi, F. (2019) Medicinal plants and their traditional uses in the highland region of Bordj Bou Arreridj (Northeast Algeria). *Journal of Herbal Medicine*, **16**, 100262.

Mikou, K., Rachiq, S., Oulidi A.J. (2016) Étude ethnobotanique des plantes médicinales et aromatiques utilisées dans la ville de Fès au Maroc. *Phytothérapie*, **14**, 135-43

Mokkedem, O. (2004) Les plantes médicinales et aromatiques en Algérie : situation et perspectives. *Actes du Séminaire International sur le Développement du Secteur des Plantes Aromatiques et Médicinales dans le Bassin Méditerranéen*, Djerba, Tunisie.

Molares, S., Ladio, A. (2009) Chemosensory perception and medicinal plants for digestive ailments in a Mapuche community in NW Patagonia : Argentina. *Journal of Ethnopharmacology*, **123**, 397-406.

Mongalo, N.I., Raletsena, M.V. (2022) An inventory of South African medicinal plants used in the management of sexually transmitted and related opportunistic infections : an appraisal and some scientific evidence (1990-2020). *Plants,* **11**, 3241.

Nguyen, T.S., Xia, N.H., Van-Chu, T., Van-Sam, H., (2019) Ethnobotanical study on medicinal plants in traditional markets of Son la province. *Forest Society*, **3**, 171-2.

Ouelbani, R., Bensari, S., Mouas, T.N., Khelifi, D. (2016) Ethnobotanical investigations on plants used in folk medicine in the regions of Constantine and Mila (North-East of Algeria). *Journal of Ethnopharmacology*, **194**, 196-218.

Ousseini, G.H., Sahabi, B., Nafiou A.M., Maazou, M.S., Mahamadou, A.A., Seini, H.S. (2021)

Etude ethnobotanique des plantes utilisées traditionnellement pour la prise du poids, la stimulation de l'appétit et contre la malnutrition dans les régions de Niamey et Tillabéri au Niger. *Algerian Journal of Natural Products*, **9**, 856-870.

Pandey, A.K., Tripathi, Y.C. (2017) Ethnobotany and its relevance in contemporary research. *Journal of Medicinal Plants Studies*, **5**, 123-129.

Quezel, P., Santa, S. (1962) " *Nouvelle Flore de l'Algérie et des Régions Désertiques Méridionales*". Centre National de la Recherche Scientifique, Paris.

Regnault-Roger, C., Philogène, B., Vincent, C. (2005) " *Biopesticides of Plant Origin*". Lavoisier Publishing, France.

Rhattas, M., Douira, A., Zidane, L. (2016) Étude ethnobotanique des plantes médicinales dans le Parc National de Talassemtane (Rif occiental du Maroc). *Journal of Applied Biosciences*, **97**, 9187-9211.

Schaal, B. (2019) Plants and people : our shared history and future. *Plants, People, Planet*, **1**, 14-19.

Shrestha, P.M., Dhillion, S.S. (2003) Medicinal plant diversity and use in the highlands of Dolakha district, Nepal. *Journal of Ethnopharmacology*, **86**, 81-96.

Singh, D., Bagchi, D., Pathak, R., Beohar P., Chaturvedi, P., Ahirwar, L. (2022) Ethno-botanical study of medicinal plants used by tribes in the Dindori District of Madhya Pradesh, India. *Egyptian Journal of Botany*, **62**, 389-398.

Suffredini, I.B., Sader, H.S., Gonçalves, A.G., Reis, A.O., Gales, A.C., Varella, A.D., Younes, R.N. (2004) Screening of antibacterial extracts from plants native to the Brazilian Amazon rain forest and atlantic forest. *Brazilian Journal of Medical and Biological Research*, **37**, 379-384.

Tahri, N., El-BAsti, A., Zidane, L., Rochdi, A., Douira, A. (2012) Etude ethnobotanique des plantes médicinales dans la province de Settat (Maroc). *Journal of Forestry Faculty*, **12**, 192-208.

Tardío, J., Pardo-De-Santayana, M. (2008) Cultural importance indices : a comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain). *Economic Botany*, **62**, 24-39.

Urso, V., Signorini, M.A., Tonini, M., Bruschi, P. (2016) Wild medicinal and food plants used by communities living in Mopane woodlands of southern Angola : results of an ethnobotanical field investigation. *Journal of Ethnopharmacology*, **177**, 126-139.

Vijayakumar, S., Yabesh, J.M., Prabhu, S., Manikandan, R., Muralidharan, B. (2015) Quantitative ethnomedicinal study of plants used in the Nelliyampathy hills of Kerala, India. *Journal of Ethnopharmacology*, **161**, 238-254.

Vitalini, S., Iriti, M., Puricelli, C., Ciuchi, D., Segale, A., Fico, G. (2013) Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy) - an alpine ethnobotanical study. *Journal of Ethnopharmacology*, **145**, 517-529.

World Health Organization (WHO) (2002) " *Monographs on Selected Medicinal Plants*". W.H.O. Geneva.

Yebouk, C., Redouan, F.Z., Benítez, G., Bouhbal, M., Kadiri, M., Boumediana, A.I., Molero-Mesab, J., Merzouki, A. (2020) Ethnobotanical study of medicinal plants in the Adrar province, Mauritania. *Journal of Ethnopharmacology*, **246**, 112217.

دراسة عرقية للنباتات الطبية العفوية في الحديقة الوطنية قورايا GNP (بجاية- الجزائر)

ثوريا دحمان [1، 2]، زكية قاسي [1، 3]، نصيرة حاج محمد [4، 5]، عائشة عابد [1]، فايزة مبخوت[6، 7]
[1] قسم العلوم الفلاحية- كلية العلوم الطبيعة وعلوم الحياة وعلوم الأرض- جامعة الجيلالي بونعامة- خميس مليانة- طريق ثنية الحد- خميس مليانة- عين الدفلة (44000) الجزائر، [2] مخبر البحث في التكنولوجيا اللينة- تثمين المواد البيولوجية والتنوع البيولوجي- جامعة محمد بوقرة بومرداس- شارع الاستقلال- بومرداس (35000) الجزائر، [3] مخبر البحث في الماء- الصخرة والنبات- جامعة جيلالي بونعامة- خميس مليانة- طريق ثنية الحد- خميس مليانة- عين الدفلة (44000) الجزائر، [4] قسم الأرض وعلوم الكون، كلية العلوم الطبيعة وعلوم الحياة وعلوم الأرض- جامعة الجيلالي بونعامة- خميس مليانة- طريق ثنية الحد- خميس مليانة- عين الدفلة (44000) الجزائر، [5] مخبر البحث في علم المعادن والصهارة الجزائر- جامعة هواري بومدين للعلوم والتكنولوجيا- ص ب 32 العالية- 16111 الجزائر العاصمة- الجزائر، [6] معهد العلوم البيطرية- جامعة سعد دحلب البليدة 1- طريق الصومعة- 09000 البليدة- الجزائر، [7] مخبر البحث في نظام ضمان الجودة والنظافة الغذائية- المدرسة الوطنية العليا للبيطرة- 16000 -الجزائر العاصمة- الجزائر.

منذ زمن بعيد، استخدم الانسان النباتات كمصدر للأدوية للطعام والمأوى. تتزايد استعمالات النباتات الطبية بالطرق التقليدية في العديد من البلدان المتقدمة والنامية بسبب وفرتها وأهميتها الثقافية وشرائها غير المكلف.

في الجزائر، ينتشر العلاج بالنباتات ويشكل جزءًا لا يتجزأ من الثقافة المحلية للسكان، ولكن لسوء الحظ، لم يتم إنشاء معجم الأدوية الجزائري التقليدي.

أُجريت الدراسة العرقية النباتية في الحديقة الوطنية قورايا GNP (بجاية -الجزائر)، بناءً على دراسة جرد شملت 50 رجلاً وامرأة من السكان الأصليين. ركزت المقابلات على لمحة عن الأشخاص (الجنس، العمر ومستوى التعليم) وعلى النباتات واستخداماتها (الفصيلة النباتية والأسماء المحلية للنباتات الطبية وطريقة استخدامها).

كشفت النتائج عن استخدام 24 نوعًا نباتيًا تنتمي إلى 18 عائلة لعلاج أمراض مختلفة. تم تحليل البيانات التي تم جمعها من خلال حساب أهمية الفصيلة النباتية FIV = 0.88 فصيلة 'الشفوية' Lamiaceae هي الأكثر تمثيلاً. تم الحصول على أعلى قيمة للتكرار النسبي (RFC) '0.96' و كذلك تسجيل أعلى قيمة الاستخدام (UV) '0.62' *Olea europeae*.

44٪ من أفراد العينة أميون. بينما يمثل الحاصلون على تعليم عال 02٪ فقط من المجموعة. غالبية السكان المحليين (64٪) لديهم معرفة تقليدية بالنباتات الطبية لعلاج الأمراض البشرية المختلفة.

معظم النباتات تساهم في علاج اضطرابات الجهاز الهضمي (36٪)، كما أن الأوراق تشكل الأجزاء الأكثر استخدامًا وأن طريقة التحضير الأكثر شيوعًا هي النقع.