



# First Ethnobotanical Study Relating to Usage of Medicinal Plants in Province of Ain Defla Region, South-West of Algeria

Zakia Kaci, Nadia Tirchi, Thoraya Dahmane<sup>1</sup>, Hassiba berrai<sup>2</sup>, Ricardo Holgado<sup>3</sup>, Sihem Boubekour<sup>4</sup>, Abderahmane Chebli<sup>2</sup> and Mohamed Biche<sup>2</sup>

Laboratory of Water-Rock-Plants, Agricultural Science Department, Faculty of Nature and Life Sciences and Earth Sciences, Research, University Djillali Bounaama, Khemis Miliana, Ain Defla, Algeria

<sup>1</sup>Laboratory of Soft Technology, Valuation of Biologic Materials and Biodiversity, University M'hamed Bouguera, Boumerdes, Algeria

<sup>2</sup>Laboratory of Protection of Plants in Agricultural and Natural Environments Against Crop Pests, Department of Agricultural and Forestry Zoology, ENSA, El Harrach, Algeria

<sup>3</sup>Norwegian Institute of Bioeconomy Research, Division of Biotechnology and Plant Health, Aas, Norway.

<sup>4</sup>Laboratory on Bioactive Products and Valorization of Biomass, ENS Kouba, Algeria  
E-mail: z.kaci@univ-dbkm.dz

**Abstract:** The study was performed through 2019-2021 in Ain Defla province (South-west of Algeria) including 10 municipalities. Ain Defla has a wide diversity of plants used by their inhabitants for therapeutic aims. The data were collected and recorded using a feedback form, from a pre-established population, targeting on informants demographics, medicinal plants and parts used, method of treatment, and diseases treated. The collected information were analysed in terms of species use value, fidelity level and informant consensus factor. 180 people were interviewed; gender distributions (40%) ladies and 60% were men. The study recounted 65 medicinal plants belonging to 33 distinct families, of which the Lamiaceae are the most commonly used. The most used parts of plants are leaves. The most common mode for therapeutic preparations was infusion. The most frequently plant used was *T. munbyanus* with 1.07 following by *Allium cepa* was with 0.69 of use value, respectively. The highest fidelity level was recorded for *Petroselinum crispum* with 100% for treatments of cardiovascular diseases, follow by *Inula viscosa* with 86% for gastrointestinal diseases. The informant consensus factor varies from 0.75 to 0.96 and gastrointestinal diseases with 0.96 represented the highest informant consensus factor.

**Keywords:** Algeria, Ain Defla, Ethnobotanical, Medicinal plants, Therapeutic value

Throughout the world, plants have always been used as medicines. These herbal drugs are considered to be low in toxicity; mild compared to pharmaceutical drugs and also considered to be a promising source of bioactive compounds. In the absence of a modern medical system, medicinal plants still considered as a source of medical aid in developing countries. Pharmaceutical industries have an increasingly interested in ethnobotanical studies (Dibong et al 2011). More than 80% of the world's population use medicinal plants to deal with health problems and for the treatment of pain (Vital and Rivera 2009, Agisho et al 2014). Algeria is one of the Mediterranean countries that encompass considerable natural resources distributed in different ecosystems with considerable botanical diversity. This richness has aroused the curiosity of several researchers strengthening ethnobotanical research with the aim of listing medicinal plants and traditional recipes as well as the elaboration of a traditional Algerian pharmacopoeia including herbal medicines (Rebbas et al 2012, Boudjelal et al 2013, Miara et al 2013, Meddour and Meddour-Sahar 2015, Benarba et al 2015, Chermat and Gharzouli 2015,

Lakhdari et al 2016, Ouelbani et al 2016, Miara et al 2019). The published literature examination indicates that in Ain Defla Province no ethnobotanical investigation has been conducted so far. In order to improve the ethnobotanical knowledge for the country, our opinion is that the present study is needed. The soil, topography and climatic conditions have favoured much diversified vegetation in the region of Ain Defla. This region has plants likely to provide active ingredients used in different fields for their properties: therapeutic (phytotherapy), fragrant (cosmetics), pharmaceutical (aromatherapy) and gustatory properties (diet therapy). However, the richness remains little explored, similarly describing to the use of medicinal plants and their traditional therapeutic importance. The objectives of the study were to: make accessible the ethnobotanical study outcome, promote crop growing medicinal plants as local flora, and to establish the importance of traditional medicine, and acquire ample information on their therapeutic uses.

## MATERIAL AND METHODS

**Study area:** Province of Ain Defla, located in the southwest

of Algeria, at 145 km from the capital Algiers, with an area of 4544.28 km<sup>2</sup>, situated in a longitude between 1°31'30"E and 2°37'38"E, at a latitude between 35°51'27"N and 36°27'19"N. Inhabitants of ten municipalities (Ain Defla, Bourached, Bathia, Rouina, Arib, El Abadia, Khemis, El Mekhatria, El Amra and El Attaf) participated in study. Ain Defla geographical localization is between the coastal region and the highlands, joining the western and eastern regions of the country. Ain Defla bounded to the following provinces: to the north Tipaza, northeast Blida, east Medea, west Chlef and south Tissemsilt (Fig. 1). The climate is semi-arid with harsh winters and dry hot summers with temperatures ranging from 46°C in July to 0°C in January (DWR, Ain Defla 2021).

**Ethnobotanical surveys:** The survey was carried out over a two-year period (2019-2021), established through a face-to-face interviews with the native population in public places frequented by the people. Prior to conducting the interview process, interviewee was verbal informed and confidentiality consent was obtained from each interviewer. Targeting informants with strong ethno-medicinal knowledge is important to enhance this kind of studies (Faruque et al 2019). The feedback form contains two parts, the first part includes the demographic characteristics of the informants (gender, age, family status, educational level), whereas, the second part focused on the use of medicinal plants, which incorporated plants names and types, plants parts used, preparation methods, use and treated diseases. The plants were collected after each interview for identification, reference specimens were deposited in the herbarium of the university. Botanical identification of the specimens was carried out using keys published by Quezel and Santa

(1962). The nomenclature has been updated according to the synonymic index of North Africa (Dobignard and Chatelain, 2010), the African Plant Database <http://africanplantdatabase.ch> and [www.theplantlist.org](http://www.theplantlist.org)

**Data analysis:** Ethnobotanical data were analysed using various quantitative indices described further down frequently used in similar studies. (Kaval et al 2014, Zashim Uddin and Abul Hassan 2014, Eddouks et al 2016, Ouelbani et al 2016, Bulut et al 2017, Kidane et al 2018, Miara et al 2019, Nguyen et al 2019, Tefera and Kim 2019, Jadid et al 2020).

**Use value (UV):** indicates the relative importance of each plant species to the local population of the study area. Calculated according to the equation

$$UV = \sum \frac{U}{N}$$

Where: UV corresponds to the use value of the species, U the number of citations per species; N: the total number of informants (Trotter and Logan 1986).

**Fidelity level (FL):** The level of fidelity is used to identify the species most frequently used by informants for a particular healing process. Calculated by the equation

$$FL(\%) = \frac{N_p}{N} \times 100$$

Where: N<sub>p</sub> is the total number of informants who listed the use of the plant to treat a particular illness and N is the total number of informants citing the plant as a medicine to treat any given disease (Friedman et al 1986).

**Informant Consensus Factor (ICF):** ICF determine the levels of consistency between the information provided by informants regarding the use of particular plants. Calculated

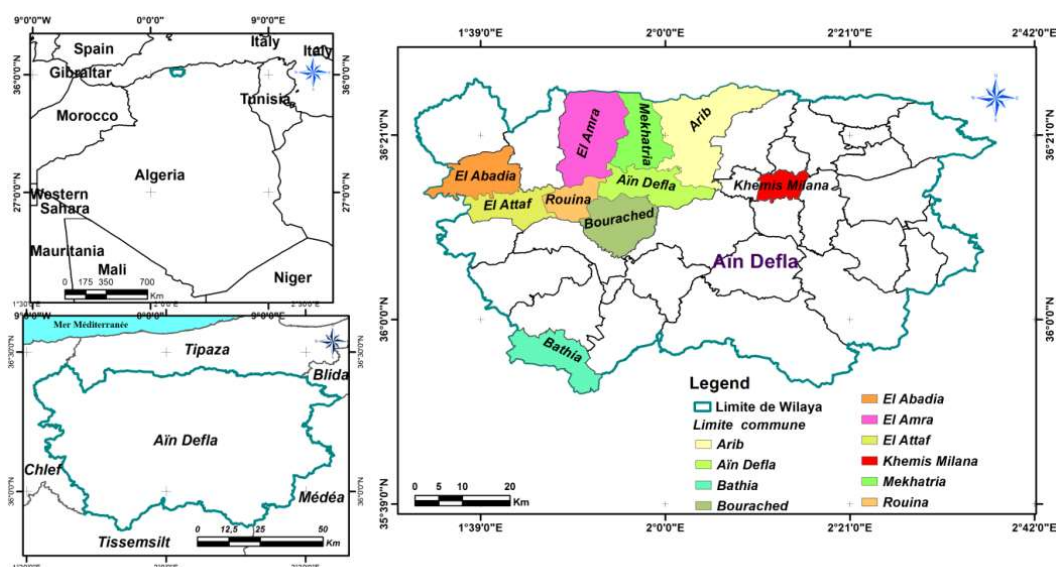


Fig. 1. Location of the study area Ain Defla Province, Algeria

according to the equation

$$ICF = \frac{(Nur - Nt)}{(Nur - 1)}$$

Where: Nur is the number of citations used in each category and Nt is the number of species used (Trotter and Logan 1986).

The ICF values are between zero and one. If the ICF value is close to zero, this explains why the plants are chosen at random or the informants do not exchange information on their use in the treatment category in question. A high value (close to one) indicates that there is a well-defined selection criterion in the community and/or if a large proportion of informants quote the information (Morvin Yabesh et al 2014).

**RESULTS AND DISCUSSION**

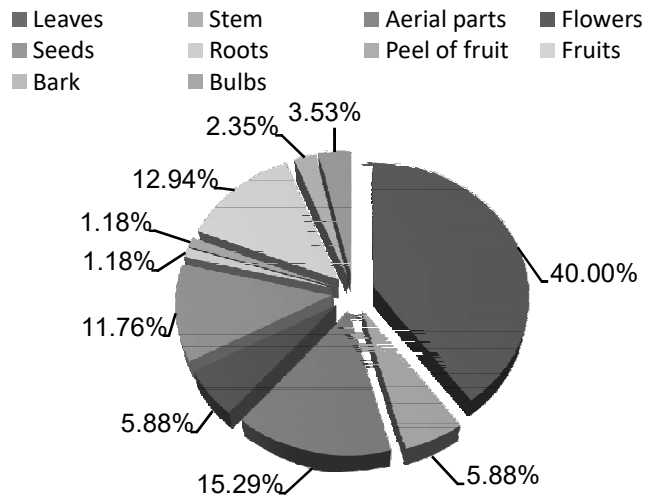
**Demographics:** the demographic characteristics outcomes for individuals obtained during the investigation are shown in Table 1.

**Medicinal plants quoted by interviews:** Based on 180 completed questionnaires, an ethnobotanical catalogue was assembled (Table 2). The botanical analysis includes 65 plant species distributed into 33 botanical families. The Lamiaceae family (thirteen species) dominates the list, represented mostly by *T. munbyanus*, *O. vulgare*, *R. officinalis* and *M. pulegium*, followed by the Asteraceae family (with seven species) represented mostly by *I. viscosa* and *A. absinthium* (Fig. 2).

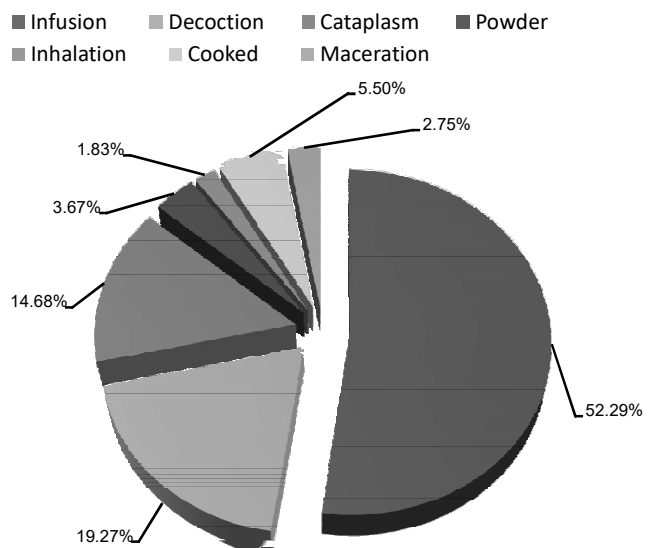
**Part of the plant and method of preparation:** Plant parts used were quoted by the interviewed, underground part (roots, bulbs), and aerial part (leaves, stems, seeds, flowers, bark). However, the leaves represent the plant organ most used by the interviewed, with a rate exceeding 40% followed by other aerial parts (15.29%). Fruits and seeds register a relatively similar rate (12.94%) and (11.76%) respectively, followed by flowers and stems with a rate of 5.88%. Other parts, use of, bark, bulb and roots were quoted less than 4% (Fig. 3). The curative preparation modes are indicating in Figure 4. The infusion mode is the most used with a rate of 52.29%, followed by decoction (19.27%) and the cataplasm mode comes in third position (14.68%).

**Table 1.** Distribution of demographic characteristics age, gender and educational level

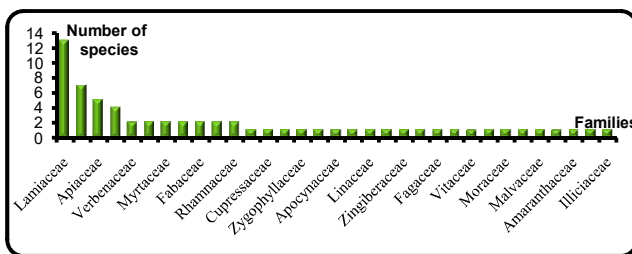
Demographic characteristics	Number	%
<b>Age</b>		
Less than 20 years	8	4.44
20-40 years	100	35.00
40-60 years	63	55.56
More than 60 years	9	5.00
<b>Gender</b>		
Men	108	60.00
Women	72	40.00
<b>Educational level</b>		
Primary	5	2,78
Secondary	81	45.00
University	94	52.22



**Fig. 3.** Plant parts used in Ain Defla province



**Fig. 4.** Methods used in Ain Defla province



**Fig. 2.** Botanical families of medicinal plants and number of species

**Table 2.** Medicinal plants commonly used in Ain Defla region

Species/voucher specimens	Family	Vernacular name	Part used	Preparation	Disease treated	UV
<i>Ajuga iva</i> L. [ZK-10]	Lamiaceae	Chendgoura	Aerial parts	Infusion	Digestive problems, eczema, antidiabetic, allergies	0.10
<i>Allium cepa</i> L. [ZK-32]	Amaryllidaceae	Basla	Bulbs	Infusion, cooked	Hypertension, hair loss, constipation respiratory problems, wounds anti-inflammatory	0.69
<i>Allium sativum</i> L. [ZK-31]	Amaryllidaceae	Thoume	Fruits	Decoction, cataplasm, cooked, maceration	Hypertension , hair loss, anti-inflammatory, cholesterol	0.49
<i>Anthemis cotula</i> L. [ZK-40]	Asteraceae	Okhouane	Flowers	Infusion, cataplasm	Rheumatism	0.06
<i>Anthemis nobilis</i> L. [ZK-38]	Asteraceae	Baboundedj	Flowers	Infusion, cataplasm, maceration	Heart diseases, respiratory diseases	0.06
<i>Apium graveolens</i> L. [ZK-45]	Apiaceae	Krafess	Aerial parts	Infusion	Rheumatism, digestive problems	0.15
<i>Artemisia absinthium</i> L. [ZK-39]	Asteraceae	Chajrat Meriam	Leaves, stems	Infusion, decoction	anti-inflammatory, digestive, hypertension	0.33
<i>Beta vulgaris</i> L. [ZK-56]	Amaranthaceae	Chamandar	Bulbs	Infusion	Anaemia, digestive	0.16
<i>Bunium elatum</i> (Batt.) Batt. [ZK-42]	Apiaceae	Talghouda	Aerial parts	Infusion	Intestinal gas, goiter	0.06
<i>Ceratonia siliqua</i> L. [ZK-46]	Fabaceae	Kharoub	Leaves	Decoction	Rheumatism, cardiovascular disorders	0.18
<i>Chamaerops humilis</i> L. [ZK-54]	Arecaceae	El doume	Leaves, stem	Infusion	Anti-tumour	0.01
<i>Citrus limon</i> L. [ZK-24]	Rutaceae	Laymoun	Fruits	Infusion	Cough, digestive problems, influenza	0.21
<i>Coriandrum sativum</i> L. [ZK-41]	Apiaceae	Kosbar	Leaves, stem	Infusion	Intestinal gas, anaemia, nervous disorders	0.27
<i>Cydonia oblonga</i> Mill. [ZK-63]	Rosaceae	Sfarjel	Leaves, fruits	Infusion	Diarrhoea, cholesterol	0.08
<i>Echinops spinosus</i> L. [ZK-36]	Asteraceae	Tasekra	Leaves	Decoction	Digestive, diabetes	0.05
<i>Eucalyptus globulus</i> Labill. [ZK-27]	Myrtaceae	Kalitouss	Leaves	Infusion, decoction, inhalation	Respiratory problems, cough, fever	0.17
<i>Ficus carica</i> L. [ZK-57]	Moraceae	El karma	Fruits	Infusion	Diarrhoea, anaemia	0.07
<i>Foeniculum vulgare</i> Mill. [ZK-44]	Apiaceae	Besbas	Fruits, seeds	Infusion	Digestive problems, heart problems, colon pain	0.25
<i>Hordeum vulgare</i> L. [ZK-59]	Poaceae	El chaâire	Seeds	Infusion, decoction, maceration	Diabetes, anaemia, diarrhoea, kidney disorder	0.35
<i>Illicium verum</i> Hook. F. [ZK-14]	Schisandraceae	Najmat l-ard	Seeds	Infusion	Nervous system disorder, colon pain	0.04
<i>Inula viscosa</i> L. [ZK-37]	Asteraceae	Magramane	Leaves, flowers	Infusion, decoction	Headache, diarrhoea	0.42
<i>Juniperus phoenicea</i> L. [ZK-21]	Cupressaceae	Aârâr	Aerial parts, leaves, fruits	Infusion, decoction	Rheumatism, antiseptic	0.12
<i>Laurus nobilis</i> L. [ZK-23]	Lauraceae	Rand	Leaves	Infusion, decoction	Carminative, antiseptic, hypertension	0.12
<i>Lavandula officinalis</i> L. [ZK-03]	Lamiaceae	El khozama	Leaves	Infusion, decoction, cataplasm	Cholesterol, relieves pain, digestive problems, diarrhoea	0.06

Cont...

**Table 2.** Medicinal plants commonly used in Ain Defla region

Species/voucher specimens	Family	Vernacular name	Part used	Preparation	Disease treated	UV
<i>Lavandula stoechas</i> L. [ZK-08]	Lamiaceae	Halhal	Leaves	Infusion	Antispasmodics nervous, cholesterol	0.12
<i>Lepidium sativum</i> L. [ZK-50]	Brassicaceae	Haberr-achad	Leaves, seeds	Infusion	Rheumatism, hypoglycaemia	0.08
<i>Linum usitatissimum</i> L. [ZK-30]	Linaceae	Zarriât elkatane	Seeds	Infusion, inhalation	Digestive problems, cholesterol, diabetes	0.21
<i>Lippia citriodora</i> L. [ZK-19]	Verbenaceae	Lwiza	Leaves	Infusion	Influenza, nervous disorder, colds, constipation	0.21
<i>Malva sylvestris</i> L. [ZK-49]	Malvaceae	El Khobbeiz	Aerial parts	Infusion, cataplasm, cooked	Abdominal pains, constipation, urinary diseases	0.18
<i>Marrubium vulgare</i> L. [ZK-04]	Lamiaceae	Timaryout	Aerial parts	Infusion, decoction, cataplasm	Cold, cough, fever, antidiabetic, allergies, hypertension	0.08
<i>Mentha pulegium</i> L. [ZK-13]	Lamiaceae	Fliou	Leaves	Infusion	Anti-hypertensive, antispasmodic, diarrhoea	0.23
<i>Mentha spicata</i> L. [ZK-02]	Lamiaceae	Naanaa	Aerial parts	Infusion, cataplasm	Headaches, muscle pains, colds, digestive problems, hypertension, sedative, nervous disorders	0.18
<i>Myrtus communis</i> L. [ZK-28]	Myrtaceae	Errayhane	Leaves	Cataplasm	Digestive disorders, hypertension , allergies, eczema	0.13
<i>Nerium oleander</i> L. [ZK-26]	Apocynaceae	Defla	Leaves	Cataplasm	Skin rashes, respiratory problems	0.10
<i>Ocimum basilicum</i> L. [ZK-12]	Lamiaceae	Lahbaq	Leaves	Infusion	Antibacterial, influenza antitumor, hypertension	0.24
<i>Olea europaea</i> L. subsp <i>europaea</i> [ZK-21]	Oleaceae	Zitoune	Leaves, fruits	Infusion, cataplasm	Heart disease, diabetes, cholesterol	0.18
<i>Opuntia ficus-indica</i> L. [ZK-58]	Cactaceae	El hendi	Leaves, fruits	Cataplasm	Diarrhoea, hair problems	0.10
<i>Origanum majorana</i> L. [ZK-11]	Lamiaceae	Mardkouche	Flowers, stem	Infusion	Hypertension, rheumatism pain, diabetes	0.13
<i>Origanum vulgare</i> subsp. <i>glandulosum</i> (Desf.) Ietsw. [ZK-09]	Lamiaceae	Zaâter	Aerial parts	Infusion, decoction	Eczema, hypertension, digestive problems, respiratory problem, antispasmodic, cold, antitumor	0.56
<i>Papaver rhoeas</i> L. [ZK-52]	Papaveraceae	Benaâmane	Flowers	Infusion	Digestive, antispasmodics, pulmonary diseases	0.12
<i>Paronychia argentea</i> Lam. [ZK-55]	Caryophyllaceae	Fatat lahjar	Leaves	Infusion	Kidney disorders	0.02
<i>Peganum harmala</i> L. [ZK-22]	Zygophyllaceae	Harmel	Leaves	Decoction	Antispasmodic, respiratory problems, pains	0.09
<i>Petroselinum crispum</i> (Mill.) Fuss. [ZK-43]	Apiaceae	Maâdnousse	Aerial parts	Infusion	Hypertension, cholesterol	0.31
<i>Pinus halepensis</i> Mill. [ZK-29]	Pinaceae	Sanawber	Leaves, bark	Infusion, cataplasm	Antiseptic, wounds, urinary problems, respiratory problems, skin affections	0.23
<i>Pistacia lentiscus</i> L. [ZK-33]	Anacardiaceae	Edhrw	Leaves, seeds	Infusion, cataplasm	Digestive problems, antiseptic, rheumatism, antispasmodic	0.19

Cont...

**Table 2.** Medicinal plants commonly used in Ain Defla region

Species/voucher specimens	Family	Vernacular name	Part used	Preparation	Disease treated	UV
<i>Prunus armeniaca</i> L. [ZK-61]	Rosaceae	El michmiche	Fruits, seeds	Infusion, cooked	Digestive, anaemia	0.04
<i>Prunus persica</i> L. Batsch [ZK-62]	Rosaceae	Khoukhe	Fruits, seeds	Infusion, cooked	Heart diseases, constipation	0.06
<i>Punica granatum</i> L. [ZK-18]	Lythraceae	Romane	Peel of fruit	Infusion, powder	Gastric problem, anaemia, pain	0.19
<i>Quercus ilex</i> subsp. <i>ballota</i> (Desf.) Samp. [ZK-51]	Fagaceae	Balloute	Fruits, barks	Infusion, decoction	Anti-diarrheic, urinary problems, pains	0.23
<i>Rhamnus alaternus</i> L. [ZK-16]	Rhamnaceae	M'liles	Leaves, Aerial parts	Infusion, decoction	Cholesterol, anaemia, diarrhoea, rheumatism	0.26
<i>Rosmarinus officinalis</i> L. [ZK-01]	Lamiaceae	Eklile	Aerial parts	Infusion, decoction, cataplasm, cooked, maceration	Hypertension, diabetes, cholesterol, teeth pain	0.26
<i>Rubus ulmifolius</i> Schott. [ZK-64]	Rosaceae	El Aallaigue	Leaves	Infusion, decoction	Anti-inflammatory, diarrhoea	0.08
<i>Ruta chalepensis</i> L. [ZK-25]	Rutaceae	Fidjel	Leaves	Infusion, decoction	Antispasmodic, diabetes, respiratory problems	0.16
<i>Salvia officinalis</i> L. [ZK-06]	Lamiaceae	Marimya	Leaves	Infusion, cataplasm	Hypertension, cholesterol, wounds, pains, digestive, rheumatism, vomiting, hair loss, colon pains	0.22
<i>Scolymus hispanicus</i> L. [ZK-34]	Asteraceae	El garnina	Leaves	Cooked	Diabetes, digestive problems	0.08
<i>Scorzonera undulata</i> Vahl. [ZK-35]	Asteraceae	El talma	Aerial parts	Infusion	Urinary problems, digestive problems	0.04
<i>Teucrium polium</i> L. [ZK-05]	Lamiaceae	Elkhayata	Leaves	Infusion, cataplasm	Diabetes, digestive, wounds	0.07
<i>Thymus munbyanus</i> subsp. <i>coloratus</i> (Boiss. & Reut.) [ZK-07]	Lamiaceae	Zâaitra	Leaves, stem	Infusion	Diabetes, hypertension, digestive, colds, rheumatism, influenza,	1.07
<i>Trigonella foenum-graecum</i> L. [ZK-47]	Fabaceae	Elhalba	Seeds	Infusion, decoction, powder	Appetite, anaemia, stomach pains	0.28
<i>Triticum durum</i> Desf. [ZK-60]	Poaceae	El kamh	Seeds	Infusion	Anaemia, digestive	0.05
<i>Urtica urens</i> L. [ZK-15]	Urticaceae	Horeig	Leaves, roots	Infusion, decoction	Rheumatism, hair loss, anaemia	0.26
<i>Verbena officinalis</i> L. [ZK-20]	Verbenaceae	Verveine	Aerial parts	Infusion	Pains, colds	0.13
<i>Vitis vinifera</i> L. [ZK-53]	Vitaceae	El dalya	Leaves	Infusion, decoction	Digestive problems, rheumatism pain, hypertension	0.36
<i>Zingiber officinale</i> Roscoe. [ZK-48]	Zingiberaceae	Zandjabil	Bulbs	Infusion, powder	Cholesterol, calm stomach, hypertension, anti-rheumatism	0.31
<i>Ziziphus lotus</i> (L.) Lam. [ZK-17]	Rhamnaceae	Sedra	Leaves	Infusion, powder	Pulmonary diseases, rheumatism	0.14

**Use value (UV):** UV fluctuate from 0.01 to 1.07. *T. munbyanus* and *A. cepa* are the most important species with UV 1.07 and 0.69, respectively, followed by *O. vulgare*, *A. sativum* and *I. viscosa* with UV of 0.56, 0.49 and 0.42 respectively (Table 2).

**Fidelity level (FL):** FL was calculated for the most quoted the plants by the interviewed (10 species) (Table 3). Highest FL (100%) was for *P. crispum* for treatment of cardiovascular diseases, following by *A. sativum* (64.77%) and *Z. officinale* (61.82%). The FL value of 86% was for *I. viscosa* used for

gastrointestinal diseases followed by *A. cepa* (60.00%), *H. vulgare* (50.79%) and *T. munbyanus* (41.45%). *O. vulgare* records a relatively similar FL value of 26.73 and 24.75%, for the treatment of gastrointestinal diseases and influenza respectively. To treat head pain and rheumatism *V. vinifera* and *A. absinthium* are most quoted with a FL of 36.67%.

**Informant consensus factor (ICF):** The ICF values calculated for diseases treated by the native population of the study area ranged from 0.75 to 0.95 indicating the concordance of the use of these plants in the use categories (Table 4). The highest value (ICF = 0.95) was reported for gastrointestinal disorders (842 use ratios with 46 species), the most cited of which are *T. munbyanus*, *A. cepa* and *I. viscosa*. The same value is recorded for cardiovascular diseases treated with 27 species where the most frequently used were *A. sativum* and *P. crispum*. Diabetes is treated with 12 species, the most widely used of which is *T. munbyanus*. Eight other species used by interviews for the treatment of influenza and colds with ICF = 0.91 of which the most cited is *O. vulgare*. Headaches, respiratory tract infection and Colds are treated with 25 species and the most cited is *A. absinthium* with an ICF value = 0.90. Renal disorders, respiratory and dermatological disorders record the same value (ICF = 0.89). The latter are treated with 2, 10 and 11 species, respectively the most used of which are *H. vulgare* (Renal diseases), *P. halepensis*, *E. globulus* (respiratory

diseases) and *U. urens* (dermatological disorders). Other categories such as tumours, anaemia and nervous problems record FIC values of 0.75, 0.77 and 0.79, respectively.

Ain Defla inhabitants have familiarity and interest in the use of medicinal plants. We recorded the predominance of men as high proportion of interviewed; it is in agreement with previous Algerian studies (Boudjelal et al 2013, Miara et al 2019). Similar remarks were reported from Turkey (Kaval et al 2014; Polat et al 2015). Traditional roots could explain the predominance of men. As in most Mediterranean societies,

**Table 4.** Category of ailments and their respectively values for Informant Consensus Factors (ICF)

Categories of ailments	Nur	Nt	ICF
Gastrointestinal disorders	842	46	0,95
Cardiovascular disorder	491	27	0,95
Diabetes	162	12	0,93
Influenza and Rheum	94	9	0,91
Pain, headaches and rheumatism	249	25	0,90
Respiratory disorder	86	10	0,89
Renal disorders	10	2	0,89
Dermatological disorders	123	15	0,89
Nervous system	20	5	0,79
Anaemia	40	10	0,77
Tumours	5	2	0,75

**Table 3.** Category of ailments, plants and their respectively values for the fidelity level (FL) for the most cited plants (10 species)

Category of ailments	Plants	Np	N	FL (%)
Gastrointestinal disorders	<i>Inula viscosa</i>	65	75	86.67
	<i>Allium cepa</i>	75	125	60.00
	<i>Hordeum vulgare</i>	32	63	50.79
	<i>Thymus munbyanus</i>	80	193	41.45
	<i>Vitis vinifera</i>	20	65	30.77
	<i>Origanum vulgare</i>	27	101	26.73
Influenza and Rheum	<i>Origanum vulgare</i>	25	101	24.75
Cardiovascular disorder	<i>Petroselinum crispum</i>	56	56	100.00
	<i>Allium sativum</i>	57	88	64.77
	<i>Zingiber officinale</i>	34	55	61.82
	<i>Artemisia absinthium</i>	21	60	35.00
	<i>Origanum vulgare</i>	21	101	20.79
	<i>Allium cepa</i>	25	125	20.00
Pain, headaches and rheumatism	<i>Vitis vinifera</i>	13	65	20.00
	<i>Artemisia absinthium</i>	22	60	36.67
	<i>Vitis vinifera</i>	32	65	49.23
Dermatological disorder	<i>Allium sativum</i>	21	88	23.86
Diabetes	<i>Hordeum vulgare</i>	21	63	33.33

traditional gender norms define women's role as basically relegated to the indoor duties this could create difficulties to communicate with women. Never the less other Algerian studies reported predominance of women (Benderradji et al 2014, Ramdane et al 2015, Negi et al 2020). Similar observations were reported for Morocco and Italy (Idm'hand et al 2020, Vitalini et al 2015). In present study, the dominant age is between 40 and 60 years (55.56%), in the same way other Algerian study (Miara et al 2019) indicated (50.98%) for age between 46 and 65 years. The majority of informants have a university level. Despite the fact, in other studies, authors reported the predominance of illiterate people, and few studies recorded the dominance of the primary level (Eddouks et al 2016, Lee et al 2018, Hu et al 2020). The 65 medicinal plant species were observed in Ain Defla province of 33 botanical families, with the highest rate of Lamiaceae with 13 and Asteraceae with seven species respectively. This agreed with previous Algerian studies conducted in Tizi-Ouzou province, were 98 plants were reported distributed in 48 families, Lamiaceae with 13 and Asteraceae with 12 species respectively (Meddour and Meddour-Sahar 2015). Likewise in M'Sila province, were documented 58 species fitting to 27 families, Lamiaceae (22.4%) and Asteraceae (20.7%) (Boudjelal et al 2013). In Algerian steppe (Miara et al 2018), recognized 97 species were found belonging to 42 families with the highest rate of Lamiaceae (18%) and Asteraceae (15%). Studies on Hoggar province by Ramdane et al (2015) reported Lamiaceae as (35%) followed by Asteraceae (12%). In North-eastern and southern Algeria (Sahara) Chenopodiaceae was reported as dominant (Chermat and Gharzouli 2015)

In Italy and Spain, dominance of Asteraceae was reported, (Vitalini et al 2015, Rigat et al 2015, Negi et al 2020). For other geographical regions, authors reported the dominance of other families (Nizar et al 2015, Tefera and Kim 2019, Prabhu et al 2020, Yebouk et al 2020) indicated the dominance of the Fabaceae.

Leaves are the part most used. This is in agreement with previous ethnobotanical studies (Adnan et al 2014, Benderradji et al 2014, Sher et al 2015, Ouelbani et al 2016, Eddouks et al 2016, Debnath and Das 2019, Nguyen et al 2019, Tefera and Kim 2019, Yebouk et al 2020, Johnny et al 2022). The regular use of leaves could be explained for the reason that leaves are not difficult to see and are of quickly harvesting, medicines prepared with leaves could rapidly relieve ailments, photosynthesis take place in leaves and are storage for secondary metabolites with biological properties (Raterta et al 2014). Preparation methods may differs in other countries; e. g. in India Hu et al 2020, indicated use of the whole plant and in Spain Rigat et al (2015) reported flowering

parts. The method commonly used is infusion. The present finding agreed with previous botanical surveys conducted in Algeria and other regions of the world (Ouelbani et al 2016, Bulut et al 2017, Miara et al 2019). Additionally large numbers of other methods such as decoction have been reported (Eddouks et al 2016, Lee et al 2018, Hu et al 2020, Mownika et al 2021, Johnny et al 2022).

The present study reported *T. munbyanus* with highest UV, this medicinal plant is little known in other regions, even though in the province of Ain Defla is frequently used against diabetes, blood pressure, deworming and stomachic. *A. cepa* traditionally used in Algeria for the treatment of cutaneous diseases, respiratory disorders, digestive problems, hair loss, hypertension and anti-inflammatory. Moreover in Adrar (south western Algeria) is utilized against back throbbing, skin injury and musculoskeletal illness (Yebouk et al 2020). In Spain, is used for cosmetologically, external antiseptic and antitoxic (Rigat et al 2015). In Mediterranean region *O. vulgare* is used; against rheumatic pain, antitumor, eczema, digestive problems, respiratory problems and antihypertension, Miara et al (2019) identical use in Bordj Bou Arreridj (highland region North-eastern Algeria). In Spain, is used against stomach upset, diarrhoea, enterobiasis, to heal wounds, sore throat, influenza, and to treat inflammation of the mucous membranes (Rigat et al 2015). The highest FL is recorded for *P. Crispum* for treatment of cardiovascular disease, this is a unique result not previously reported, probably could be explained as this species is specific for Ain Defla. *A. sativum* displayed FL of 64.77%, used for hypertension and also, used in Italy for high blood pressure (Vitalini et al 2015). In Morocco used against microbial infections Eddouks et al (2016), reported FL of 64 % for this plant and 61.81% for *Z. officinale*. In India (Hu et al 2020) mentioned 100% FL for *Z. Officinale* used for treatment of cough. *H. vulgare* account FL (33.33%). Other studies reported FL of 74.19% and 21.05% for treatment of renal disorders (Ouelbani et al 2016, Miara et al 2019). In terms of ICF, the highest value was for gastrointestinal and cardiovascular disorders (0.95), besides for diabetes (0.93), this agreed with other studies in Algeria, Morocco and Italy (Miara et al 2019, Eddouks et al 2016, Idm'hand et al 2020, Vitalini et al 2015).

## CONCLUSION

This is the first ethnobotanical study conducted in 10 municipalities of Ain Defla province, recording basic information on medicinal plants. The study identifies 65 plant species, distributed in 33 families, including *T. munbyanus* frequently used in Ain Defla, but little known in other regions. Numerous plants are used for alleviated different illnesses;



the most frequently cited are those associated with digestive and cardiovascular systems. Algerian inhabitants possess knowledge on medicinal plants growing in different regions, which are documented in previous studies, as well as in our study. The information collected in our study deliver elementary information on medicinal plants used by inhabitant of Ain Defla. The plant and the treatment for a specific disease we reported, should be investigated further involving, medicinal plants their bioactive compounds including phytochemical and pharmaceutical importance. The documented information could be useful for future research projects with the aim of establishing traditional pharmacopoeia.

### ACKNOWLEDGEMENTS

The authors are grateful to the 180 people who participated in the study. These residents of the 10 different municipalities of Ain Defla have contributed with their knowledge relating to medicinal plants, their use for diseases therapies. Their valuable collaboration has made possible the present study and the preparation of this manuscript.

### REFERENCES

- Adnan M, Ullah I, Tariq A, Murad W, Azizullah A, Khan AL and Ali N 2014. Ethnomedicine use in the war affected region of northwest Pakistan. *Journal of Ethnobiology and Ethnomedicine* **10**(1): 1-16.
- Agisho H, Osie M and Lambore T 2014. Traditional medicinal plants utilization, management and threats in Hadiya Zone, Ethiopia. *Journal of Medicinal Plant Studies* **2**(2): 94-108.
- Benarba B, Belabid L, Righi K, Bekkar A, Elouissi M, Khaldi A and 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, Ghabbane M, Bounar R, Brini F and 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**(12): 445-459.
- Boudjelal A, Henchiri C, Sari M, Sarri D, Hendel N, Benkhaled A and Ruberto G 2013. Herbalists and wild medicinal plants in M'Sila (North Algeria): an ethnopharmacology survey. *Journal of Ethnopharmacology* **148**: 395-402.
- Bulut G, Haznedaroğlu MZ, Doğan, A, Koyu H and Tuzlacı E 2017. An ethnobotanical study of medicinal plants in Acipayam (Denizli-Turkey). *Journal of Herbal Medicine* **10**: 64-81.
- Chermat S and 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.
- Debnath N and Das AK 2019. Ethnomedicinal plants used by the Halam tribe of North Tripura, northeast India. *Indian Journal of Ecology* **46**(2): 437-443.
- Dibong SD, Mpondo ME, Nigoye A, Kwin MF and Betti JL 2011. Ethnobotanique et phytomédecine des plantes médicinales de Douala, Cameroun. *Journal of Applied Biosciences* **37**: 2496-2507.
- Dobignard A and Chatelain C 2010. *Index synonymique et bibliographique de la flore d'Afrique du Nord*. Conservatoire et Jardin botaniques de la Ville de Geneve (CH), p. 455.
- DWR, Ain Defla 2021. *Statistical data. Direction of Water Resources of Ain Defla*.
- Eddouks M, Ajebli M and Hebi M 2016. Ethnopharmacological survey of medicinal plants used in Daraa-Tafilelet region (Province of Errachidia), Morocco. *Journal of Ethnopharmacology* **198**: 516-530.
- Faruque MO, Feng G, Khan MN A, Barlow JW, Anghi UR, Hu S, Kamaruzzaman M, Uddin SB and Hu X 2019. Qualitative and quantitative ethnobotanical study of the Pangkhua community in Bilaichari Upazilla, Rangamati District, Bangladesh. *Journal of ethnobiology and ethnomedicine* **15** (1): 1-29.
- Friedman J, Yaniv Z, Dafni A and Palewitch D 1986. A preliminary classification of the healing potential of medicinal plants based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. *Journal of Ethnopharmacology* **16**(2-3): 275-287.
- Hu R, Lin C, Xu W, Liu Y and Long C 2020. Ethnobotanical study on medicinal plants used by Mulam people in Guangxi, China. *Journal of Ethnobiology and Ethnomedicine* **16**(1): 1-50.
- Idm'hand E, Msanda F and Cherifi K 2020. Ethnobotanical study and biodiversity of medicinal plants used in the Tarfaya Province, Morocco. *Acta Ecologica Sinica* **40**(2): 134-144.
- Jadid N, Kurniawan E, Himayani CES, Prasetyowati I, Purwani KI, Muslihatin W, Purwani, KI, Muslihatin W, Hidayati D and Tjahjaningrum ITD 2020. An ethnobotanical study of medicinal plants used by the Tengger tribe in Ngadisari village, Indonesia. *Plos one* **15**(7): e0235886.
- Johnny J, Lebbie A and Wadsworth R 2022. Ethnobotanical survey of medicinal plants utilized by forest edge communities in southern Sierra Leone. *Journal of Medicinal Plants Research* **16**(1): 11-25.
- Kaval I, Behçet L and Cakilcioglu U 2014. Ethnobotanical study on medicinal plants in Geçitli and its surrounding (Hakkari-Turkey). *Journal of Ethnopharmacology* **155**(1): 171-184.
- Kidane L, Gebremedhin G and 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): 1-19.
- Lakhdari W, Dehliz A, Acheuk F, Mlik R, Hammi H, Doumandji-Mitiche B, Gheriani S, Berrekbia M, Guermit K and Chergui S 2016. Ethnobotanical study of some plants used in traditional medicine in the region of Oued righ (Algerian Sahara). *Journal of Medicinal Plants Studies* **4**: 204-211.
- Lee C, Kim SY, Eum S, Paik JH, Bach TT, Darshetkar AM, Choudhary RT, Hai DV, Quang BH, Thanh NT and Choi S 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.
- Meddour R and Meddour-Sahar O 2015. Medicinal plants and their traditional uses in Kabylia (Tizi Ouzou, Algeria). *Arabian Journal of Medicinal and Aromatic Plants* **1**(2): 137-151.
- Miara MD, Hammou MA, Aoul SH 2013. Phytothérapie et taxonomie des plantes médicinales spontanées dans la région de Tiaret (Algérie). *Phytothérapie* **11**(4), 206-218.
- Miara MD, Bendif H, Hammou MA and Teixidor-Toneu I 2018. Ethnobotanical survey of medicinal plants used by nomadic peoples in the Algerian steppe. *Journal of Ethnopharmacology* **219**: 248-256.
- Miara MD, Bendif H, Rebbas K, Rabah B, Hammou MA and 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.
- Morvin Yabesh JE, Prabhu S and Vijayakumar S 2014. An ethnobotanical study of medicinal plants used by traditional healers in silent valley of Kerala, India. *Journal of Ethnopharmacology* **154**(3): 774-789.
- Mownika S, Sharmila S, and Ramya EK 2021. Documentation of ethnomedicinal plants used for treating rheumatoid arthritis

- disorder by aboriginal communities of manar beat, karamadai range, western ghats, India. *Indian Journal of Ecology* **48**(1): 75-84.
- Negi K, Vasishth A, Joshi R, and Kumar V 2020. Ethnobotanical uses of medicinal plants in part of Pauri Garhwal. *Indian Journal of Ecology* **47**(4): 1091-1098.
- Nguyen TS, Xia NH, Van Chu T and Van Sam H 2019. Ethnobotanical study on medicinal plants in traditional markets of Son La province, *Vietnam Forest and Society* **3**(2): 171-2.
- Nizar KM, Gopakumar S, Kumar V and Ajeesh R 2015. Indigenous ethnomedicines and victuals of Malayans: An indigenous population of Peechi-Vazhani Wildlife Sanctuary, Western Ghats, India. *Indian Journal of Ecology* **42**(1): 9-15.
- Ouelbani R, Bensari S, Mouas TN and 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.
- Polat R, Cakilcioglu U, Kallitioğlu K, Ulsan MD and Türkmen Z 2015. An ethnobotanical study on medicinal plants in Espiye and its surrounding (Giresun-Turkey). *Journal of Ethnopharmacology* **163**: 1-11
- Prabhu S, Vijayakumar S, Morvin Yabesh JE, Prakashbabu R and Murugan R 2020. An ethnobotanical study of medicinal plants used in Pachamalai hills of Tamil Nadu, India. *Journal of Herbal Medicine* **25**: 100400.
- Quezel P and Santa S. 1962. *Nouvelle flore de l'Algérie et des régions désertiques méridionales* Vol. 2 CNRS, Ed. Paris, p. 1170.
- Ramdane F, Mahammed MH, Hadj MDO, Chanai A, Hammoudi R, Hillali N, Mesrouk H, Bouafia I and Bahaz C 2015. Ethnobotanical study of some medicinal plants from Hoggar, Algeria. *Journal of Medicinal Plants Research* **9**(30): 820-827.
- Raterta R, de Guzman GQ, Jonathan G and Alejandro D 2014. Assessment, Inventory and Ethnobotanical Survey of Medicinal Plants in Batan and Sabtang Island (Batanes Group of Islands, Philippines). *International Journal of Pure and Applied Biosciences* **2**: 147-154.
- Rebbas K, Bounar R, Gharzouli R, Ramdani M, Djellouli M et Alatou D 2012. Plantes d'intérêt médicinale et écologique dans la région d'Ouanougha (M'Sila). *Phytothérapie* **6**: 1-12.
- Rigat M, Valles J, Gras A, Iglésias J and Garnatje T 2015. Plants with topical uses in the Ripollès district (Pyrenees, Catalonia, Iberian Peninsula): Ethnobotanical survey and pharmacological validation in the literature. *Journal of Ethnopharmacology* **164**: 162-179.
- Sher H, Aldosari A, Ali A and de Boer HJ 2015. Indigenous knowledge of folk medicines among tribal minorities in Khyber Pakhtunkhwa, northwestern Pakistan. *Journal of Ethnopharmacology* **166**: 157-167.
- Tefera BN and Kim YD 2019. Ethnobotanical study of medicinal plants in the Hawassa Zuria District, Sidama zone, Southern Ethiopia. *Journal of ethnobiology and ethnomedicine* **15**(1): 1-21.
- Trotter RT and Logan MH 1986. *Informant consensus: a new approach for identifying potentially effective medicinal plants*. In: Etkin, N.L. (Ed.), *Plants in Indigenous Medicine and Diet*. Redgrave Publishing Company. New York, p. 91-112.
- Vital PG and Rivera WL 2009. Antimicrobial activity and cytotoxicity of *Chromolaena odorata* (L. f.) King and Robinson and *Uncaria perrottetii* (A. Rich) Merr. Extracts. *Journal of Medicinal Plants Research* **3**(7): 511-518.
- Vitalini S, Puricelli C, Mikerezi I and Iriti M 2015. Plants, people and traditions: Ethnobotanical survey in the Lombard Stelvio National Park and neighbouring areas (Central Alps, Italy). *Journal of Ethnopharmacology* **173**: 435-458.
- Yebouk C, Redouan F Z, Benítez G, Bouhbal M, Kadiri M, Boumediana AI, Molero-Mesab J and Merzouki A 2020. Ethnobotanical study of medicinal plants in the Adrar Province, Mauritania. *Journal of Ethnopharmacology* **246**: 112217.
- Zashim Uddin M and Abul Hassan MD. 2014. Determination of informant consensus factor of ethnomedicinal plants used in Kalenga forest, Bangladesh. *Bangladesh Journal Plant of Taxonomy* **21**(1): 83-91.