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ETHNOBOTANICAL SURVEY OF THE APIACEAE FAMILY SPECIES USED IN THE REGION OF SOUK-AHRAS (NORTHEASTERN ALGERIA)

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ABSTRACT

The Apiaceae family is one of the largest plant groups and contains a huge number of medicinal plants. The wildlife and cultural heritage of the Souk-Ahras region located in northeastern Algeria are both abundant. As a result, we assumed that the people of Souk-Ahras would know how to use indigenous medicinal plants in the traditional way. The present study is a contribution to the knowledge of the medicinal plants of the Apiaceae family. For this, a series of ethnobotanical surveys were carried out between January and April 2019 using 260 questionnaire sheets, where the prospecting of different localities in the Souk-Ahras region in search of Apiaceae resulted in the inventory of 25 species/subspecies belonging to 21 genera in these regions, and identify 13 medicinal species that can treat 24 pathological groups, the most common are digestive problems where the Fennel (*Foeniculum vulgare* Mill.) is the highest plant mainly used to treat digestive symptoms (16%). A decoction is the most used method (69 %) and the mostly administrated method is oral (84%). The seeds constitute the most used part in the studied region with (49%) then comes the underground part (13%). Cultivated plants of the Apiaceae taxa are widely used with (68%). Women are more used Apiaceae taxa with (57%) against male sex (43%). The age group under 50 years (67%) is the first user. Finally, the study uncovered a remarkable amount of ethnopharmacological knowledge and information that is ingrained in the Souk-Ahras people's cultural and traditional heritage and calls for further study.

Keywords: Apiaceae, Ethnobotanical Survey, Medicinal Plants, Souk-Ahras, Algeria.

Introduction

The field of ethnobotany is concerned with the traditional use of medicinal plants by indigenous peoples and rural populations (Balick and Cox, 1996). With the quick advancement of life and the pharmaceutical industry, this knowledge is dwindling and disappearing, necessitating the preservation and integration of traditional medicine into the modern health system through ethnobotany and ethnopharmacology (Boudjelal *et al.*, 2013). In this context, ethnobotanical surveys on traditional medicine have been conducted in Northeastern Brazil, Turkey, India, the Philippines, Ghana, Côte d'Ivoire, Tunisia and Morocco (Senouci *et al.*, 2019). In order to preserve indigenous knowledge and build a strategy to safeguard biodiversity and plant species, many ethnobotanical and ethnopharmacological studies have recently been conducted in diverse places around Algeria (Boutabia *et al.*, 2011; Meddour *et al.*, 2011; Ouelbani *et al.*, 2016; Bouasla and Bouasla, 2017; Hamel *et al.*, 2018; Boutabia *et al.*, 2020; Klech *et al.*, 2022). However, due to Algeria's enormous variety and scale, most of its geographical areas and ethnic

communities are still to be ethnobotanically investigated (Miara *et al.*, 2018). The Souk-Ahras region is located in the northeastern part of Algeria. Geographically, it sits in a basin, surrounded by mountains with complex mountainous relief, forming part of the Tell Atlas to the North and the High Plains to the South. It is characterized by a continental climate with Mediterranean and desert influence (Khoualdia *et al.*, 2014) it has a much diversified floristic heritage, particularly in the field of aromatic plants. The Apiaceae, formerly known as the Umbelliferae, are a family of roughly 3000 species classified into 469 genera found across the temperate world, but especially in the northern hemisphere. In Algeria, there are 55 genera with 117 species, including 24 endemics (Yaacoub and Tlidjane, 2017). The Apiaceae are most often aromatic plants. They secrete essential oils which give them characteristic smells and flavors. These organoleptic properties mean that many species are widely used as vegetables or spices. Plants of the Apiaceae family such as: *Anethum graveolens* L., *Pimpinella anisum* L., *Angelica archangelica* L., *Carum carvi* L., *Coriandrum sativum* L. (Esseid, 2018). Some species are toxic, like *Conium maculatum* L. (Byng, 2014). Several species of this

family are considered a rich source of essential and vegetable oils that can be exploited in the pharmaceutical, cosmetics, and perfumery and food industries (Sayed Ahmed, 2018).

This study is an ethnobotanical approach relating to the Apiaceae family of the Souk-Ahras region in northeastern Algeria, which is one of the families that contains a large number of medicinal plants. The flora and cultural heritage of Souk-Ahras are both abundant. Accordingly, we assumed that the inhabitants of Souk-Ahras would know how to use native medicinal plants in a traditional way. We have created a bibliographical review of ethnic and botanical remedies from the region to meet our objectives.

Materials and Methods

The study area

The Souk-Ahras region is located in northeastern Algeria (36°17'11"N, 7°57'4"E) (Fig. 1). It is distinguished by two essential characteristics: The northern part is located in mountainous part of the Tell Atlas and the southern part is located on the high plains. The region is characterized by two types of climate sub humid in the north and semi-arid in the south.

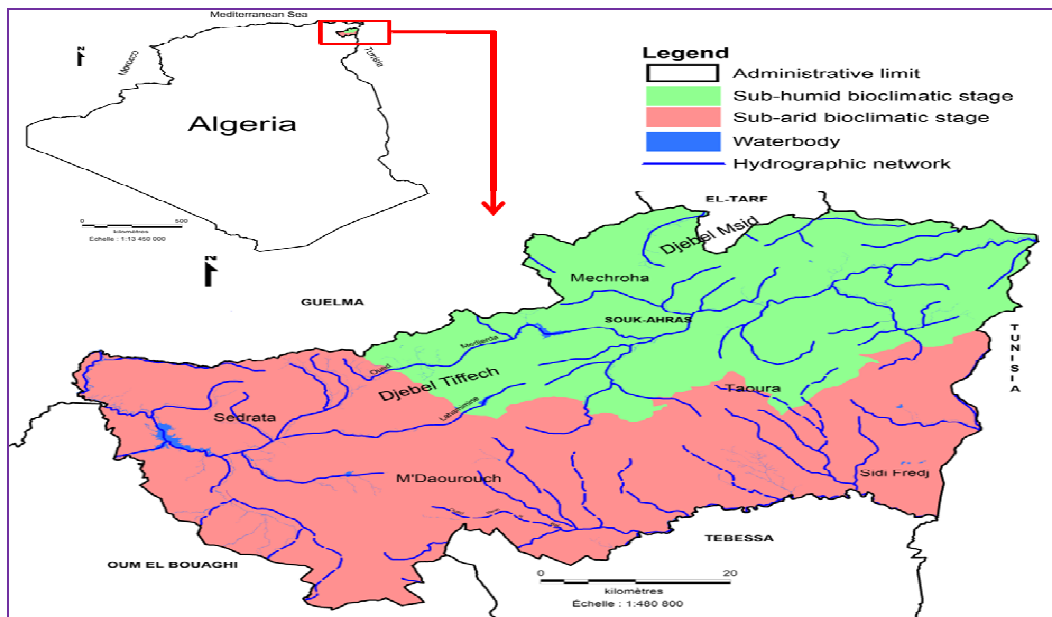


Fig. 1 : Location of the study area Souk-Ahras region

Study method

Ethnobotanical surveys were carried out between January and April 2019 in order to study the traditional and therapeutic use of medical plants amongst the local population. Questionnaires were conducted with 260 persons from the Souk-Ahras region (Fig. 2). The value of each medicinal plant in the Apiaceae family and the personal

information on the traditional healer in different places is the source of variability. The knowledge of the informant and his level of schooling are an example of a variant, because in phytotherapy, the statements of an illiterate differ from those of an educated. The interest of the investigation is given to this variability in space and time and the repetitiveness of information from one locality to another

Form number: Date:...../...../.....

Sociodemographic Data

* Gender: Female Men * Age:.....

*Level of people surveyed: illiterates primary education secondary education high school

*Social situation: unemployed service provider commercial farmer functionary

Plant Material

*Vernacular name: *Scientific name:

* Type of plant: Wild Cultivated

* Use of the plant: Therapeutic Cosmetic Other

* Part used: Stem Flowers Fruits Seed Bark Rhizome Bulb Leaves Whole plant

Other combinations :.....

* Method of preparation: Decoction Powder Maceration Fumigation Infusion Other.....

*Administration mode : Oral Massage Rinse Poultice Lotion Inhalation Other.....

*Uses: Dermatological disorders Digestive tract disorders Respiratory disorders Gland disorders Cardiovascular disorders Appendages of the digestive tract Genitourinary disorders Neurological disorders Osteo-articular disorders Metabolic disorders

Fig. 2 : Ethnobotanical survey sheet

Inventory of Apiaceae species in the study region

The lack of information on the distribution of Apiaceae in the region of Souk-Ahras has forced us to opt for a random sampling method that directly targets the Apiaceae development sites, as already done by de Bélair *et al.* (2005) for all of Numidia. For this purpose, field surveys were carried out during the flowering period from March to July 2019.

The identification of the specimens was made *in situ*, if necessary in a photograph, while being based, among other things, on the morphometric characters of the plant (Cherifi *et al.*, 2017). GPS tracking of the various stations has been done.

Data analysis

Once acquired, the data was collated using Microsoft Excel and displayed as graphs and tables. Additionally, the

database includes categories for classifying diseases (as they were noted in the interviews) and an ETIC category for classifying diseases into pathological groupings as suggested by Staub *et al.* (2015).

Results and Discussion

The geographical distribution of Apiaceae in the study area

Prospecting the different sites of Souk-Ahras region in search of Apiaceae resulted in the inventory of 25 species / subspecies belonging to 21 genera (Table 1). The geographical distribution of Apiaceae is far from uniform, with the north, north-east and north-west regions being much richer in species than those in the interior and the south (Fig. 3).

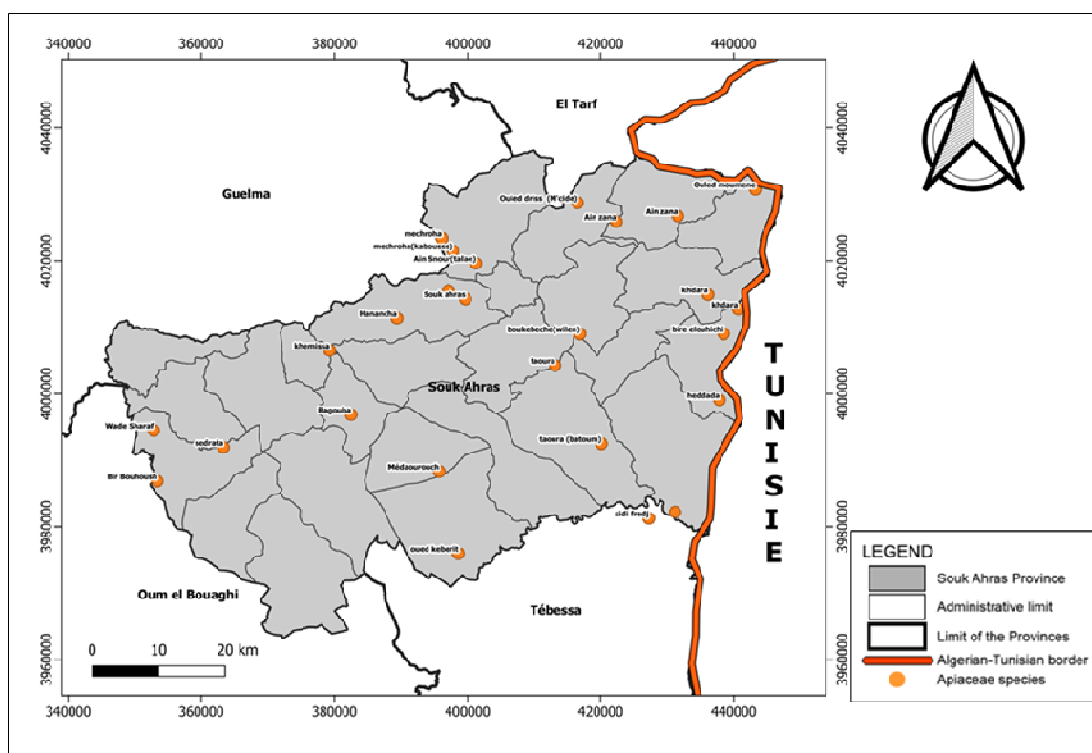


Fig. 3 : Distribution map of the Apiaceae family in the Souk-Ahras region.

Ethnobotanical survey

During fieldwork, 260 people were surveyed in the study area. The percentage of different frequencies of use of Apiaceae in traditional medicine in the Souk-Ahras region is calculated from the results of the ethnobotanical survey respondents can be classified according to several pre-established criteria, which are as follows: Sociodemographic data (sex, age, occupation, educational situation) and use of parts of the plant.

Socio-Demographic Data

According to sex

It has been noted that the female sex is more important and more used Apiaceae taxa whether in the field of herbal medicine or in the field of cooking and their ability to distinguish between them, where the percentage of male sex (43%) of surveys against (57%) for women (Fig. 4).

The activities of women at home could be the reason why they used medicinal herbs at a higher rate than males. In fact, women were in charge of drying, preserving, and preparing the herbal medicine for their family's continued health. Several researchers have made the same observation, for instance in Algeria Bouzid *et al.* (2017), Miara *et al.* (2018), Boutabia *et al.* (2020), Benderradji *et al.* (2021) and Klech *et al.* (2022); in Tunisia Jdaïdi and Hasnaoui, 2016. In Morocco, Belhaj *et al.* (2020), El-Assri *et al.* (2021) and Naceiri Mrabti *et al.* (2021 and 2022) noted that women are knowledge holders in the field of traditional herbal medicine, while men reserve the task of harvesting plants in hilly and dangerous areas.

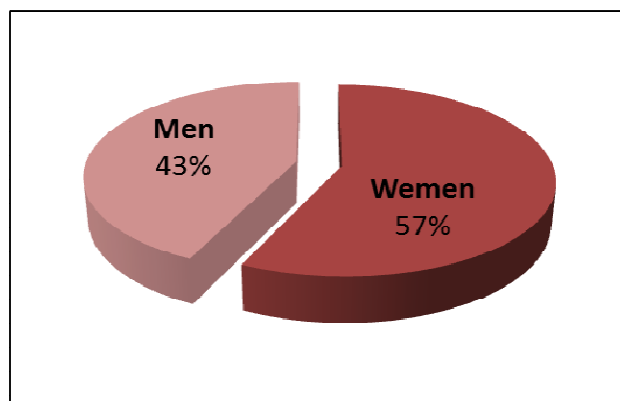


Fig. 4 : Percentage of female and male respondents in the study area.

According to age

Field surveys have shown us that the knowledge of medicinal plants, their method of use, and their properties are the result of a long experience transmitted from one generation to another. We have classified age groups into two categories (over 50 years old) and (under 50 years old) where we have noticed: the use of Apiaceae plants in the study area is widespread in all age groups with predominance of people under age 50 (67%) compared to older age groups. 50 years old (33%) (Fig. 5). This result explains that age groups under 50 years old they became more interested in herbal medicine and more confident in the effectiveness of plants of the Apiaceae family in the field of herbal medicine. People between the ages of 50 and 80 use herbal medicine more. Similarly, they are more experienced in the use of plants in traditional medicine and their knowledge of this area remains more in-depth. The use of medicinal plants by older people has also been reported in other studies (Boutabia *et al.*, 2011; Jdaïdi and Hasnaoui, 2016; Boutabia *et al.*, 2020, Gherairia, 2020, Benderradji *et al.*, 2021, Naceiri Mrabti *et al.*, 2022).

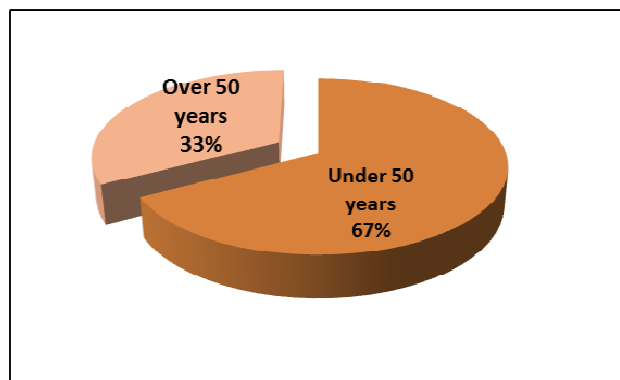


Fig. 5 : Represents the classification of respondents according to age

According to profession

According to the survey carried out, 39% of the populations studied are without profession. While 24% are functionary, 14% commercial; sellers, 12% service provider, the rest which is 11% of farmer (Fig. 6). This is explained by the fact that the people without work and the officials are responsible for providing the first therapeutic care for the whole family and our societies, thus reducing the material loads required by the doctor and pharmacist, because of the low cost of plants of the Apiaceae family. This reflects the

image of the relative transmission of traditional practices from generation to generation. These results agree with those of Boudjelal *et al.* (2013), Aouadi (2021) and Benderradji *et al.* (2021).

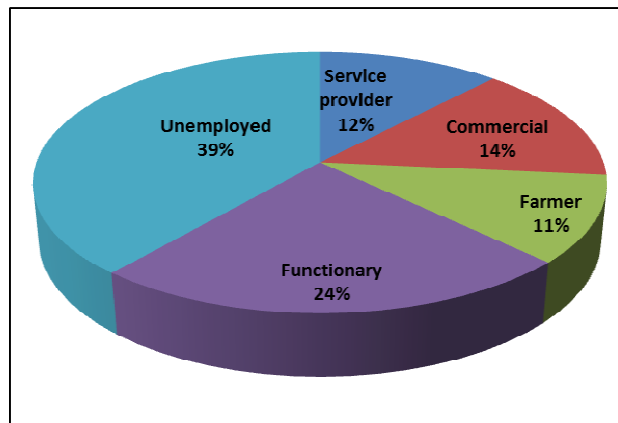


Fig. 6 : Use of plants of the Apiaceae family according to the profession

According to level of people surveyed

Of all the users of plants in the family Apiaceae in traditional medicine, people with a secondary education dominate with a percentage of 41%. This percentage of use is not negligible among people with a higher level (38%), while illiterates (11%) and people with primary education use fewer Apiaceae in herbal medicine with a percentage of 10% (Fig. 7). This result explains that the medicinal plants of the Apiaceae family can be dangerous when they are used unconsciously, and this asserts itself in some illiterate people who use the medicinal plants of the Apiaceae family in an irrational way, on the other hand. With a secondary and higher level can understand precisely the verbal instructions given by herbalists and healers. These results agree with those Boughrara and Legseir (2016).

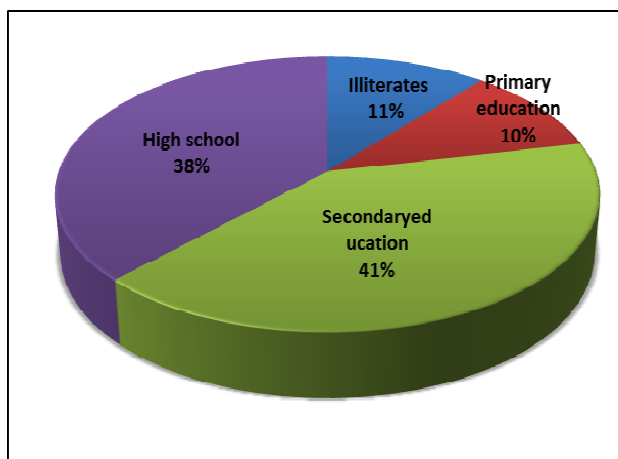


Fig. 7 : Use of plants by level of education

Plant material

Most commonly used plants

The studied population draws the plants of the Apiaceae family for their traditional therapeutic practice in the first place and for their food. On all the results obtained, we have gathered the plants of the Apiaceae family most used by the population of the Souk-Ahras region. Where 13 plants are known in our community among the total Apiaceae taxa.

Most plants grow cultivating like: *Pimpinella anisum*, *Carum carvi*, *Cuminum cyminum*, *Apium graveolens*, *Coriandrum sativum*, *Fenouiculum vulgare*, *Petroselinum crispum*, *Daucus carota* subsp. *sativus* or are spontaneous like: *Ammi visnaga*, *Anethum graveolens*, *Daucus carota*, *Thapsia garganica*, *Pituranthos scoparius*.

The percentage of *Fenouiculum vulgare* is the highest (16%), this proves that fennel is the most used medicinal plant by the population of the Souk-Ahras region, followed by *Pimpinella anisum* (13%), *Petroselinum crispum* (12%), *Thapsia garganica* (10%), *Cuminum cyminum* (9%), *Ammi visnaga* (8%), *Petroselinum crispum* and *Coriandrum sativum* (5%), *Carum carvi* and *Daucus carota* (4%) and *Daucus carota* subsp. *sativus* (2%) (Fig. 8). Generally the species which have a high percentage of use are considered by users as vegetable vegetables or used as aromatic spices or condiments.

Plants of the Apiaceae family have an important place in herbal medicine in the treatment of functional digestive disorders (Baba Aissa, 2000; Beloued, 2003; Teuscher et al., 2005; Filiat, 2012; Hamel et al., 2018; Chaachouay, 2020).

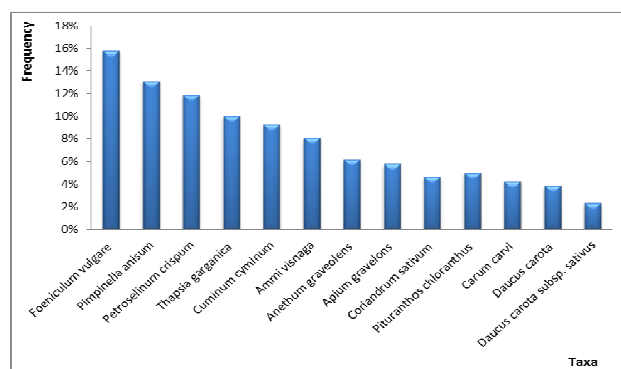


Fig. 8 : The most used plants of the Apiaceae family in the study region

Type of plant

Cultivated plants of the Apiaceae family are widely used with 68% of the total species in the study area. This is due to their availability throughout the year (such as parsley, cumin ...). Unlike spontaneous or wild species which are only partially so (32%) (Fig. 9). These results agree with those of Filiat (2012).

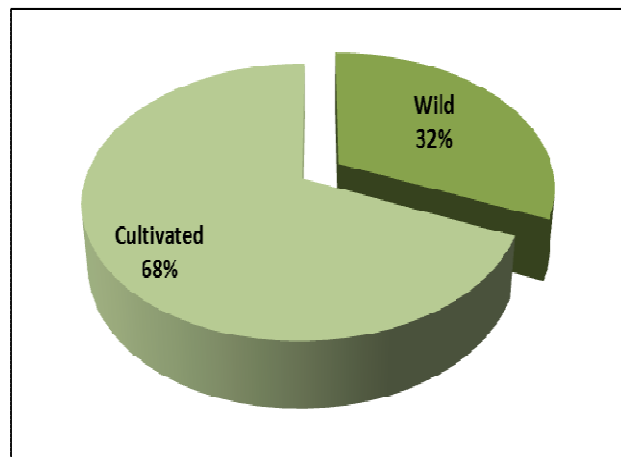


Fig. 9 : Use of plants of the Apiaceae family according to type

According to the part used

Each part of the plants used by the people surveyed in the study area has therapeutic properties. For this, the plants of the Apiaceae family in herbal medicine can be used whole or in part (leaves, stem, root, fruit, flower, bulb) or used the aerial part, this is what the following results show:

The ethnobotanical survey revealed that the seeds constitute the most used part in the studied region with a percentage of 49%, then come the underground part (13%), leaf (11%), whole plant (10%), aerial part and flowers (6%), stem (5%) (Fig. 10). The same observation was made by Filiat (2012) and Chaachouay (2020) in their study on Apiaceae.

The high percentage of seeds used within the Souk-Ahras region is in accordance with other studies such as those by El-Hilaly et al. (2003); Fakchich and Elachouri (2014); Hachi et al. (2015) and Haouari et al. (2018). It may be the most common uses of one plant organ over another within the therapeutic field may be related to the location in which secondary metabolites are likely to be concentrated. The Apiaceae family is recognized for producing essential oils frequently in both their leaves and fruits, which contain secretory pathways. Therefore, the widespread use of fruits is not surprising and may be explained by the substantial amounts of essential oils they contain. However, other secondary metabolites might also be significant. In this family, the endosperm has a high concentration of bitter compounds such as Petroselinic acid (Avatoa et al., 2010; Goncalves et al., 2012; Bagci, 2013). The roots of the Apiaceae family also contain several secondary metabolites, such as Furanocoumarins (Wink, 2015). This difference in proportions in the plant parts used is justified by the variability in the concentration of the active ingredients in each plant organ or even each species Bruneton (2009).

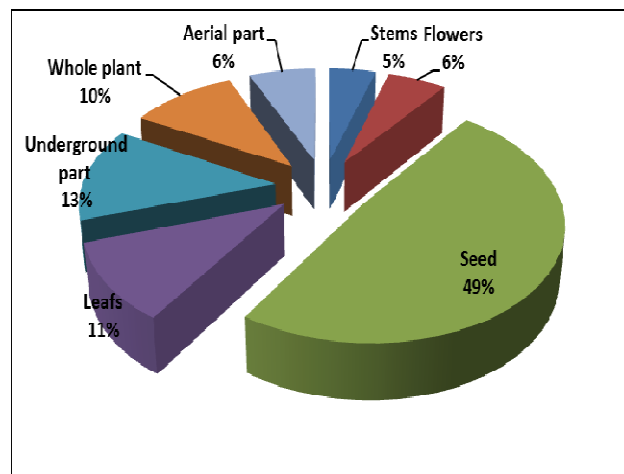


Fig. 10 : The percentage of the different parts used in plants of the Apiaceae family

According to method of preparation and administration

Simple means of preparation were preferred, as is customary for ethno botanical research investigations of plants used in traditional medicine. The decoction was the method of preparation that was used the most in our study (69%), followed by powder and infusion (30%) than fresh (23%) categories. 15% of the total is made up of additional ways of preparation, including, fumigation, boiling,

maceration, lotion, and juice (Table 1). The decoction was a highly regarded way of preparation since our interviewees were confident that it allowed for the extraction of the most active phytochemicals while simultaneously working to disinfect the used plant parts and warm the body. The widespread decoction has also been recognized by other researchers studying ethnobotany (Boutabia *et al.*, 2011; Martins *et al.*, 2015; Abubakar *et al.*, 2020; Naceiri Mrabti *et al.*, 2021; Kachmar *et al.*, 2021; Bouafia *et al.*, 2021; El-Assri *et al.*, 2021; Alami *et al.*, 2021). The majority of cures were taken orally (84%) according to our study, but there were also reports of poultice and massage (15%) inhalation

and lotion (8%) use (Table 1). Despite the fact that our informants were unfamiliar with chemical compounds, extraction methods, we were able to see certain instances where the same plant was administered in various ways to cure various conditions. For instance, *Pituranthos chloranthus* is given orally after the fruits are decocted to reduce flatulence; nevertheless, an inhalation made from dried roots or essential oils is created and used topically to treat Respiratory problem. Pharmacological research on this plant's application to use as a natural disinfectant and insecticide has previously been conducted Yangui *et al.* (2009).

Table 1 : Plants of the Apiaceae family most commonly used for therapeutic use in the Souk-Ahras region

N°	Botanical Name	Vernacular Name	Name in Arab	Status	Part used	Diseases Treated	Method of preparation	Mode of administration
1	<i>Pimpinella anisum</i> L.	Green Anise	Habet Hlawa	Cultivated	Seeds	- Digestive - Urogenital	Infusion	Oral
2	<i>Carum carvi</i> L.	Caraway	Caraway	Cultivated	Seeds, Roots	- Digestive - Metabolics	Powder, Decoction, Maceration	Oral
3	<i>Cuminum cyminum</i> L.	Cumin	Camone	Cultivated	Whole Plant, Seeds, Leaf, Roots	- Digestive - Antibacterial activity - Analgesic	Powder, Maceration, Decoction, Infusion, Fumigation Lotion	Oral
4	<i>Apium graveolens</i> L.	Celery	Krafes	Cultivated	Whole Plant, Roots	- Urogenital - Hypertension - Gout - Eczema	Infusion, Decoction	Poultice Oral
5	<i>Coriandrum sativum</i> L.	Coriander	Debshaa	Cultivated	Whole Plant	- Digestive - Urogenital	Decoction, Infusion, Fresh	Oral
6	<i>Foeniculum vulgare</i> Mill.	Fennel	Besbes	Cultivated	Whole Plant, Seeds	- Digestive	Infusion, Decoction	Oral
7	<i>Petroselinum crispum</i> Mill.	Parsley	Maadnous	Cultivated	Whole Plant	- Metabolics - Digestive - Urogenital	Decoction, Infusion, Fresh	Oral
8	<i>Daucus carota</i> subsp. <i>sativus</i> (Hoffm.) Schübler & G. Martens	Carrot	Zroudia	Cultivated	Whole Plant ; Roots	- Metabolics - Kidney Diseases - Dropsy	Fresh consumption, Jus	Oral Lotion Massage
9	<i>Ammi visnaga</i> Lamk	Toothpick-herb	Khella	Spontaneous	Stem, Fruits, Whole Plant	- Flatulence - Digestive - Absence of menstruation - Urogenital	Decoction	Poultice
10	<i>Anethum graveolens</i> L.	Anth	Thebesh	Spontaneous	Whole Plant, Roots, Leaf, Stems	- Digestive - Flatulence, Gastritis - Hemorrhoids, Hiccups, Heartache, Coughs	Decoction, Fresh consumption Fumigation	Oral

11	<i>Daucus carota</i> L.	Wild Carrot	Djazar Bari	Spontaneous	Roots, Stems, Seeds and Leaf	- Urinary infection - Dermatology - Digestive tract	Decoction , Lotion, Fresh	Oral
12	<i>Thapsia garganica</i> L.	Thapsia	Deriass	Spontaneous	Roots	- Bronchitis - Allergies - Joint symptom	Powder With Olive Oil, Macerated In Olive Oil	Massage
13	<i>Pituranthos chloranthus</i> (Coss. & Durieu) Benth. & Hook. f.	Deverra	Elgouzih	Spontaneous	Stems , Seeds	- Respiratory - Anti-inflammatory - Against headaches	Infusion, Powder Fumigation	Oral inhalation

Conclusion

The abundant and diverse flora of Algeria helps to explain why plants are frequently used for gastronomic, cosmetic, and therapeutic purposes. However, plant consumption that is irrational, anarchic, and uncontrolled can lead to toxicity that can be fatal. Because of the availability of modern synthetic medications and the progress in medical technology, it was possible for us to characterize the relative relevance of phytotherapy to the inhabitants of the Souk-Ahras region and to confirm that people continue to employ plants for medicinal purposes. Unknown recipe ingredients and dangerous plants are also sold to consumers, it was discovered. As a result, there is interest in spreading awareness about the risks of using non-scientifically proven plants for treatment. The prospecting of different localities in Souk-Ahras region in search of Apiaceae resulted in the inventory of 25 species / subspecies belonging to 21 genera. People from the Souk-Ahras region use up to 13 medicinal plants belonging to the genus Apiaceae. We have registered medicinal uses to treat many symptomatic conditions associated with 24 pathological groups. The most highly referenced conditions have digestive symptoms. The preferred preparation methods used by individuals in the area are decoction and are mostly administrated orally. The ethnobotanical survey revealed that the seeds constitute the most used part in the studied region with a (49%) then comes the underground part (13%), leaf (11%), whole plant (10%), where the Fennel (*Foeniculum vulgare* Mill.) is the highest plant mainly used to treat digestive symptoms (16%). Finally, the study uncovered a remarkable amount of ethnopharmacological knowledge and information that is ingrained in the Souk-Ahras people's cultural and traditional heritage and calls for further study. Nearly half of the included uses had never been documented before, even when incorporating some earlier studies on the use of medicinal plants in the Souk-Ahras region and other regions of Algeria. These findings motivate us to carry out more fieldwork and record Algeria's ethnopharmacological knowledge, either by expanding the scope of our research to include interviews with a larger number of unrelated subjects or by widening the geographic scope of our research to more intriguing regions. It goes without saying that maintaining the biomes in Algeria and preserving this significant and fascinating traditional knowledge are both necessary for protecting the traditional pharmacopeia.

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