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Ethnopharmacological Survey on *Otoglyphis pubescens* (Desf.) Pomel in the Northeast of the Algerian Sahara

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Abstract

The utilization of phytotherapy is essential in the Algerian Sahara, where endemic plants such as *Otoglyphis pubescens* are used to address certain health issues. However, discrepancies in knowledge and application of these botanical resources may lead to toxicity and reduced efficacy. A questionnaire was prepared and interviews conducted among herbalists and common population to collect data according to the objectives set. Ethnobotany indices were calculated and comparison was made between the different subgroups of the sampled population.

The most commonly used vernacular names for *Otoglyphis pubescens* are: Gartoufa, Gritfa, and Wazwaza. This plant is endemic and grows wild. The most commonly used parts are the whole aerial parts dried in the shade. This plant is used as herbal tea. The most commonly used preparation methods are maceration and infusion. This plant is used mainly for its therapeutic properties to address issues related to the treatment of digestive, genitourinary, and respiratory problems, and fever. According to the analysed indices, the interviewed populations showed high knowledge of the uses of *O. pubescens*, with subpopulations such as married individuals, females, persons aged over 60 years, the less educated, and the unemployed noting superior use of the plant. Variations are noted in the answers of the interviewed subjects and differences stood comparing to data reported in the literature, but close responses patterns were noted between the herbalists and the common population.

Key words: *Matricaria pubescens*, Gartoufa, Gritfa, survey, ethnobotany, herbalists, population

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Introduction

Traditional medicine remains the main recourse for large groups of populations to alleviate their health problems, not only because it constitutes an important element of cultural heritage, but also for reasons of limited financial means or difficul access to conventional medecine. It has been transmitted from one generation to another through oral communication, posing the danger of losing some knowledge (1). Ethnobotanical research is essential for knowledge of medicinal plants and their uses. A broad knowledge of how to use plants against different diseases is very common in areas where the use of plants is still of great importance (2). In Algeria, traditional medicine and Phytotherapy are frequently used, sometimes even more than contemporary medicine (3). The World Health Organization (WHO) reports that about two thirds of people use Phytotherapy, primarily because plants are naturally occurring and reasonably priced. In Algeria, 109 genera and 408 species of the Asteraceae family are found (4).

The study focused on *Otoglyphis pubescens* (Desf.) Pomel – an annual endemic plant that grows naturally in arid regions in North Africa and belongs to the *Asteraceae* family, tribe *Anthemideae*, subtribe *Glebionidinae* (5). This plant is used by the local population in daily life under several forms and for several therapeutic, food and cosmetic indications (6). It is characterized by its pubescent (hairy) foliage and stems, which are adaptations to arid environments in subtropical biomes. It is described as a rustic, aromatic, pleasant smelling species, growing along roadsides in rural areas. Although sometimes considered a pest, it is suitable for rock and herb gardens, as well as edging plants (7). Their multi-branched stems are prostrate, erect, glabrous and very leafy, they are slender, cylindrical, and branched, often slightly woody at the base in mature plants. The leaves are bipinnate, alternate, pinnately lobed or deeply dissected, measuring 1–5 cm in length, with linear to narrowly oblong lobes, and are densely covered in short, soft hairs (pubescent) (8). The flowers are radially symmetrical, greenish-yellow in color with semi-spherical heads. White rays may be present. The disc florets are toothed with 4 to 5 lobes. The receptacle is 2–3 times taller than its width, with pappus that may be in the form of a short crown. The fruits are small, 1–2 mm long, cylindrical or slightly flattened in shape, with a smooth or faintly ribbed surface (8, 9). Various names have been suggested such as: *Matricaria pubescens (Desf) Sch.Bip* Hairy camomille, *Aaronsohnia pubescens (Desf), Cotula pubescens Desf* 1799, *Chamomilla pubescens (Desf) Alavi*, *Chlamydophora pubescens (Desf) Coss & Durieu*, *Chrysanthemum pumila Batt & Jahand*, *corymbosumvar Chrysanthemum cossonianum Batt* (9). In 1874, French botanist Auguste Pomel re-examined the group and transferred Desfontaines' species to the genus Otoglyphis, creating the combination: *O. pubescens*, which is currently accepted in major taxonomic databases (Plants of the World Online (POWO), The International Plant Names Index (IPNI), World Flora Online) (8). The phytochemical composition of *O. pubescens* is characterized by coumarins, which are among the primary constituents, predominantly found in the aerial parts, including herniarin and dihydroherniarin, (2E, 4E) -6- (2-thienyl) -2,4 hexadiene-isobutylamide (10). Besides, several flavonoids have been isolated from the aerial parts: Apigenin, Luteoline, Quercetin, Apigenin 7-O- β-D

glucoside, Luteoline 7- O - β-D –glucoside, Quercetin 3-O- β-D –Glucoside, Isorhamnetine 3- O - β-D –glucoside, Isovitexine, 4`- O Methylisoscutellareine-7- O - [6 " '- O -acetyl β-D-glucosyl- (1 → 2) -β -D- glucoside], Isoscutellareine-7- O - [6 " '- O -acetyl-β-D glucosyl- (1 → 2) -β-D-glucoside], 4`- O Methylisoscutellareine-7- O - [β-D-glucosyl- (1 → 2) -β-D-glucoside] (9).

This study aims to investigate the utilization of *O. pubescens* in the northeast of the Sahara region. The region was chosen due to its demographic importance (around 10% of the population of Algeria and 62% of the population of the Algerian Sahara) (11) and the significant role of Phytotherapy in local healthcare. The research pursues two primary objectives. Firstly, it evaluates the knowledge, usage, and working conditions of local herbalists regarding *O. pubescens*. Secondly, it assesses the knowledge and use of the plant among the general population, considering their varying access to local healthcare facilities due to the region's expansive geography. Additionally, the study explores whether the natural abundance of *O. pubescens* in the region correlates with its widespread recognition and frequent prescription by local herbalists.

Material and Methods

Context of the Study

The survey was conducted over two years, from January 2022 to December 2023, and targeted 174 herbalists and a sample of 711 participants from the general population. It was conducted using data from face-to-face interviews. Information on the plant's indications, toxicity, adverse effects, and contraindications was compared with findings from studies in other regions to test the hypothesis of significant variability in knowledge and use across different population subgroups.

The study region (Figure 1) has a desert climate, characterized by hot, dry summers and mild winters. Annual rainfall is typically below 100 mm, with an average yearly temperature of 20.9 °C (12).

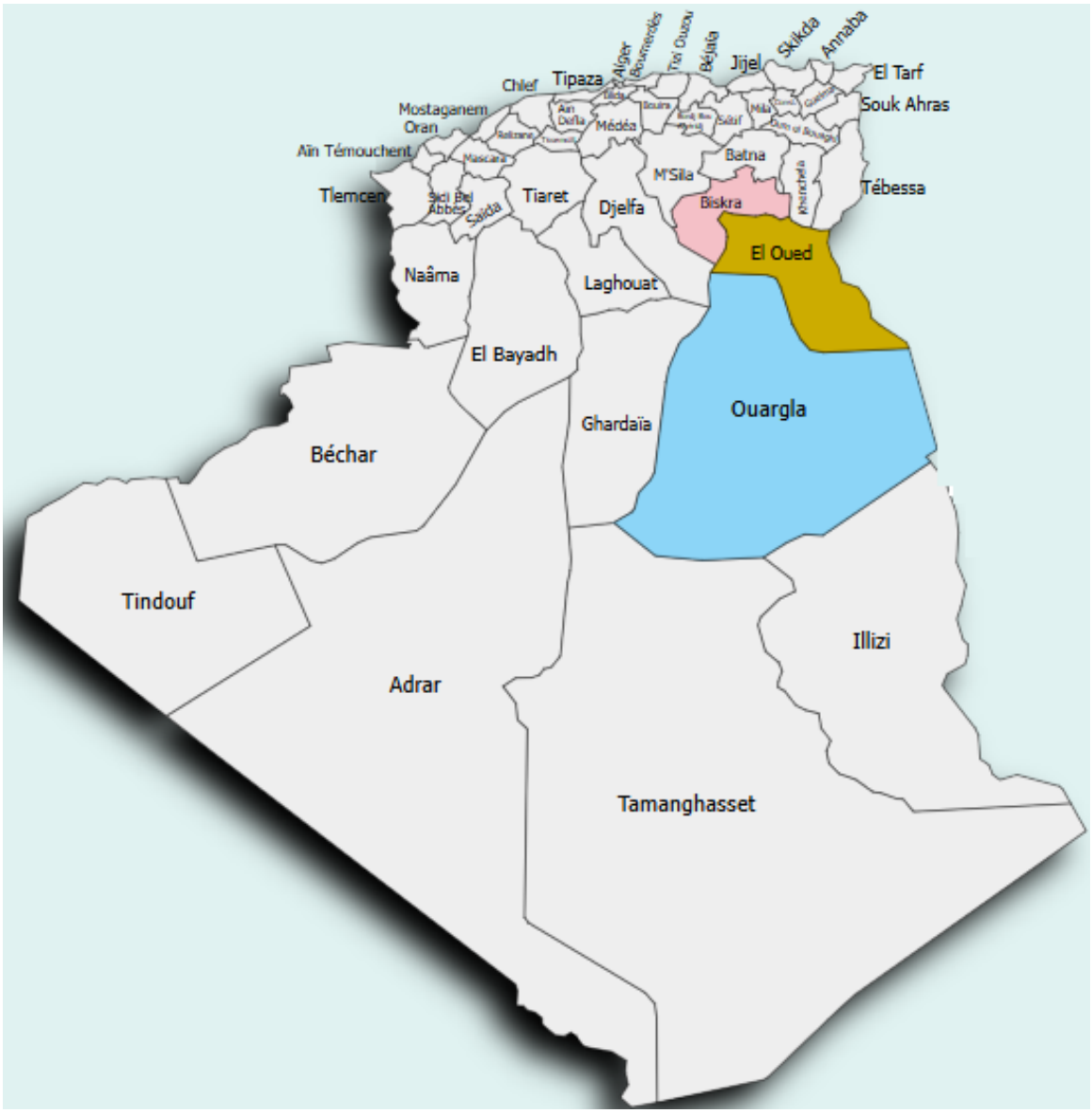

Figure 1. Map of Algeria with the 3 surveyed provinces colored
Slika 1. Mapa Alžira sa 3 ispitane provincije u boji

Plant Material

A voucher sample was deposited at the CRSTRA (Center for Scientific and Technical Research on Arid Regions), University of Mohamed Khider Biskra (specimen No. 003CRSTRA0040).

Study Population

The survey was divided into two parts following the methodology given in (13).

- First part: Survey of herbalists; All herbalists holding a commercial register were surveyed (174 herbalists)
- Second part: Survey of the general population (consumers)

The sample size for the entire population was calculated using the following formula (14, 15):

$$n = \frac{\mathrm{N\ x\ P\ x\ (1-P)}}{\mathrm{(N-1)\ x\ \left(\frac{d}{z}\right)^2 + P\ x\ (1-P)}} \qquad [1]$$

n – the sample size to be calculated

N – the size of the total population (number of inhabitants) of the provinces El Oued, Ouargla and Biskra in the last population census undertaken in 2018 (11) respectively (771900 + 640368 + 84967 = 2261940)

P – 56%, the initial level of the indicator to be measured (the level of knowledge of *O. pubescens* calculated from the pre-survey; in fact, a pre-survey was conducted prior to the survey and 56% of the surveyed population gave an answer regarding the plant)

d – the margin of error (5 %)

z – the confidence level corresponding to the risk of error chosen (1.96)

The result must however be adjusted according to the effect of the sampling plan (x 1.5), and the expected number of non-responses (20%) (16, 17). Based on the above formula and specified parameters, the required sample size was calculated to be of 711 participants.

It is noted that the number of inhabitants per studied province (Biskra, El Oued and Ouargla) was taken into account when assigning the surveyed samples (18).

Eligibility Criteria

The inclusion criteria applied in the study are presented in Table I. Distinct criteria were defined for herbalists as compared to the general population. Two primary inclusion criteria were established for herbalists, whereas three criteria were determined for the general population. One non-inclusion criterion was applied to herbalists, while three exclusion criteria were applied to the general population.

Table I Inclusion and Non-inclusion criteria of the study

Tabela I Kriterijumi za uključivanje i isključivanje iz studije

Inclusion criteria	Non-inclusion criteria
Herbalists	
- Any person working as a herbalist in the three provinces of study, registered or not at the commerce administration - Must be present on the day of the survey and must accept participation regardless of his age	- Refusal to participate, change of function or no availability on the day of the survey
General population	
- Age ≥ 20 years - Resident in the region for at least five years regardless of gender and level of education - Consent to participate in the survey	- Age under 20 - Resident in the region for less than five years - Refusal to participate in the survey

Type of Study

A cross-sectional descriptive study was conducted to assess the knowledge, attitudes, and practices of herbalists and the general population concerning the use of the plant (19).

The primary outcome measure was the characterization of the uses of the plant and the profile of its users, with the aim of guiding subsequent research on its pharmacological activities more accurately.

Data Collection

An initial interview was conducted in order to obtain the study participation consent.

Data collection was then carried out through interviews following a structured questionnaire.

The questionnaire was developed on the basis of existing questionnaires and validated by the Cultural and Technical Cooperation Agency (ACCT) in previous studies and during the pre-survey (20, 21).

A feasibility study of the acceptability of the questionnaire was carried out with 50 individuals (pre-survey or pilot test). This led to reformulating certain questions, reviewing the sequence of the different sections of the questionnaire and adding others.

The measurement of exposure was estimated by an indirect approach meaning that the interviews were not necessarily conducted by the study team, and information could be collected from a general discussion in an informal manner (22). The information

relating to the factors studied among herbalists and the general population was obtained through face-to-face interviews (direct administration questionnaire) (23) lasting 30 to 60 minutes. A specimen of the plant was shown to the respondents to avoid confusion of vernacular names between the different regions.

The questionnaire was translated into Arabic and adjusted with local dialects (24). These interviews were conducted with herbalists in their workplaces, and with the population in different places (home, market, bus stop and others) (25).

The Questionnaire

The questionnaire consisted of five parts covering the aspects shown in the section results and discussion.

Data Analysis

Microsoft Access software was used for data entry and management. The data was then processed using Epi Info software (version 3.5.4), which enabled a descriptive statistical analysis of the responses given by the respondents. ANOVA and t-tests have been performed in order to compare the different socio-demographics subgroups according to some criteria relevant to the use of plant. The significance threshold for all analyses was 5% (p = 0.05).

Calculation of Important Indices of Ethnobotany

Diversity index of knowledge of respondents: a metric to assess the variation and richness in traditional knowledge about plants among informants (respondents), it evaluates how knowledge is distributed across individuals, communities, or groups (26, 27).

$$\boldsymbol{ID = -\sum(Ni/N)log2\left(\frac{Ni}{N}\right)} \qquad [2]$$

Ni – the number of uses cited by the respondent

N – total number of uses recorded

Equitability index of knowledge of respondents: measures how evenly knowledge about plants or their uses is distributed among respondents; a high equitability index indicates that knowledge is shared broadly across respondents, while a low value suggests that knowledge is concentrated among a few individuals (28).

$$\mathbf{IE} = \frac{\boldsymbol{ID}}{\boldsymbol{IDmax}} \qquad [3]$$

IDmax = log2 *n*, where *n* is the total number of respondents

Medical use value (Med.UVs): represents the relative importance or popularity of a medicinal plant based on the number of uses cited by respondents. It is calculated based on the frequency and diversity of a plant's reported medicinal uses by informants (29, 30).

$$\textbf{Med. UVs} = \frac{\sum \boldsymbol{Uis}}{\boldsymbol{ns}} \quad [4]$$

Uis – the total number of citations of medicinal uses of the species mentioned by the informant
ns – the total number of informants

Ethical Aspect

The study protocol was reviewed, commented and initially approved by the Ethics Committee of the University Hospital of Batna on the 5th of October 2021, under the reference: CHU-CE/112 in accordance with the ethical guidelines for epidemiological studies. Anonymity and confidentiality will be maintained during and after the study.

Results and Discussion

Sociodemographic Characteristics of the Surveyed Subjects

The majority of the herbalists surveyed were from the province of El Oued (59.77%), 20.69% from the province of Biskra and 19.54% from Ouargla. Regarding the common population, it was distributed between villages (48%), towns (44%), douars (6%) and nomads (2%).

The most frequently surveyed age group (herbalists and common population) in this survey was between 50 and 59 years old, with a percentage of 22.08%, followed by the age groups between 40 and 49 years old (19.27%), between 30 and 39 years old (17.72%), over 60 years old (16.58%), and between 20 and 29 years old (14.35%). The sex ratio for the herbalists stood at 33.8 with the preponderance of males, while it is more balanced (1.06) for the general population, indicating the profession of herbalist is mainly practiced by males.

The majority of the herbalists had undergone no training related to the job and cumulated less than 10 years of experience, for the general surveyed population 46.27% was without professional activity, the rest is classified as follows: intermediate professions (14.89%), farmers (11.25%), retired (9.28%), workers (8.44%), employees (5.49%), craftsmen, traders and business managers (1.69%) and executives and higher intellectual professions (1.69%) (Table II).

Table II The sociodemographic characteristics of the interviewed subjects (herbalists and general population)

Tabela II Sociodemografske karakteristike ispitanika (travari i opšta populacija)

Question		**Herbalists**	**General population**
Distribution according to the provinces of study		174	711
Distribution by age(years)	Average ±Standard deviation Median	42.28 ± 14.39 39	47.88 ± 13.9 49.30
Distribution of by gender	Male Female	97.13% 2.87%	52% 48%
Distribution according to educational level	Uneducated Primary school Intermediate Secondary University	29.31% 8.05% 1.15 47.13% 14.37%	43.03% 11.25% 3.94% 19.41% 22.36%
Distribution according to training conduct	No training Training in Phytotherapy Inheritance	87.86% 9.83% 2.31%	
Distribution according to professional experience in years	<10 years 10–20 years 21–30 years 31–40 years 41–50 years	70.69% 16.09% 7.47% 4.02% 1.72%	

General Information on *O. pubescens*

The quasi totality of the surveyed subjects (herbalists or general population) had identified the plant and confirmed its dispensation for the herbalists or use for the common population. Of the 7 herbalists that did not dispense the plant, 5 gave no reason, and 2 attributed it to the lack of demand from the consumers.

This medicinal plant is used by the common population as a habit (46.52%), due to its effectiveness (33.07%) and because it is safe (36.07%). Family heritage and the experience of others constituted 90.44% of the sources of knowledge for the plant. General culture represented 12.44%, while a prescription from herbalists constituted only 5.61% (Table III).

Table III The general information on *Otoglyphis pubescens* collected from the interviewed subjects

Tabela III Opšte informacije o vrsti *Otoglyphis pubescens* prikupljene od intervjuisanih ispitanika

Question	Variable	Herbalists	General population
Identification of the plant		100%	99%
Dispensation of the plant (answered by 96.55% of the herbalists and 100% of general population)	Dispense / use Not dispense / Not use	96% 4%	91% 9%
Distribution of age groups of patients using this plant (161 herbalists answered this question)	Children Adults Elderly	72.83% 79.62% 68.51%	
Distribution of plant use by gender of patients (162 herbalists answered this question)	Females Males	86.33% 70.18%	

Information on the Identification and Use of the Plant Material of *O. pubescens*

Gartoufa and **Gritfa** were the primary vernacular names used by both herbalists and the general population, although numerous other names were reported with lower frequency. This finding corroborates several studies conducted in the Ouargla and El Oued regions, which identified *O. pubescens* as **Gartoufa** (28, 29). In contrast, studies from Libya and Mauritania assign the name **Gartoufa** to *Brocchia cinerea* and **Wazwaza** to *O. pubescens* (25, 26, 27). Meanwhile, a Moroccan study refers to *O. pubescens* as **Lerbyân**, a name attributed to *Brocchia cinerea* in our study, aligning with the vernacular name used in Libya (24). Other vernacular names were also reported, namely: **Tchih, Tchîh n'el jemal**, **Ghrissa**, **Chih**, **Azukni**, **Assekkar**, in studies conducted in Morroco and the far south of Algeria (32, 33, 34).

Only 3 herbalists were able to give a scientific name, with one giving the exact one: *Matricaria pubescens (Desf.) Schultz, Chamomilla pubescens (Desf.) Alavi et Jaffri, Chlamydophora pubescens Coss. et DR.*

For the general population, 6 persons answered the question. According to 4, the latin name of this plant was *Matricaria pubescens* and according to 2, the name was *Matricaria discoroides*.

The primary use of this plant was for therapeutic purposes among both herbalists and the general population. In fact, 68.19% of the population habitually used *O. pubescens* before turning to conventional medicine. 28.76% used it in conjunction with conventional medicine, and only 6.8% resorted to it after conventional medicine had failed.

The majority of the surveyed subjects, including herbalists and the general population, stated that the primary source of the plant is wild, harvested manually in the spring, used mainly in its dried state, and stored in the shade for therapeutic purposes, either alone or in combination with other substances such as Thyme (22.58%), Mugwort (12.09%), Tobacco (9.67%), Cinnamon (8.87%), Rosemary (7.25%), Cumin (7.25%), Mint (7.25%), Juniper (6.45%), Verbena (4.83%), Red mugwort (4.03%), Olive oil (4.03%), Coriander (4.03%), Lavender (2.42%), Fenugreek (2.42%), Honey (2.42%), Onion (2.42%), *Brocchia* (2.42%), Date (1.61%), Milk (1.61%), Wheat (1.61%), Wormwood (0.8%), Rose (0.8%), White cumin (0.8%), Fennel (0.8%), Globularia (0.8%), Ginger (0.8%), Animal fat (0.8%), Henna (0.8%), Vinegar (0.8%), Guentes (0.8%), Basil (0.8%), Aspicate (0.8%), Ajuga iva (0.8%), Mustard (0.8%), and Nutmeg (0.8%). The main plant material used consists of the whole aerial parts, prepared by maceration or infusion and consumed as herbal tea or powder, taken orally with a spoon, in doses below 50 g per glass of water or below 100 g per liter of water. It is typically administered once a day for children and twice a day for adults and the elderly, for a duration of less than a week, as recommended by the surveyed herbalists or until healing, as stated by the general population, and stored away from light. The survey results are consistent with a study conducted in Morocco, which reported that *O. pubescens* is associated with tea or consumed with animal fat (31). Further studies noted that the leaves were the most commonly used part of the plant (32). Additionally, decoction was identified as the most significant method of preparing (33) (Table IV).

Table IV The information on the identification and use of the plant material of the plant collected from the interviewed subjects

Tabela IV Informacije o identifikaciji i upotrebi biljnog materijala biljke prikupljene od ispitanih subjekata

Question	Variable	Herbalists	General population
Common name (98.27% of the herbalists, and 678 persons from the common population responded this question)	**Gartoufa**	58.47%	41.44%
	Gritfa	52.04 %	43.21%
	Wazwaza	40.35 %	27.13%
	Harra	5.26 %	
	Timguitet	2.33 %	
	Gortaifa	0.58 %	0.88%
	Gnitsa	0.58 %	0.58%
	Gartifa		0.44%
	Gtaf		0.29%
	Ghrissa		0.29%
	Gatifa		0.14%
	Jaada		0.14%
	Gartafa		0.58 %
	Gartaf		1.03%
Source of the plant (163 herbalists and 699 from the general population answered this question)	Wild	95.7%	72.24%
	Cultivated	15.95 %	4.15%
	Weed	2.46%	5.15%
	Imported	1.22%	
	Unknown		7.62%
Use of the plant (163 herbalists and 637 subjects answered this question)	Therapeutic	77.64%	92.62%
	Food	35.88%	34.37%
	Cosmetic	35.88%	1.72%
	Other		9.73%
Harvesting method (173 herbalists and 530 subjects from the general population answered this question)	Manual method	87.28%	99.62%
	Mechanic method	12.71%	0.75%
Harvest time (9% of the herbalists and 528 subjects of the common population answered this question)	Spring	71.42 %	75%
	Winter	17.39 %	6.62%
	Summer	11.18%	9.84%
	Autumn	4.76%	6.62%
	All year round	2.48%	9.84%
Use of the plant alone or in association (161 herbalists and 270 subjects from the general population answered this question)	Alone	86.06%	65%
	Associated	66.06%	68.53%
Plant Usage States (95.40% herbalists and 626 subjects from the general population answered this question)	Dry state	96.98%	92.97%
	Fresh state	25.9%	25.9%
	Pretreatment	0.60%	

Drying method (148 herbalists and 359 subjects from the general population answered this question)	In the shade Under the sun In the air Other methods	72.29% 18.91% 10.13%	44.01% 53.76% 15.32% 3.34%
Part used (161 herbalists and 618 subjects from the general population answered this question)	The aerial part Flowers Stems Whole plant Leaves Fruits Grains Rhizomes Barks Bulbs Others	49.06% 32.91% 25.46% 20.49% 16.77% 3.72 % 1.24 % 0.62 % 0.62 %	41.9% 20.22% 13.43% 25.08% 26.69% 4.53% 2.26% 0.80%) 1.13% 0.16%
Form of use (166 herbalists and 623 subjects from the general population answered this question)	Herbal tea Powder Extract Granule Essential oil Fatty oil	77.71% 67.46% 56.02% 8.43% 3.01% 0.6%	60.76% 68.21% 27.12% 4.65% 1.44% 0.32%
Method of preparation (154 herbalists and 617 subjects from the general population answered this question)	Maceration Raw use Decoction Infusion Cooked Fumigation, Juice Poultice Cataplasm Compress	69.48% 45.45% 37.01% 25.97% 14.93% 1.94% 1.29% 0.64%	30.47% 26.41% 33.87% 39.54% 13.33% 2.76% 1.45% 1.94% 0.64%
The unit dose used (154 herbalists and 582 subjects from the general population answered this question)	Spoon Handful Pinch Other	52.98% 34.32% 17.16% 2.23%	45.26% 35.91% 17.35% 3.6%
The dose used in grams / glass of water (18 herbalists and 68 subjects from the general population answered this question)	≤ 50 grams/glass of water 50–150 grams /glass of water 200–250 grams /glass of water	94.44% 5.55%	47% 26.46 1.47%
The dose used in grams/liter of water **(**14 herbalists and 68 subjects from the general population answered this question).	≤ 100 grams/L 100–200 grams/L 300–400 grams/L	92.85% 7.14%	66.66% 22.22% 11.11%

Mode of administration (160 herbalists and 711 subjects from the general population answered this question)	Oral intake Inhalation Massage Rinsing Brushing	96.25% 3.12% 1.25% 1.25%	85.25% 7.98% 4.60% 4.20%
Mode of administration A total of 74, 112, and 105 herbalists responded to questions regarding children, adults, and the elderly, respectively. In contrast, 356 individuals from the general population answered questions related to children, 491 responded to questions about adults, and 460 addressed questions concerning the elderly.	**Children:** Once a day Twice a day 3 times a day Other **Adults:** Once a day Twice a day and 3 times a day Other **Elderly:** Once a day Twice a day 3 times a day Other	 45.94% 44.59% 9.45% 27.67% 53.57% 16.96% 26.66% 57.14% 14.28%	 47.19% 28.93% 6.74% 17.13% 24.03% 39.91% 27.08% 8.96% 25.65% 45.21% 19.13% 10%
Duration of use Only 18 herbalists and 419 subjects from the general population answered this question	≤ 7 days 15 to 30 days 30 to 45 days. 45 to 60 days Until healing	55.55% 11.11% 5.55% 27.77%	27.44% 4.53% 1.19% 0.24% 65.87%
Storage 131 herbalists and 485 subjects from the general population answered this question	Away from light Exposed to light Other	83.97% 15.26%	80% 15.46% 9.89%

Information on the Pharmaco-toxicological Properties of *O. pubescens*

The plant *O. pubescens* was recognized for its therapeutic effects on multiple ailments affecting various organs, as reported by both the surveyed herbalists and the general population. Digestive disorders were the most frequently cited condition treated through self-prescription, consistent with findings from several ethnobotanical surveys conducted in Morocco and Algeria (31, 32, 33). The plant's digestive healing properties may be attributed to its ethanolic extract, which exhibits anti-inflammatory and antioxidant effects targeting the liver and gut, suggesting potential hepatoprotective benefits that indirectly support digestion (34). Anti-inflammatory properties relevant to digestive conditions, such as irritable bowel syndrome or ulcers, were confirmed in an *in vivo* study, where *O. pubescens* alkaloids inhibited carrageenan-induced edema, mirroring mechanisms underlying antispasmodic effects on the gut (35).

The plant *O. pubescens* has been reported to exhibit therapeutic effects on respiratory conditions, with 45.27% of surveyed herbalists and 36.34% of the general population endorsing its efficacy, while a related study noted that 58% of respondents observed benefits for ailments such as colds, coughs, bronchitis, and infections (31). These findings are consistent with similar studies conducted in Morocco (32, 33). The preparation of *O. pubescens* commonly involves decoction (82% of cases) or infusion using dried aerial parts (79.33%) (31). Its essential oils and flavonoids demonstrate anti-inflammatory properties, potentially mitigating respiratory inflammation. Additionally, *in vitro* studies suggest antioxidant effects that may protect lung tissue from oxidative stress (35, 36).

Approximately 40% of the informants in the current study reported using *O. pubescens* for genitourinary disorders, while 48% of herbalists in Morocco's Draa-Tafilalet region indicated its application in treating urinary tract infections, kidney stones, and menstrual disorders (32). Preparations typically involve decoctions or infusions of dried aerial parts (37). Phenolic acids and sesquiterpene lactones contribute to its antimicrobial and anti-inflammatory properties, potentially supporting urinary tract health. Antioxidant activity has been demonstrated, which may aid kidney protection, though specific clinical evidence for genitourinary applications remains limited (38).

Only 7% of the general population reported using *O. pubescens* for osteoarticular conditions, though it is traditionally employed to treat rheumatism and joint pain (39, 40, 41), likely due to its flavonoids and alkaloids, which exhibit antioxidant and anti-inflammatory properties (35, 42). A study conducted in the provinces of Ouargla and Ghardaia documented its use in the traditional management of diabetes (43), while a study from the Moroccan Sahara reported its application in respiratory diseases, hemorrhoids, and rheumatism (44). These findings align with the results reported by a previous study conducted in two regions of southern Algeria (31). In veterinary applications, *O. pubescens* is primarily utilized as a component of livestock feed. Herbalists consider *O. pubescens* nontoxic. This finding is supported by a study on laboratory rats showing no adverse effects on liver or kidney function at dietary levels (34). However, some individuals from the general population reported adverse effects, including digestive issues, hematotoxicity, and nephrotoxicity. A study highlights that bioactive compounds, such as sesquiterpene lactones, may cause allergic reactions (e.g., contact dermatitis) in sensitive individuals, a common risk with *Asteraceae* plants (45). Both herbalists and the general population recommended cautious use, particularly for pregnant women and children. This aligns with a study advocating precaution during pregnancy due to secondary metabolites, such as coumarins, which may interfere with hormonal processes (33). Approximately 6% of the surveyed herbalists and 4% of the general population reported using the plant for cardiac disorders, while 5% of the herbalists and 3% of the general population cautioned against its use in hypertensive patients. However, studies have shown that the aqueous extract of the plant's aerial parts reduces systolic, diastolic, and mean arterial pressure in hypertensive rats but not in normotensive rats (46).

Similarly, 8.6% of the herbalists and 6.5% of the general population recommended caution for individuals with gastric ulcers, despite other studies demonstrating the plant's antiulcer properties, primarily attributed to flavonoids such as apigenin and luteolin derivatives (47) (Table V).

Table V The data collected about the pharmaco-toxicological properties of *Otoglyphis pubescens*

Tabela V Podaci prikupljeni o farmakotoksičnim svojstvima vrste *Otoglyphis pubescens*

Question	Variable	Herbalists	General population
Types of human diseases treated by *Otoglyphis pubescens*	Digestive system diseases	58.78%	53.95%
	Respiratory diseases	45.27%	36.34%
	Genitourinary disorders	40.54%	37.96%
	Fever	15.54%	11.3%
	Digestive tract appendages	12.16%	
148 herbalists and 619 subjects from the general population answered this question	Dermatological	7.43%	5.49%
	Cardiovascular	6.08%	4.04%
	Metabolic	4.05%	1.93%
	Neurological	4.05%	1.13%
	Pediatric	4.05%	1.77%
	Glandular disorders	1.35%	2.90%
	Scorpionism	1.35%	14.86%
	Fight against thirst	2.02%	6.13%
	Osteoarticular disorders		7.27%
Veterinary use	Food for animals	76.61%	69.48%
	Preventative	9.58%	3.57%
73 herbalists and 308 subjects from the general population answered this question	Curative	19.17%	20.12%
	Other uses		6.81%
Distribution according to the origin of the prescription	Herbalists	28.36%	15.49%
	Physicians	2.83%	2.96%
	Self-medication	80.14%	78.81%
	Others	1.41%	5.01%
141 herbalists and 439 subjects from the general population answered this question			

Side effects 161 herbalists and 85 subjects from the general population answered this question	Digestive disorders High blood pressure Dizziness Other side effects Bleeding	38.46% 15.38% 15.38% 30.76%	57.64% 2.35% 2.35% 2.35%
Toxicity 170 herbalists and 58 subjects from the general population answered this question	Not toxic Digestive toxicity Blood toxicity Nephrotoxicity	100% 0% 0% 0%	44.82% 10.34% 8.62% 6.89%
Precautions of use 35 herbalists and 93 subjects from the general population answered this question	Pregnant women People suffering from gastric Ulcers Children People with high blood pressure People with allergies Other precautions	66.57% 8.57% 8.57 5.71% 2.85% 11.42%	59.13% 6.45% 7.52% 3.22%

The study found that the general population exhibited a significantly higher diversity knowledge index (ID = 303.79) compared to the surveyed herbalists (ID = 70.16). This suggests greater variability in plant-related knowledge among the general population relative to the herbalists. Conversely, the medicinal use value (Med.UVs) of the surveyed herbalists (Med.UVs = 1.83) was higher than that of the general population (Med.UVs = 1.74), indicating greater relative importance or prevalence of the medicinal plant based on the number of uses reported by respondents (Table VI). Furthermore, the informants demonstrated familiarity with the plant, with knowledge distribution varying across demographic and socio-economic factors. Specifically, the highest diversity knowledge index (ID) and Equitability Index of knowledge (IE) values were observed among individuals over 60 years of age (ID = 73.33, IE = 0.24), married individuals (ID = 215.92, IE = 0.71), males (ID = 127.03, IE = 0.42), those in socio-professional category 8 (ID = 80.65, IE = 0.26), less educated individuals (ID = 114.10, IE = 0.37), and rural residents (ID = 84.27, IE = 0.27). These findings indicate that older adults, males, married individuals, those in socio-professional category 8, less educated individuals, and rural inhabitants possess greater diversity and richness in plant-related knowledge compared to other subgroups (Table VII). Besides the subgroups of people above 60 years old, females, married, less educated, category 1 and inhabitants of douars and nomads showed generally statistical significance in the identification, use, recourse to the plant before and after failure of allopathy comparing to the other subgroups (Table VIII).

Table VI Diversity index of herbalists and common population knowledge of the plant

Tabela VI Indeks raznolikosti znanja o biljci kod travara i opšte populacije

	General population	Herbalists
ID	303.79	70.16
Med.UVs	1.74	1.83

Table VII The ethnobotanical indices calculated for the surveyed population

Tabela VII Etno-botanički indeksi izračunati za istraživanu populaciju

Socio-demographics	Variable	Indices	
		ID	IE
Age	20–39	28.6	0.09
	30–39	39.45	0.13
	40–49	50.21	0.16
	50–59	57.81	0.19
	Above 60	73.22	0.24
Family situation	Single	33.41	0.11
	Married	215.92	0.71
Sex	Male	127.03	0.42
	Female	122.32	0.4
Educational level	Uneducated	114.1	0.37
	Primary	27.07	0.09
	Middle	8.05	0.02
	Secondary	32.29	0.1
	University	36.34	0.12
Socioprofessional categories	1	21	0.07
	2	2.97	0.01
	3	2.97	0.01
	4	27.38	0.09
	5	7.4	0.02
	6	13.25	0.04
	7	17.03	0.05
	8	80.65	0.26
Localization	Douar	11.07	0.03
	Countryside	84.27	0.27
	City	74.51	0.24
	Nomad	2.796	0.01

ID: Diversity index of knowledge of respondents

IE: Equitability Index of knowledge of respondents

Table VIII Comparison of the different parameters according to the study population; for each parameter the subgroup of the highest occurrence is mentioned with the p-value and the significance of the test (IS: Significant, NS: Non significant)
(INSEE: National Institute of Statistics and Economic Studies)

Tabela VIII Poređenje različitih parametara prema istraživačkoj populaciji; za svaki parametar navedena je podgrupa sa najvećom učestalošću, zajedno sa p-vrednošću i značajem testa. (IS: značajno, NS: nije značajno)
(INSEE: Nacionalni institut za statistiku i ekonomske studije)

Socio-Demographic parameters	**Identification of the plant**	**Use of the plant**	**Recourse to the plant before allopathy**	**Recourse to the plant after failure of allopathy**
Age	Persons over 60 years S : $p < 0.05$	Persons over 60 years S : $p < 0.01$	Persons over 60 years S : $p < 0.01$	Elderly S: $p = 0.002$
Family situation	Married S : $p < 0.01$	Married S : $p < 0.01$	Married S : $p = 0.01$	Married S : $p = 0.017$
Sex	NS **:** $p = 0.33$	Female S: $p < 0.01$	Females S: $p < 0.01$	Females S : $p < 0.01$
Educational level	NS : $p = 0.16$	Educated use less S : $p < 0.01$	Uneducated S : $p < 0.01$	NS : $p = 0.65$
Socio-professional (INSEE)	NS: $p = 0.86$	Category1 S : $p < 0.049$	NS **:** $p = 0.08$	Categories 4,5 and 6 S : $p < 0.04$
Localization	NS: $p = 0.51$	Nomads and inhabitants of douars S : $P < 0.02$	Nomads S : $P < 0.0072$	NS $P = 0.12$

Conclusion

Otoglyphis pubescens is an endemic plant common to the Algerian Sahara, due to the hugeness of the region, and limited access to healthcare facilities. The local population relies upon the flora to treat certain ailments. Despite its limitations, such as the respondents' recall bias, the ethnobotanical survey allows for the identification of the uses of this plant. This step is essential for conducting phytochemical and pharmacotoxicological studies. The main vernacular names used by herbalists and the population for *O. pubescens* were **Gartoufa**, **Gritfa**, and **Wazwaza**.

This work also showed that this plant was primarily used for therapeutic purposes and secondarily as food for livestock and cosmetic.

The most commonly used preparation methods for *O. pubescens* were maceration, infusion, decoction, raw and cooked, while the most commonly used part was the whole aerial part, followed by the flowers, leaves, and fruits. The most commonly used forms were herbal tea, powder, extract, and granules.

O. pubescens was indicated for the treatment of digestive, genitourinary, and respiratory diseases and fever.

The elderly, married, less educated, and inhabitants of rural areas and nomadic communities demonstrated rich and varied knowledge about the plant. They were also the most likely to identify and utilize it.

Finally, despite the variations noted in the answers given by the interviewed subjects, similar patterns were observed between the herbalists and the common population and the findings were close to those encountered in similar studies.

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Declaration of Competing Interest

The authors declared no conflict of interest.

Author Contributions

M.T.B.M: Writing - original draft, Methodology, Formal analysis, Data curation, Conceptualization; S.N.: Writing – review & editing, Validation, Data curation; A. A.: Methodology, Formal analysis, Data curation; S.A.: Methodology, Formal analysis; M.O.: Formal analysis, Data curation; S.C.: Validation, Supervision; Y.H.: Visualization, Validation, Supervision, Project administration.

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Etnofarmakološko istraživanje *Otoglyphis pubescens* (Desf.) Pomel na severoistoku alžirske Sahare

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Kratak sadržaj

Fitoterapija je od ključnog značaja u alžirskoj Sahari, gde upotreba endemičnih biljaka kao što je *Otoglyphis pubescens* omogućava lečenje određenih zdravstvenih problema. Međutim, razlike u znanju i načinu primene ovih biljnih resursa mogu dovesti do toksičnosti i smanjene efikasnosti. Pripremljen je upitnik i sprovedeni intervjui sa travarima i opštom populacijom radi prikupljanja podataka u skladu sa postavljenim ciljevima. Izračunati su etnobotanički indeksi i izvršeno je poređenje između različitih podgrupa ispitanog stanovništva.

Najčešće korišćena narodna imena za *O. pubescens* su: *Gartoufa*, *Gritfa* i *Wazwaza*. Ova biljka je endemična i samonikla. Najčešće se koriste čitavi nadzemni delovi biljke, osušeni u senci. Ova biljka se primenjuje u obliku čaja. Najčešće se pripremaju macerat i infuz. Biljka se uglavnom koristi zbog svojih terapijskih svojstava za lečenje problema vezanih za digestivni, genitourinarni i respiratorni sistem, kao i za snižavanje temperature. Ispitano stanovništvo je pokazalo visok nivo znanja na osnovu izračunatih indeksa, pri čemu se pokazalo da neki delovi populacije, kao što su oženjeni/udate, žene, osobe starije od 60 godina, slabije obrazovani i nezaposleni, češće upotrebljavaju ovu biljku. Primećene su varijacije u odgovorima ispitanih osoba i razlike u poređenju sa podacima iz literature, ali su zabeleženi slični obrasci odgovora između travara i opšte populacije.

Ključne reči: *Matricaria pubescens*, *Gartoufa*, *Gritfa*, istraživanje, etnobotanika, travari, populacija