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FROM INDIGENOUS KNOWLEDGE TO ETHNOPHARMACOLOGY: POISONOUS SPONTANEOUS FLORA OF SOUTHEASTERN ALGERIA

DO CONHECIMENTO INDÍGENA À ETNOFARMACOLOGIA: FLORA ESPONTÂNEA VENENOSA DO SUDESTE DA ARGÉLIA

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Abstract
Poisonous spontaneous plants in South Algeria have long been used traditionally as medicinal remedies. This study examined the use of poisonous wild plants as traditional medicines in Biskra, highlighting their ecological diversity and environmental adaptations. Using a questionnaire survey containing 300 items was developed and distributed in the region. The survey shows that the majority of respondents (65%) are between 30 and 60 years old, with women (59%) being more involved than men (41%). Most live in the outskirts of Biskra (62%), university graduates (36%) are the most knowledgeable. Citrullus colocynthis, Ruta chalepensis, and Thapsia garganica were among the most commonly used plants in the region used to treat digestive (20%) and dermatological (20%) disorders. Leaves are most used (38%) administered orally (54%) with common preparations decoctions (33%) and powders (29%). Measured by handful (55%) by spoonful (25%) and by a pinch (20%). Digestive toxicity is most common (30%), followed by skin, nerve,

Resumo
As plantas espontâneas venenosas do sul da Argélia têm sido tradicionalmente utilizadas como remédios medicinais. Este estudo analisou o uso de plantas silvestres tóxicas na medicina tradicional na região de Biskra, destacando a sua diversidade ecológica e as adaptações ambientais. Foi elaborado e aplicado na região um inquérito por questionário contendo 300 itens. Os resultados mostram que a maioria dos inquiridos (65%) tem entre 30 e 60 anos, sendo as mulheres (59%) mais envolvidas do que os homens (41%). A maioria reside na periferia de Biskra (62%), e os indivíduos com formação universitária (36%) demonstraram maior nível de conhecimento. Citrullus colocynthis, Ruta chalepensis e Thapsia garganica estiveram entre as plantas mais frequentemente utilizadas na região, principalmente no tratamento de distúrbios digestivos (20%) e dermatológicos (20%). As folhas são a parte mais utilizada (38%), administradas predominantemente por via oral (54%), com preparações comuns sob a forma de decocções (33%) e pós (29%). As doses

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and kidney effects (15%). Medicinal plants contain both beneficial and toxic compounds, making extracts promising yet risky. Proper identification, characterization, and quantification are essential for safe and effective use.

Keywords: Ethnobotanical. Inventory. Safe Use. Traditional Medicine. Toxic Plants.

são geralmente medidas por punhado (55%), por colher (25%) ou por pitada (20%). A toxicidade digestiva é a mais frequente (30%), seguida de efeitos cutâneos, neurológicos e renais (15%). As plantas medicinais contêm compostos benéficos e tóxicos, tornando os extratos promissores, porém arriscados. A identificação, caracterização e quantificação adequadas são essenciais para um uso seguro e eficaz.

Palavras-chave: *Etnobotânico. Inventário. Uso Seguro. Medicina Tradicional. Plantas Tóxicas.*

1 INTRODUCTION

Since antiquity, humanity has used medicinal plants to treat and cure various diseases. Today, plants continue to play a crucial role in the field of healing worldwide. Many people are turning back to natural remedies and traditional treatments used by their ancestors, which attests to their effectiveness. Nearly 80% of rural African populations continue to rely on herbal medicine (WHO, 2023). This use demonstrates that traditional medicine holds an important place in healthcare systems and is an integral part of Africain and Algerian culture (Belhouala and Benarba, 2021).

In Algeria, traditional medicine has been widely used due to the richness and diversity of its flora, which includes around 3000 species, where 600 have been identified for their medicinal use belonging to different botanical families, forming an important phytogenetic reserve and reflects ancestral knowledge passed from generation to generation (Deghiche Diab, 2016; Bouzid *et al.,* 2017; Souilah *et al.,* 2020; Beldi *et al.*, 2021).

Medicinal plants possess compelling therapeutic properties due to their abundant active ingredients. Nevertheless, a significant number are toxic due to the presence of substances that can be harmful to the human body (Belhouala and Benarba, 2021). According to WHO (2015), plant intoxication often results in significant morbidity and mortality, exceeding 1 million cases per year and where only plant intoxications represent 2.3% of all poisonings recorded (Wendt *et al.,* 2022; Belhamra *et al.*, 2025). Studies show that most harmful effects of medicinal plants are due to misidentification rather than the

plants themselves (Bose *et al.,* 2021; Rathore *et al.,* 2022). In addition to the effect of plants toxicity, remedies can also depend on factors such as age, genetics, and concurrent illnesses among consumers (Zeggwagh *et al.,* 2013). The confusion related to vernacular names has can also an important cause of deaths in addition to the improper dosing, or interactions with medications (Deghiche Diab *et al.,* 2016).

Traditional medicine encompasses a vast and heterogeneous knowledge, practices, and beliefs regarding health, transmitted from generation to generation, often orally or in writing. It is based on theories, experiences, and observations accumulated over time, sometimes unexplained by modern science. Ethnobotany is essential in converting traditional knowledge of medicinal plants into scientific data, especially in phytotherapy context of. Its scope ranges from diagnosing and preventing physical and mental illnesses to promoting general well-being and addressing psychosocial imbalances (Abyoumi, 2010). In many instances, a single plant may have certain parts that are safe to eat or have medicinal properties while others may have certain parts that are poisonous. Often, the distinction between food, medicinal plants and those that are toxic or medicinal is not straightforward (Whiting, 1963). It also emphasizes the current importance of studying the use, efficacy, and safety of toxic medicinal plants, as well as the need to regulate their use to ensure a rational approach. These measures aim to prevent inappropriate use, abuse, or reckless self-medication with these plants (Adriana *et al.*, 2022).

Despite growing global interest in ethnobotanical research and phytotherapy, there remains a noticeable scarcity of studies focused on the traditional medicinal plant knowledge in Algeria, and more specifically, within Biskra region. This gap highlights the urgent need to document, analyze, and scientifically assess local ethnobotanical practices. Such research is crucial not only for preserving intangible cultural heritage but also for contributing to sustainable healthcare solutions rooted in traditional knowledge. The present study, therefore, seeks to address this lack by exploring and validating the traditional use of medicinal plants in this under-researched region and to create a repository of toxic medicinal plants in the Biskra region, classify them by disease categories they treat, and provide detailed descriptions of their preparation and use in safe manner.

2 METHODOLOGY

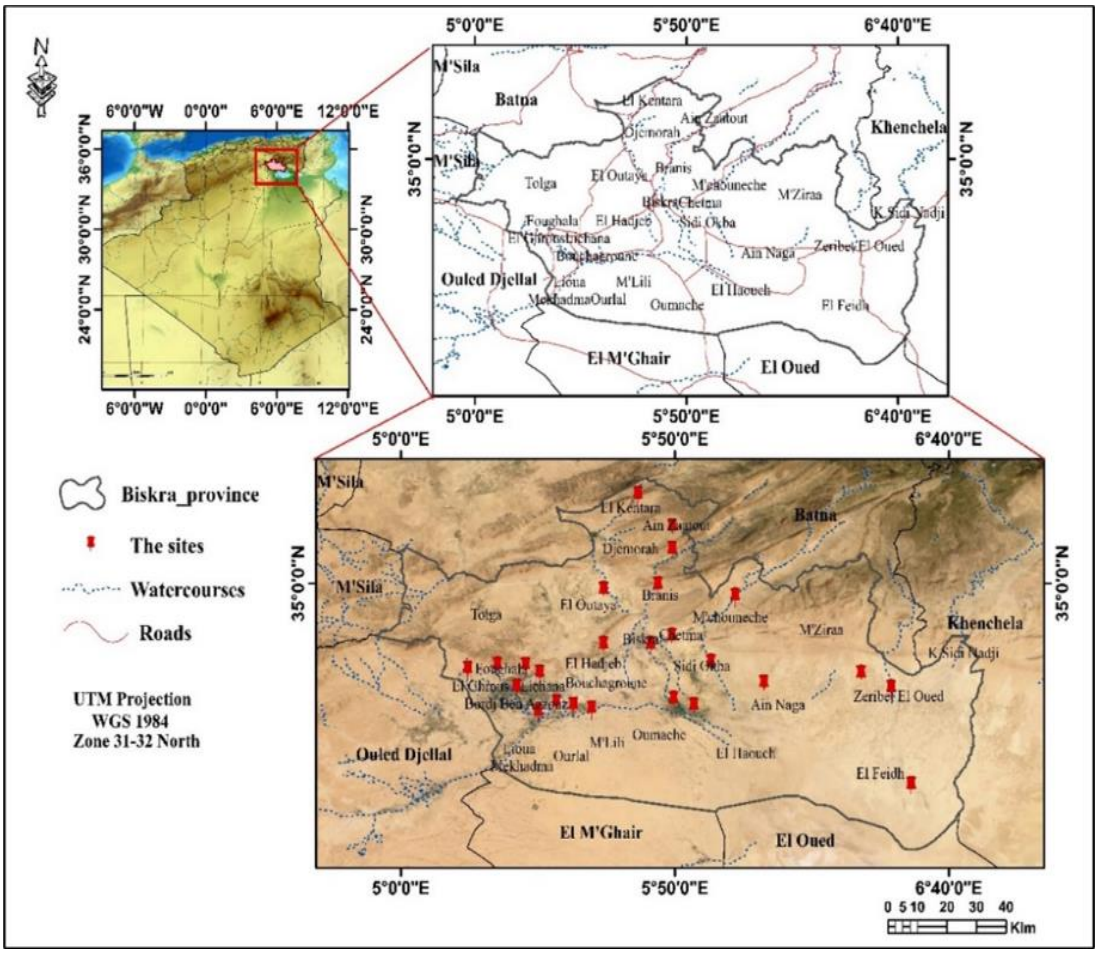
2.1 Study area and survey site

Covering a total area of 21 501 km², Biskra (Figure1a) our study area is situated in the northeastern Algerian Sahara (34.48’ N and 5°.44’ E), approximately 400 km from the capital Algiers. It is one of the country’s key agricultural regions, located on the northern boundary of the African plateau. The study area extends to the Chott Melghir region to the southeast (Deghiche-Diab *et al*., 2022a).

The Wilaya of Biskra was created following the territorial restructuring in 1974 and was further adjusted after the restructuring in 2021. It currently comprises 10 daïras and 27 communes. Bordered to the north by Batna, to the northwest by M'sila and Ouled Djellal, to the northeast by Khenchela, and to the south by El Oued and Ouargla province, cover a large area of 21 501 km² in southern Algeria and influenced by various geological, geographical, and climatic factors, that features a variety of ecosystems, including forests, mountains, plateaus, steppes, and oasis habitats, boasts a rich and diverse vegetation cover (Deghiche-Diab and Deghiche, 2022).

Figure 1

Situation of the a) study province, and b) localization of the survey and investigation sites.



2.2 Methods

The first part of our study involves an inventory of toxic plants species present naturally under Biskra arid conditions. The sampling of plant species was carried out between January and May 2024 at representative stations from the 27 munisipalities and districts (Fig.1b). At each station, vegetation was randomly selected within minimum area of 100 m² each (Gounot, 1969 ; Glande *et al.*, 2003 ; Deghiche-Diab, 2015). The suitable approach for recording tree and shrub species in an open environment was based on conducting floristic surveys along transects measuring 1 meter in width and 10 meters in length, placed within the 100 m² plots (Fatimata, 2010 ; Deghiche Diab, 2019).

The second part was related to an ethnobotanical survey on the used spontaneous plants in traditional medicine that was conducted among the population of the (300 persons), herbalists, and traditional healers in the Biskra region and its surroundings districts (Figure 1b). This survey utilizes inquiry forms aimed at assessing the therapeutic and toxic effects of toxic medicinal plants in local traditional phytotherapy. Based on the collected information's precise and clear measurement will be done using scientific manner.

Apart from traditional practitioners and herbalists, individuals are randomly selected to ensure diverse perspectives in a non-exhaustive survey. The questionnaire was distributed in both French and Arabic to collect- data on the general population (age, sex, residence, level of education, and profession), residing in the study regions. It also treats another part related to the use of spontaneous medicinal plants, including, plant types, parts used, targeted diseases, preparation methods, dosages, modes of administration, duration of treatment, potential toxic effects, and usage restrictions.

2.3 Data analysis

All data has been organized and structured into an XLSTAT program for processing and analysis. Geographic Information System (GIS ArcMap 10.8) tools were also used to map the distribution of toxic plant species that were previously collected from different habitats within the study area ArcGIS is a comprehensive system that facilitates the collection, organization, management, analysis, communication, and dissemination of geographically referenced information on a map (Deghiche Diab, 2020). It enables the synthesis of data from multiple sources into a unified geographical view.

3 RESULTS AND DISCUSSIONS

3.1 Ethnobotanical survey

The ethnobotanical investigation into the use of wild toxic plants in traditional medicine, conducted in all over the wilaya of Biskra with over 300 participants during

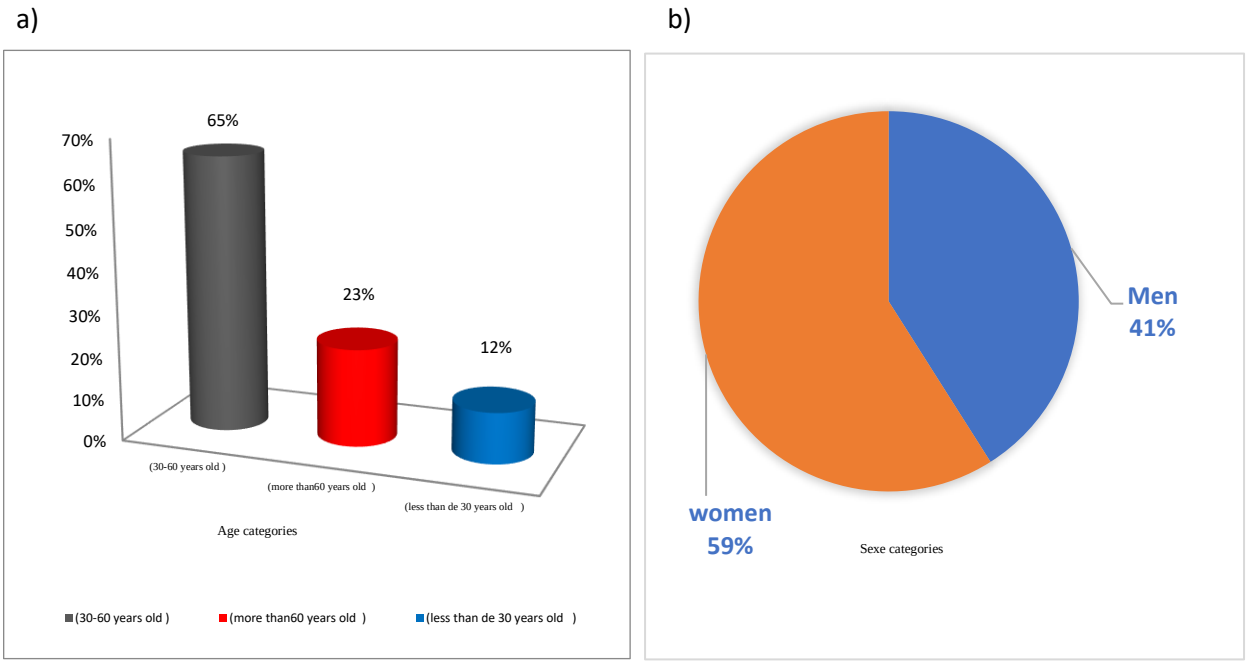
2023-2024, enabled us to gather valuable information and data, which were organized and analyzed using Excel software.

The results of our survey show that respondents familiar with toxic plants in the study area span all age groups. Most participants are between 30 and 60 years old, making up 65% of the total population being surveyed. This is followed by seniors (over 60 years) at 23%, and younger individuals (under 30 years) at 12%, the smallest group (Figure 2a). Both men and women engage in traditional medicine, but a higher percentage of women are involved, representing 59% compared to 41% for men (Figure 2b). Additionally, more than half of the informants (62%) reside in the outskirts of Biskra province, while only 38% live in the city center (Figure 2c). The university graduates form the most knowledgeable group regarding medicinal plants making up 36% of the total respondents. In contrast, illiterates account for the lowest percentage at 6%. Other educational categories include 33% with secondary education, 18% with middle school education, and 7% with primary education (Figure 2d). Out of the total of 300 respondents surveyed, 79.2% were members of the general population, while 20.7% had knowledge of phytotherapy. Within this knowledgeable group, 22 identified as herbalists and 10 as traditional practitioners. These findings suggest that the use of toxic plants is more prevalent among middle-aged individuals compared to other age categories. Women have greater interest in phytotherapy, this trend could be linked to their use of plants in other contexts, such as beauty and wellness, as well as their roles as mothers, who often manage first aid for their families. Thus, this study suggests that phytotherapy continues to be predominantly of interest to women. It was reported in official fact sheets and reports (WHO 2008, 2013; Kasilo *et al.*, 2010) that in some developing countries, 80% of the population depends on traditional medicine, particularly in rural areas, due to the availability and affordability of these healthcare options, as well as limited access to modern medical services (De Smet, 1998). These findings indicate that a significant portion of the population studied holds a university degree, which may be influenced by our data collection methods (using both paper and electronic questionnaires) that require a certain level of education. However, this does not appear to have a direct correlation with the use of plants.

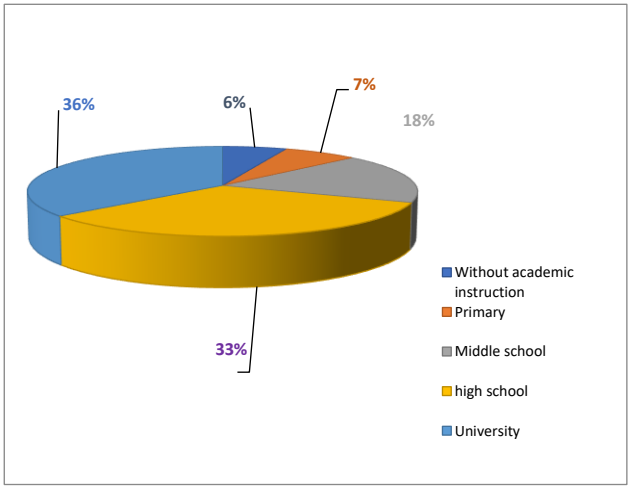
It was also indicated (Figure 2d) in this study that the primary sources were the social and family environment (49%), followed by herbalists and traditional practitioners at 20%. This highlights the importance of family relationships in preserving traditional and cultural knowledge. These familial connections could play a crucial role in maintaining this natural heritage, and their promotion may contribute to scientific research. Information derived from scientific documents represents 12%, while the internet and academic studies show lower values (6%, 9%, and 4%) respectively, which may reflect society's neglect of scientific information. In this regard, Slimani *et al.* (2016) confirmed that the population relies on the experiences of their parents to use medicinal plants as remedies for specific ailments. In addition, it reflects the transmission of traditional practices from one generation to another, which remains highly valued by the community.

Figure 2

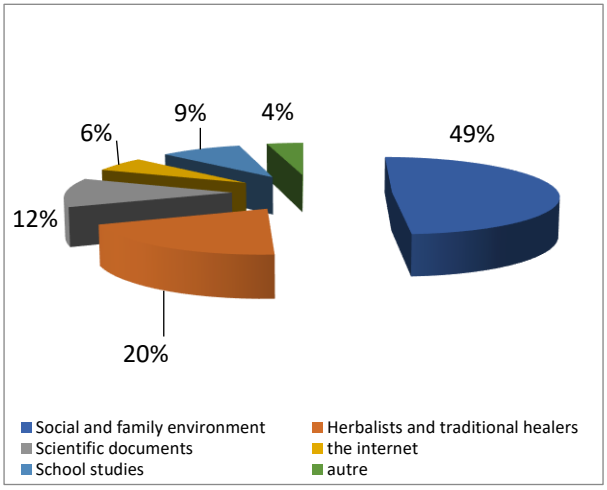
Toxic plants importance uses by categories a) age groups b) use by sexes c) education d) the target population surveyed



c)



d)



3.2 Taxonomic composition

The second part related to the inventory of toxic plant species used for treatment conducted during 2023-2024 across various sampling sites in the Biskra region (Figure 1), that revealed a comprehensive list of 30 species from 18 botanical families (Figure 3), highlighting the wide diversity of toxic plants within the local flora. The most represented families were; Solanaceae family (6 species), Asteraceae family (4 species) closely followed by the Euphorbiaceous family (3 species) and Cucurbitaceae family with (2 species). The other families including Urticaceae, Lamiaceae and Oleaceae,.. were less represented (Figure 3, Table 1).

Table 1

Total collected toxic plant species under arid conditions Biskra region by family, used plant part, the principle active responsible for the toxicity, the estimated toxic dose based and the main form of toxicity associated

Family/ Species	Toxic part	Principe / toxic dose	Use and toxicity
Apiaceae *Thapsia garganica* L. (1767) **Bounafaa**	Whole plant	**Principe** Thapsigargine, Thapsigarginine(Histamine-releasing agents, sesquiterpene lactones: thapsigargin and thapsigarginine	Cutaneous: Skin irritations, diarrhea and vomiting
Aristolochiaceae *Aristolochia rotunda* L. (1753) **Beroustoum**	Whole plant	**Principes** Aristolochic acids, Aristoloctams.	tubulo-interstitial nephritis
Asparagaceae *Urginea maritima* (L.) Baker **Bassel l'far**	Whole plant Especially bulb.	**Principes** Cardiotonic bufadienolide glycosides: scillarene A, B. Scilliroside, cardiotonic and rodenticide **Doses** 3 g of squill powder / adults would be fatal. 50-100 mg of scillarenes or digitaliques.; 200-500 mg of poudre	Cardiac
Cucurbitaceae *Citrullus colocynthis* (L.) Schrad. **Handhel, H'dej, Hadj**	Whole plant Especially fruit and seeds.	**Principes** Cucurbitacins (B, D, E, I, J, K, L, T) and glycosides **Doses (**DL50) Rabbit : 600 mg/kg d'extrait hydroéthanolique Sheep: 1 g/kg of fruits or 0,25 g/kg of leaves Else: 5 g/kg of fruits kill animals of 2-3days	Digestive: Abdominal pain, vomiting, bloody diarrhea, renal hyperemia, glomerulonephritis, death from circulatory arrest
Ecballium elaterium (L.) A.Rich. **Fagous el h'mir**	Whole plant	**Principe** Cucurbitacins (B, D, E, I, J, K, L, T) and glycosides	Digestive: rhino-Iaryngee
Dioscoreaceae *Tamus communis* **(L.)** Caddick & Wilkin **Karma saouda**	Whole plant	**Principes** Calcium oxalate raphides, Saponins, Histamine.	Dermatitis, severe digestive disorders, respiratory issues, hyperthermia, death
Rosaceae *Prunus dulcis* Batsch, (1801)	Fruit seed	**Principes** Cyanogenic glycosides: amygdaloside (amygdalin) **Doses**	Metabolic: respiratory, acidosis, coma, death

Laouz Elmour		0,5-3,5 mg/kg 35-250 mg de cyanures 0,6-4 g d'amygdaline 12-80 almonds 4 % d'amygdaline. 60 bitter almonds/ adults 5 to 10 almonds/ children 10 drops of bitter almond oil /children	
Solanaceae *Hyoscyamus niger* (L.) Dulac **Sakirane**	Whole plant	**Principes** Hyoscyamine, Scopolamine, Atropine. Alcaloïdes	Anticholinergic
Solanum nigrum Linn**.** **Anb dhib**	Whole plant	**Principes** alkaloids, flavonoids, tannins, saponins, glycosides, proteins, carbohydrates, coumarins & phytosterols steroidal alkaloid glycosides, Solamargine, Solasonine, α and β- solanigrine	anti-tumor activity, Anticancer, hepatotoxicity hepatoprotective, anticancerous, antipyretic, anti-inflammatory, anti-ulcerative, and cytoprotective
Cestrum nocturnum **L.** **Mesk lail**	Whole plant	**Principes** Triterpenic glycosides Flavonoids and steroidal saponins	anti- inflammatory, analgesic, antimicrobial, anticonvulsant, and sedative properties Cardiac
Datura stramonium L., 1753 **Elhabala**	Whole plant, seeds	**Principes** Alcaloïdes tropaniques (atropine, hyoscyamine...)	Antimuscarinic and anticholinergic, potentially causing a variety of symptoms. 10 Ds Dryness, Dysphagia, Dilated pupils, Diplopie, Delirium, Drunken, Delusions, Dysurie, Death
Solanum elaeagnifolium	Whole plant, seeds	**Principes** Solanine and solasonine, Glycoalkaloid **Doses** Ingestion of the plant can be fatal to both animals and humans	Cytotoxic effect Poisoning in livestock and children, Apathy, drowsiness, tremors, respiratory difficulties, paralysis, loss of consciousness, gastrointestinal symptoms such as excessive salivation, vomiting, and diarrhea.

Lycium afrum Manby. Et Batt. **Elgthem**	Seeds	**Principes** Glucoalcaloïdes (solanine, solanidine) et saponosides **Doses** Toxic, at least in high doses. It affects heart, pupils, etc.	Diuretic, immune system stimulant, hypoglycemic, laxative.
Ranunculaceae *Clematis vitalba* **Yesmine Bari**	Whole plant	**Principes** Protoanémonine	Dermatitis, severe purging
Rutaceae *Ruta chalepensis* L. **L'faidjel**	Whole plant	**Principes** Coumarins - furocoumarins - alkaloids. **Doses** **Animals** Mouse: DL50 of ethanolic extract: > 5 g/kg Mouse: Essential oil: DL50 > 2 g/kg; rates : > 5 g/kg. **Human** 0,1 - 1 g of pouder*:* emmenagogue. Dose 15 mg of 8-MOP'	Digestive, neurological, phototoxicity; emmenagogue, abortifacient
Zygophyllaceae *Peganum harmala* L. **Harmel**	Whole plant Especially seeds	**Principes** Major carboline alkaloids B: harmine, harmane, harmaline, harmol, harmalol **Doses** hallucinations and vomiting : absorption of > 2.5 g (800 seeds)/adult psychomimetic: 4 mg/kg of Harmaline	-Neurological, neuromuscular
Euphorbiaceae *Euphorbia guyoniana* **Loubaina**	Whole plant	**Principes** Flavonoids, Cyanogenetic, Saponins, terpenes,	Antibacterial **Antihyperglycemic**
Euphorbia publeuroides **Loubaina**	Whole plant	**Principes** Saponosides, érythèmes, phlyctènes, polyphénols	anti-inflammatory skin and eye lesions (including blindness), respiratory and gastrointestinal issues
Ricinus communis L. **Kharoub**	Whole plant and seeds	**Principes** Glycoproteine, ricine. **Doses** **Animal** Mouse: DLso 20-30 mg/ Horse or sheep : 30 seeds intoxication **Human** DL50: 1 mg/kg/adult (5-10 seeds), 20 mg/kg.	Gastrointestinal

		3-4 seeds/ Child, 15-20 seeds/ adult severe hepatonephris or death.	
Apocynaceae *Nerium oleander* L. **Defla**	Whole plant and fresh or dry	**Principes** Cardenolide cardiac glycosides: oleandrin, Cardiotonic glycosides or Cardiac glycosides **Doses** **Animals** Sheep ruminants: One leave =3-4 g/kg= 110 mg/kg. DL50 : 0,5 mg/other animals **Human** One leaf/ Child = death Adulte 3-10 leaves/the ingestion of leaves was responsible for very serious disturbances. >0.5 mg/kg of body weight would cause death. DL_{50}=4 g of leaves.	-Cardiaque
Lythraceae *Punica granatum* L. Roman	Fruit peels	**Principes** Pelletierine	Digestive and nervous toxicity
Asteraceae *Dittrichia viscosa* (L.) Greuter, 1973 **Magrammene**	Whole plant	**Principes** Guaianolides, sesquiterpenes, sesquiterpenes acids, triterpenoids, azulenes, lactones, flavonoids, costic acid and essential oils Cytotoxic, antimicrobial, antioxidant, antihypertensive, hypoglycemic, hypolipidemic	Depressive effect on the nervous system
Echinops spinosissimus Turra 1765 **Chawk Jmel**	Whole plant	**Principes** Pyrrolizidine alkaloids.	Hepatotoxic
Atractylis gummifera L **Laded**	Whole plant fresh root	**Principes** Glycosides and diterpenes: atractyloside, carboxyatractyloside. **Doses** **Animals** Root extract : DL50 (intraperitoneal route) on mouse. 49 mg/kg- 101,5 mg/kg. - Glycosides: > 1000 mg/kg l'atractylosidem 350 mg/kg carboxyatractyloside	Hepatic, renal
Artemisia herba alba **Echih**	Whole plant	**Principes** Antioxidants, flavonoids, polyphenols, tannins **Doses**	**Hepatic and renal toxicity** Digestive disease (Peptic ulcer)

		Body: beta-thujone more than 5 mg/kg	Respiratory disease (Asthma, bronchitis) Rheumatologic disease (Inflammation and joint pain)
Oleaceae *Olea europaea* L. **Zaitoune**	Leaves	**Principes** **Oleuropein**: A bitter compound (leaves, fruits, olive oil). **Salidroside**: A phenolic glucoside (leaves and fruits)	Gastrointestinal toxicity
Urticaceae *Urtica dioica* L**.** **Horaig**	Whole plant	Formic acid, acetylcholine, and serotonin	Skin toxicity: Irritant
Lamiaceae *Vitex agnus* L.	Whole plant	**Principes** Iridoid, diterpenoid, ecdysteroid, flavonoid, phenolic	Anti-inflammatory, antibacterial, antifungal, antimicrobial, antioxidant, and anticancer properties (Infertility disease; Genital disease) Hepatic toxicity; Menstrual cycle, Fibroids, Vaginal dryness kin problems, headaches, diarrhea, vertigo, and palpitations
Polygonaceae *Polygonum Aviculare*	Fruit	**Principes** Tannins, flavonoids, mucilages, oxalic acid, resins, silica, coumarins. Toxic: Equids, cattle, sheep, if consumed in large quantities. **Toxicity** Astringent properties; Diuretic action; Anti-inflammatory effect; Respiratory system support; Wound healing.	Oxalic acid photosensitivity and death Allergies or skin irritations Cough or itching
Primulaceae *Anagllis Arvensis* **L.**	Seeds	**Principes** Glycosides, saponin, flavonoid, anthraquinone, alkaloids, rutin, kaempferol, oleananetriterpenes, anagalligenin, anagalligenone, stigasetrol, arvenin I, arvenin II, cucurbitacin B, D, E, I,L& Q, n-hexosamine, β-amyrin, sterols carbohydrates, lacceric acid **Toxicity** Cytotoxic activity. Survival and cell = MTT [3-(4, 5-Dimethylthiazol-2-Yl)-2, 5-Diphenyltetrazolium Bromide and LDH lactate dehydrogenase	Respiratory diseases: it is diuretic and healing (fungicidal), but also narcotic and hemolytic anti-mycotic, antimicrobial, molluscicidal, antioxidant, anti-inflammatory, anti-leishmania, antiviral, cytotoxic, and spermatogenesis

The distribution of plant species in the Biskra region (Figure 4) highlights remarkable ecological diversity, demonstrating significant adaptation to a variety of environments, including mountains, plains, chotts, and sandy areas (Fig. 4a). Among the studied locations, the North part represented by Ain Zaatout (8%), Djemorah, El Hadjeb (7%) and El Kentara (6%) emerged as particularly rich in terms of species analyzed (Figure 4b), The other sites were enregistred less pourcentage of richeness; El Outaya (5%) .The distribution of spontaneous plant species was largely documented in last years were Belhadj *et al*. (2023); indicated the importance of Chenopodiaceae and Asteraceae, as well as the co-dominance of Chamaephytes and Therophytes at El Haouch, Sidi okba and El Feidh municipalities. In another study Rekis *et al.* (2023), in the Tolga region, a total of 63 plant species from 28 families were recorded, equally divided between perennial and ephemeral species. The biological spectrum is dominated by chamaephytes (49%), followed by therophytes (25%). Whereas Guehiliz (2015), indicated low floristic composition with notable taxonomic diversity with most represented botanical families including Amaranthaceae, with species (5species). Fabaceae (3 species) and Asteraceae (2species).

Figure 3

Some toxic spontaneous medicinal plants in Biskra Arid region: a) Cucurbitaceae: Citrullus colocynthis, b) Ecballium elaterium, c) Astaeraceae: Artemisia herba alba, d) Inula viscosa, e) Echinops spinosus, f) Zygophyllaceae: Peganum harmala, g) Solanaceae: Solanum nigrum, h) Hyoscyamus niger, i) Cestrum nocturnum, j) Urticaceae: Urticaca dioica, k) Rutacée : Ruta chalepnsis. L) Euphorbiacée: Ricinus communi, m) Oleaceae: Olea europaea, n) Discoreaceae: Tamus communis, o) Ranuculaceae: Clematis vitalba, p) Rosaceae : Prunus dulcis, q) Apiaceae: Thapsia garganica, r) Lythraceae; Punica granatum, s) Apocynaceae Nerium oleander





Based on the information collected from the investigated person, the most frequently used species include: Citrullus colocynthis (56.43%), Ruta chalepensis (52.16%), Thapsia garganica (30.20%), Peganum harmala (26.27%), Aristolochia sp. (24.96%), Ecballium elaterium (22.37%), Punica granatum L. (21.78%), and Nerium oleander L. (20.8%). Other species were less frequently used for treatment, Urtica dioica (18.90%), Ricinus communis L. (15.94%), Vitex agnus-castus (12.55%), Inula viscosa L. (10.98%), Atractylis gummifera (10.98%) and Olea europaea (10.59%). Minimum use was declared for Cestrum nocturnum, Clematis vitalba, Prunus dulcis, Drimia maritima,

Hyoscyamus niger, and Tamus communis L. This distribution can be explained by the fact that these families are the most prevalent in this region and constitute a significant part of its flora (Ozenda, 1958; Ozenda, 2004; Quezel and Santa, 1963; Deghiche Diab, 2019).

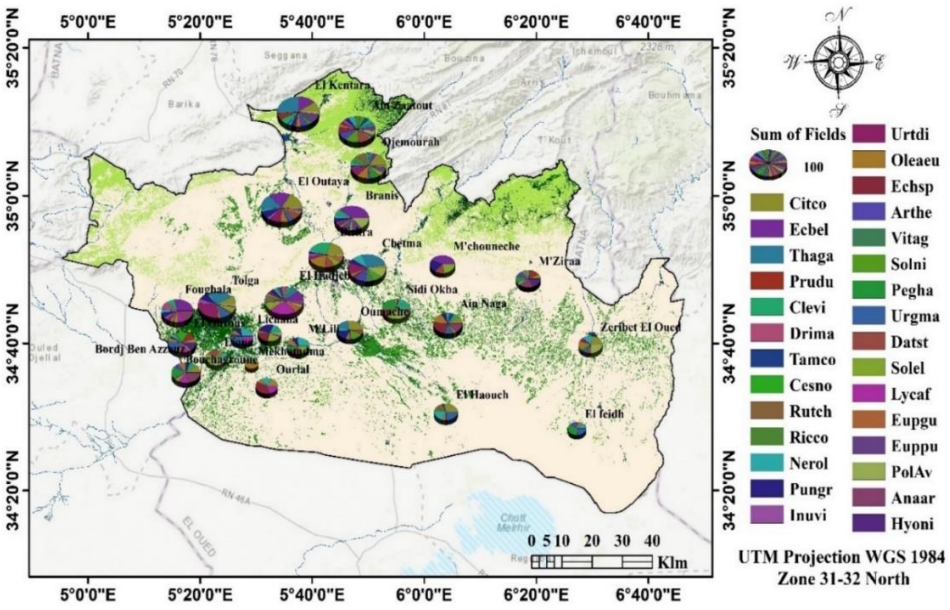
3.3 Toxic plants in traditional medicine

It was noted through the investigation that the most represented medicinal plants were usually used for treating digestive and dermatological diseases (20%). Other plants are used to treat various problems related to metabolic diseases (17%), rheumatological issues (13%) hepatic, menstrual, respiratory, dental problems (each representing 4%) and the infectious diseases (3%). Conditions related to infertility, renal issues, and oral health account for 1%, while the plants used for treating other diseases remains ambiguous (6%) (Figure 5a.). Numerous studies have demonstrated the significant use of medicinal plants in addressing digestive disorders (Slimani *et al*, 2016; Sadallah and Laidi, 2018; Djemaa and Lamari, 2018; Hamel *et al.*, 2018)

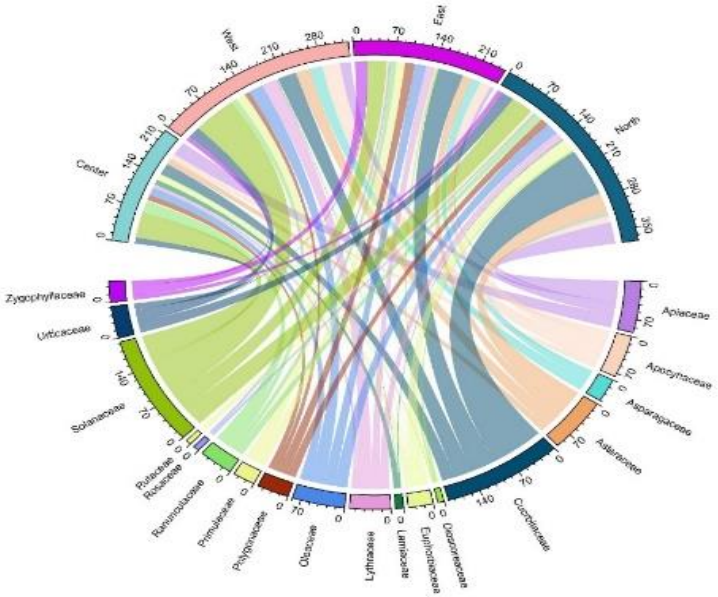
Figure 4

Toxic plants a) geographical distribution and b) Diagram distribution in Biskra region

a)



b)



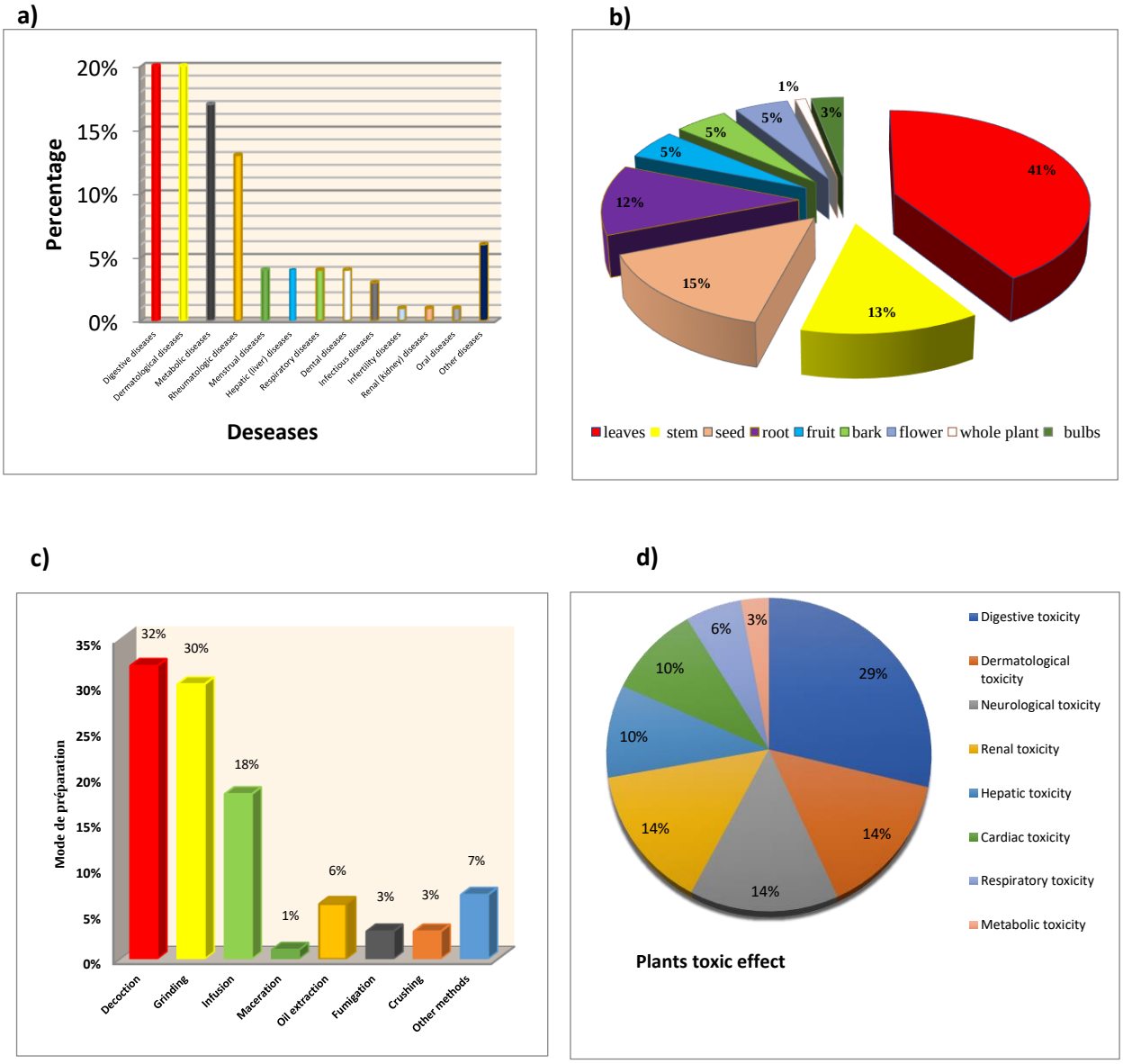
Different organs of plants were used (Figure 5b), leaves were widely used (38%), stems (13%), Seeds (14%), roots (11%) and also fruits (8%), the use of bark, flowers and the whole plant was less important (5%). Bulbs ranked last with a lower rate (3%). Our results are in concordance with those presented by Salhi *et al.* (2011) and Boutabia (2020). The frequent use of leaves can be attributed to their key role in photochemical reactions and their function as reservoirs of organic materials, along with their ease and speed harvest (Bitsindou, 1986). Similar findings have been shown in earlier studies Bouallala *et al.* (2014), Sadallah and Laidi (2018) and Hamlet *et al.* (2018). Slimani et al. (2016) noted that leaves are the site of photosynthesis and occasionally store secondary metabolites responsible for plant biological properties.

To simplify the administration of the active ingredient, different preparation methods were used for remedies (Figure 5c), the obtained results show that two preparation methods are the most commonly used decoction (33%) and powder (29%), infusion ranks the third position (15%), while less frequently used methods include maceration (4%), oil extraction (4%), fumigation (3%), crushing (3%) and other various methods (8%). It was indicated that users always seek the simplest method to prepare phytomedicines that explain the importance use of plants as powder and decoction in their preparation. Our results are in concordance with those of Bakiri *et al.* (2016) and also confirmed by Bouzid *et al.* (2016) and Salhi *et al.* (2011).

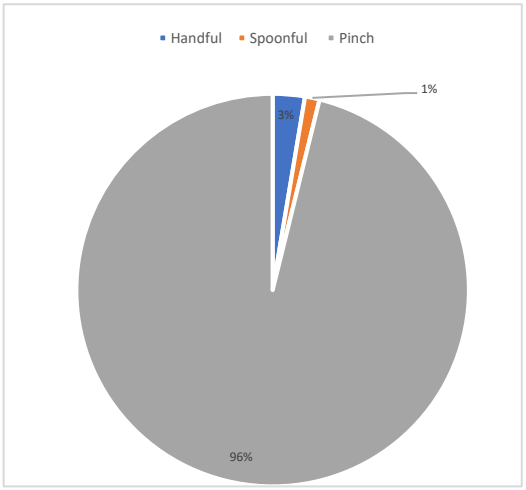
The most prepared remedies are administered orally, accounting more than a half of the total percentage (54%), as it represents the simplest, most effective, and fastest way of administration. Followed by topical administration, which represents (35%). The least used methods include gargling (3%), followed by nasal, auricular, bath, and other methods, each at a similarly low percentage (1%). It is known that plants are primarily administered orally (Slimani et al., 2016). Oral administration encompasses all preparation methods, including infusion, decoction, and herbal tea (El Hafian *et al.*, 2014).

Figure 5

Medicinal plants a) Treated diseases, b) used part, c) preparation methods d) toxic effect and e) measurement



e)



The most common toxicity caused by plants (Figure 5d.) was digestive toxicity (30%), followed by dermatological, neurological and renal toxicities (15%). Hepatic and cardiac toxicities occur less frequently (10%). Conversely, respiratory (6%) and metabolic (3%) toxicities are recorded at the lowest rates.

3.4 Dosage practices

Four hundred years back, Paracelsus stated that all substances are inherently toxic; however, it is the dose that determines whether a substance acts as a poison or a remedy. In this context, the results of investigation revealed that the use of medicinal plants often lacks precise dosage control. The obtained data from our investigation showed that 55% of applications were measured by handful, 25% by spoonful and 20% by a pinch (Figure 5e). Such imprecise methods of dosage highlight deficiencies in traditional practices that may lead to serious health risks. These findings are consistent with those reported by Benkhnigue *et al.* (2010), who indicated that only 14.88% of medicinal plant uses involved accurate dosages, while 85.12% were based on approximate quantities: 50.12% by handful, 26.20% by spoonful, and 8.8% by pinch.

Many species are employed for therapeutic purposes despite their toxicity, plants can pose risks because they contain both beneficial and toxic compounds, the dual nature often relies on empirical use where the therapeutic dose is very close to the toxic or lethal dose. Consequently, traditional preparations often consist of complex mixtures of unknown substances (Azzi *et al.*, 2012). The collected toxic spontaneous plants used in

traditional medicine as preparations are described with their characteristics, including the toxic plant part, the principle active responsible for this toxicity, the estimated toxic dose based on previous research.

The plant parts linked to toxicity differ across species. The entire plant was most frequently cited as toxic in 26 species. Some species exhibit toxicity specific to certain parts, seeds were highly toxic in Ricinus communis (ricin) and Prunus dulcis (amygdalin). In other species Atractylis gummifera, the roots are the most toxic parts and are responsible for severe or even fatal poisoning. Latex or sap are irritant in Euphorbia species and Thapsia garganica. The fruits of Citrullus colocynthis and Solanum sodomeum cause intense gastrointestinal disorders.

Different active compounds are responsible for toxicity including; Cyanogenic glycosides present in Prunus. The tropane and pyrrolizidine alkaloids present in Datura stramonium and Echium plantagineum. Some other plants present another type of products responsible for the toxicity as *Hemolytic saponins* in *Euphorbia and Thapsia* and toxic diterpenes, especially in *Euphorbia* species. Cardiotonic substances, such as digitalis-like glycosides are detected in *Nerium oleander*.

The Clinically toxic effects of plants species used by the population that represent toxic effect in the regions include a severe gastrointestinal symptom vomiting, diarrhea, abdominal cramps, Neurological effects: hallucinations, seizures, paralysis Hepatotoxic and nephrotoxic reactions are noted with *Aristolochia rotunda*, *Echium plantagineum*.

Certain other species, particularly from the Euphorbiaceae family, are associated with dermatological and ocular damage, including rashes, blistering, and partial blindness. Whereas *Ruta graveolens, Citrullus colocynthis* present an abortive or a teratogenic effect. The documented fatalities are associated with *Nerium oleander*, *Atractylis gummifera* and *Ricinus communis*.

For instance, *Citrullus colocynthis* is traditionally used as a purgative but can cause hemorrhagic enteritis and abortion. Likewise, *Thapsia garganica* and *Euphorbia publeuroides* are known for their severe skin-irritating effects, exploited in traditional treatments but highly dangerous if misused.

The identification of partially or poorly characterized active substances in some plants suggests the presence of yet-unknown toxic compounds, underscoring the need for further phytochemical and toxicological investigations.

The use of many plants with abortive or contraceptive properties, such as *Ruta graveolens*, indicates that traditional practices often extend into sensitive areas of reproductive health, demanding careful consideration in terms of safety, ethics, and regulation.

4 CONCLUSION

Confronted with a range of diseases and disabilities affecting the community, the traditional healer asserts themselves as a provider of solutions, offering remedies that are both curative and preventive. Their therapeutic approach, drawing from an extensive etiology, reflects the richness and complexity of the traditional medical system. However, the continued use of medicinal plants also presents a significant challenge due to the lack of knowledge regarding appropriate dosages. This gap increases the risk of toxicity and adverse effects, highlighting the urgent need for standardized guidelines and toxicological research to ensure safe and effective traditional medicine practices. To address these gaps, future research should prioritize interdisciplinary collaborations that combine ethnobotany, pharmacology, and toxicology. Standardizing the documentation of traditional practices, identifying bioactive compounds, and establishing safe dosage guidelines are critical steps toward integrating traditional remedies into formal healthcare systems. Moreover, engaging traditional healers in participatory research will not only preserve ancestral knowledge but also enhance the cultural relevance and acceptance of scientific findings. Ultimately, advancing research in this field can contribute to the development of safe, effective, and culturally appropriate healthcare solutions rooted in biodiversity and local heritage.

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AUTHORS' CONTRIBUTION

All authors contributed equally to the development of this article.

DATA AVAILABILITY

All datasets relevant to this study's findings are fully available within the article

REFERENCES

1. Abomughaid, M. M., Teibo, J. O., Akinfe, O. A., Adewolu, A. M., Teibo, T. K. A., Aff, M. M., Al Farga, A. M. H., Al kuraishy, H. M., Al Gareeb, A. I., Alexiou, A., Papadakis, M., & Batiha, G. E. S. (2024). A phytochemical and pharmacological review of Ricinus communis L. Discover Applied Sciences. https://doi.org/10.1007/s42452-024-05964-5

2. Althaher, A. R., Oran, S. A., & Jarrar, Y. (2024). Phytochemical investigation and biological activities of Ruta chalepensis methanolic extract: Antioxidant, anti-inflammatory, anticollagenase, and antielastase properties. *Journal of Food Biochemistry*. https://doi.org/10.1155/jfbc/9921218

3. Belhamra Y.I., Deghiche Diab, N., Somia, S., Abdelmoneim, O. T., Samira, K., Madjed, D., ... & Djazouli, Z.E. 2025. Eco-friendly extract derived from Dittrichia viscosa (L.) Greuter 1973, from Algerian arid region, antioxidant evaluation and biopesticide use. *Journal of Ecological Engineerin*g, 26(1), 14-29. https://doi.org/10.12911/22998993/195185

4. Belhouala K. and Benarba B. 2021. Medicinal Plants Used by Traditional Healers in Algeria: A Multiregional Ethnobotanical Study. *Front. Pharmacol*. 12:760492. doi: 10.3389/fphar.2021.760492.

5. Bhowmik, D., Gopinath, H., Kumar, B. P., Duraivel, S., Aravind, G., & Sampath Kumar, K. P. (2013). Medicinal uses of Punica granatum and its health benefits. *Journal of Pharmacognosy and Phytochemistry*, 1(5), 28–35.

6. Boumaza, S., Bouchenak, O., Yahiaoui, K., Toubal, S. E. H., & Arab, K. (2018). Effect of the aqueous extract of Euphorbia guyoniana (Euphorbiaceae) on pathogenic bacteria from land-based sources. *Applied Ecology and Environmental Research*, 16(4), 3767-3781. DOI: http://dx.doi.org/10.15666/aeer/1604_37673781

7. Bozorgi, M., Amin, G., Shekarchi, M., & Rahimi, R. (2017). Traditional medical uses of Drimia species in terms of phytochemistry, pharmacology and toxicology. *Journal of Traditional Chinese Medicine*, 37(1), 124-139. https://doi.org/10.1016/S0254-6272(17)30036-5

8. Chérifi, A., Belboukhari, N., Sekkoum, K., & Hacini, S. (2006). Plantes des régions semi-arides algériennes utilisées pour le traitement des troubles gastro-intestinaux. *Journal Algérien des Régions Arides*, (5).

9. Deghiche Diab, N. (2020). *Entomofauna of humid, steppe, and date-palm groves in the Ziban: A structural and functional analysis* (Doctoral dissertation). University of Biskra (in frensh).

10. Deghiche-Diab, N. (2019). *Weed flora of the Ziban oases. Biskra -Algeria*. (p. 150). INRAA (In frensh).

11. Deghiche-Diab, N., & Deghiche, L. (2016). The spontaneous flora of the Ziban oases. Biskra-Algeria (p. 300). European Academic Publishing (EUE) (In frensh).

12. Djebaili, S. (1984). *Algerian steppe: Phytosociology and ecology. University Publishing Office* (p177) O.P.U. Ben Aknoun (In frensh).

13. Dobignard, A., & Chatelain, C. (2010–2013). *Synonymic index of North African flora* (4 vols.). Geneva: C.J.B.G.(In frensh).

14. Elawad, A. A., EM, A. B., Mahmoud, O. M., & Adam, S. E. (1984). The effect of Citrullus colocynthis on sheep. Veterinary and Human Toxicology, 26(6), 481-485. https://pubmed.ncbi.nlm.nih.gov/6516206/

15. El Kadi, F., Kanoun, K., Trouzine, A., Tehami, W., Lebga, H., Boumaza, N., & Harir, N. (2021). Phenolic compound profiles and antioxidant activity of Ruta chalepensis L. leaves, a spontaneous medicinal herb: Influence of harvest zone (Western Algeria). *International Journal of Minor Fruits, Medicinal and Aromatic Plants*, 7(1), 26-35.

16. Fatimata, N. D. (2010). *Trainer training module on the monitoring of aquatic flora and vegetation*: Integration of freshwater biodiversity into the development process in Africa (62 pp.) (In frensh).

17. Gland, F., Christiane, F., Paul, M., Jean, D., & Jean-Louis, H. (2003). *Ecology: Practical scientific approach* (5th ed., 395 pp.). Lavoisier: Paris (In frensh).

18. Gounot, M. (1969). *Quantitative methods for studying vegetation* (314 pp.). Masson et Cie (In frensh).

19. Habibatni, S., Maiuolo, J., Davì, F., Samir, Z., Lyas, B., Cacciola, F., … Miceli, N. (2025). Characterization of the phenolic profile, antioxidant and neuroprotective activity of leaf hydroalcoholic extracts of Euphorbia bupleuroides subsp. luteola (Kralik) Maire growing wild in Algeria. *International Journal of Environmental Health Research*, 1–17. https://doi.org/10.1080/09603123.2025.2461098

20. Hegazy, M. E. F., Mohamed, A. E. H. H., Aoki, N., Ikeuchi, T., Ohta, E., & Ohta, S. (2010). Bioactive jatrophane diterpenes from Euphorbia guyoniana. *Phytochemistry*, 71(2–3), 249–253. https://doi.org/10.1016/j.phytochem.2009.10.003

21. Herouini, A., Kemassi, A., & Ould El Hadj, M. D. (2015). Study of the biological activity of aqueous extracts of Euphorbia guyoniana (Euphorbiaceae) collected from Oued Sebseb (Algerian Sahara). *Revue El-Wahat pour les Recherches et les Études*, 8(2), 15–25. (In frensh) https://www.researchgate.net/publication/313361544

22. Kalita, K., & Raina, D. (2024). Potential of Nerium oleander as a traditional medicine: A review of phytoconstituents and CNS-depressant properties. South *African Journal of Botany*, 173, 411–416. https://doi.org/10.1016/j.sajb.2024.08.015

23. Murlanova, K., Cohen, N., Pinkus, A., Vinnikova, L., Pletnikov, M., Kirby, M., Gorelick, J., Drori, E., & Pinhasov, A. (2022). Antidepressant-like effects of a chlorogenic acid and cynarine enriched fraction from Dittrichia viscosa root extract. *Scientific Reports*, 12, 3647. https://doi.org/10.1038/s41598-022-04840-9

24. Rathore, B.S., Kotecha, M., Chaudhary, K., Manjula, R. (2022). Adulteration and Substitution in Indian Medicinal Plants: A Review Article. *International Research Journal of Ayurveda & Yoga* 05(05):72-78. doi: 10.47223/IRJAY.2022.5512

25. Rafael, A., Barros, L., Carvalho, A. M., & Ferreira, I. C. F. R. (2011). Topical anti-inflammatory plant species: Bioactivity of Bryonia dioica, Tamus communis and Lonicera periclymenum fruits. *Industrial Crops and Products*, 34(3), 1447–1454. https://doi.org/10.1016/j.indcrop.2011.04.021

26. Rekis, A., Elbar, D., & Laiadi, Z. (2023). Floristic diversity of a Saharan region in the south east of Algeria. *Journal Algérien des Régions Arides*, 15(1), 90–100.

27. Shafaei, H., Esmaeili, A., Soleimani Rad, J., Delazar, A., & Behjati, M. (2012). Citrullus colocynthis as a medicinal or poisonous plant: A revised fact. *Journal of Medicinal Plants Research*, 6(35) : 4922–4927. https://doi.org/10.5897/JMPR11.264

28. Souilah, N., Amrouni, R., Bendif, H., Daoud, N., & Laredj, H. (2020). Ethnobotanical study of the toxicity of Ecballium elaterium (L.) A. Rich. in the Northeast of Algeria. *Journal of Medicinal Botany*, 4 : 9-13. https://doi.org/10.25081/jmb.v4.6181

29. Saleem, T. S. M., Chetty, C. M., Ramkanth, S., Alagusundaram, M., Gnanaprakash, K., Thiruvengada Rajan, V. S., & Angalaparameswari, S. (2009). Solanum nigrum Linn. A review. *Phcog Reviews*, 3(6), 342–345.

30. Sharma, D., & Sharma, L. (2024). *An edible berry*, *Solanum nigrum: A medicinal plant and its new food products in health improvement*: A review. In Futuristic trends in agriculture engineering & food sciences (IIP Series, Vol. 3, Book 13, Chapter 21, e-ISBN: 978-93-5747-578-5). Publisher.

31. Turgumbayeva, A., Zhanat, T., Zhakipbekov, K., Kalykova, A., Kartbayeva, E., Mombekov, S., Tastambek, K., Akhelova, S., Sadykov, N., Omari, A., Dauletova, G., Altynbayeva, G., & Dilbarkhanov, B. (2023). A review on the medicinal plant Echinops ritro species: Phytochemistry and biological activity. *Farmacia*, 71(3).

https://doi.org/10.31925/farmacia.2023.3.2

32. Uçar, E. (2024). Polygonum aviculare L.'s biological activities: Investigating its anti-proliferative, antioxidant, chemical properties supported by molecular docking study. *Inorganic Chemistry Communications*, 162, 112228. https://doi.org/10.1016/j.inoche.2024.112228

33. Vuko, E., Dunkić, V., Maravić, A., Ruščić, M., Nazlić, M., Radan, M., Ljubenkov, I., Soldo, B., & Fredotović, Ž. (2021). Not only a weed plant Biological activities of essential oil and hydrosol of Dittrichia viscosa (L.) Greuter. *Plants*, 10(9), 1837. https://doi.org/10.3390/plants10091837

34. Vallejo, J. R., Peral, D., Gemio, P., Carrasco, M. C., Heinrich, M., & Pardo-de-Santayana, M. (2009). Atractylis gummifera and Centaurea ornata in the Province of Badajoz (Extremadura, Spain) Ethnopharmacological importance and toxicological risk. *Journal of Ethnopharmacology*, 126(2), 384–396. https://doi.org/10.1016/j.jep.2009.08.036

35. Zitouni-Nourine, S. H., Belyagoubi-Benhammou, N., Zitouni-Haouar, F. E., Douahi, O., Chenafi, F., Fetati, H., Chabane Sari, S., Benmahieddine, A., Zaoui, C., Mekaouche, F. Z. N., Atik Bekkara, F., Kambouche, N., Gismondi, A., & Toumi, H. (2022). Echinops spinosissimus Turra root methanolic extract: Characterization of the bioactive components and relative wound healing, antimicrobial and antioxidant properties. *Plants*, 11(24), 3440. https://doi.org/10.3390/plants11243440Beer, M., Spector, B., Lawrence, P., Mills, Q., & Walton, R. (1985). *Human resource management: A general manager's perspective.* Text and cases. New York: Free Press Macmillan.