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Original Paper

From Traditional Use to Toxicology: Ethnobotanical Analysis and Acute Toxicity Assessment of *Berberis sp* in Algeria

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Abstract

Introduction: This study aims to bridge the gap between traditional knowledge and toxicological assessment, focusing on species of the Berberis genus used in Algerian folk remedies.

Materials and Methods: An ethnobotanical study was conducted based on a bibliographic analysis and field surveys. At the same time, experimental test was conducted to verify the immediate harmful effects on BALB/c mice using an aqueous extract obtained by boiling 10% of the root bark of wich has being identified as *Berberi shispanica* (later known as *Berberis vulgaris ssp. australis*), collected in Tikejda forest arean (Djurdura national park). Experimental test has being conducted in accordance with OECD 423 guidelines.

Results: The ethnobotanical survey revealed frequent confusions between *Berberis vulgaris* and *Berberis hispanica*, we fund a marked lack of awarness ignorance among 93% of the herbalists interviewed about the availability and existence of Berberis taxa in Algeria, as well as the origin of plant material sold. This ignorance increases the risk of misidentification. The LD50 was estimated at 3162.27 mg/k, while the total lethal dose was 5000 mg/kg in males and 6000 mg/kg in females, indicating a higher toxicological sensitivity in males.

Keywords: *Berberis hispanica*, *Berberis vulgaris* ssp. *australis*, ethnobotany, toxicology, lethal dose 50 (LD50).

Introduction

The genus *Berberis* belongs to the family Berberidaceae, which encompasses a great diversity of species, with approximately 500 to 600 species recognized worldwide, a significant number of which are endemic to Asia, particularly in China (Harber 2020). some species and subspecies are present in temperate region of Europe, Africa and America. In Algeria, there is a taxonomic obscurity, concerning the status and synonymy of *Berberis vulgaris* and *Berberis hispanica*, which are often confused due to their strong morphological resemblance. Historically, and according to Cosson (1879), the name *Berberis hispanica* is attributed in certain regions, such as Djebel Tababort and the summit of central Djurdjura. However, he mentioned its synonym with *Berberis vulgaris*. Battandier and Trabut (1888) identified *Berberis hispanica subsp. australis*, specifying its presence in Sidi Abd El-Kader and Beni Saleh locations in the Atlas of Blida, as well as at the summit of the Dréat mountain in the Aurès. Maire (1964), also supported the distinction between *Berberis vulgaris* subsp. *australis* and *Berberis hispanica*, extending it to areas such as the Atlas of Blida, Bellezma Mountain in Aurés region, and the Hodna Mountain around M'sila. In recent databases, such the Plants of the World Online, *Berberis vulgaris* var. *Australis (Boiss.) Heywood* and Berberis *hispanica* Boiss. & Reut. are listed as synonyms. *Berberis vulagris var. australis was proposed as basioname of Berberis vulagis subsp. australis. In catalogue of*

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life Berberis hispanica and Berberis hispanica subsp. hispanica are registered synonyms of Berberis vulgaris subsp. hispanica (Boiss and Reut) Malag. (1975).

This confusion is further exacerbated by the use of multiple vernacular names, such as "Bou Saman," "Agheris," or "Amir Baris" (Trabut 1888; Ibn Hamadouche el-Djazaïri, 18th century), which seem to refer to forms of *Berberis vulgaris* or *Berberis hispanica*, without a clear distinction between these two statuses. These taxonomic ambiguities make their identification difficult based on traditional morphological criteria. Recent work on the phylogeny of the genus *Berberis* suggests that taxonomic revision is necessary to resolve these ambiguities. Some studies, such as those by Yu and Chung (2017), proposed a new classification of the genus *Berberis* based on genomic data and suggested the creation of new genera, such as *Alloberberis* and *Moranothamnus*, instead of the single genus *Berberis*. These identification illusions do not seem to be specific to *B. vulgaris* and *B. hispanica*; it appears that the identification errors presented in the species *Berberis woomungensis* C. Y. Wu, *Berberis pruinosa* Franch., *Berberis thunbergii* DC., *Berberis chinensis* Poir., *Berberis wilsoniae* Hemsl., and *Berberis sp.* are due to their morphological resemblance (Li et al., 2025).

The difficulty in taxonomic identification of *Berberis* is all the more significant given the growing interest in their medicinal properties. Indeed, these species are widely used in traditional medicine for their beneficial effects, particularly their antimicrobial, anti-inflammatory, and antidiabetic properties, as well as their hypotensive, hypolipidemic, and antioxidant effects (Mokhber-Dezfuli et al., 2014; Bhardwaj and Kaushik 2012). However, their therapeutic potential should not overshadow their toxicological risks. Some species, such as *Berberis hispanica*, contain bioactive compounds that, due to their potential toxicity, can cause serious side effects when misdosed or used over long periods (El Fakir et al., 2021).

The work presented in this study, although conducted in 2014, could only be published now and aims to clarify the taxonomy and use of *Berberis* in Algeria through two complementary approaches. The first part consists of an in-depth ethnobotanical study, exploring the traditional use of *Berberis* in ancient works of traditional medicine compared its current uses through field surveys conducted with local populations. The second part is dedicated to the experimental study of acute toxicity and the determination of the LD50 for the first time in using the Algerian plant materiel, based on the collection of *Berberis* samples, supposedly identified as *B. hispanica*, but considered as synonym of *B. vulgaris spp australis*, but requiring a taxonomic reevaluation using modern methods to confirm their true identity. This study highlights the need for a complete taxonomic revision and validation of the medicinal properties of these plants while taking into account the risks associated with their use.

Ethnobotanical Study

Bibliographic Analysis

Vernacular names

The vernacular names attributed to this plant was analyzed through Trabut's, (1935), « *Répertoire des noms indigènes des plantes spontanées, cultivées et utilisées dans le nord de l'Afrique »*.

Ancient traditional use by the Algerian people

The written manuscript Abderrezak Ibn Hamadouche el-Djazaïri, " كشف الرموز في بيان الأعشاب " (literally "Revealing the Symbols in the Explanation of Herbs)", was meticulously studied to reveal the ancient uses of *Berberis* in his time in the mid-18th century, as well as those of Abu Muhammad Ibn al-Baitar to compare the uses and names in his book " الجامع لمفردات الادوية و الاغذية". The work of *Victoria Hammich, (2013)* «Toxic Plants for Medicinal Use in the Mediterranean Region», was examined to obtain information on toxicological indications.

Investigation Based on Databases: *A Comprehensive Review of Berberidaceae Research Conducted in Algeria*

A search on the PubMed and Google Scholar databases was conducted to compile all the works carried out in Algeria on Berberidaceae familly. The search was conducted using the keywords: «*Berberis vulgaris*», «*Berberis hispanica*», *and* «Algeria». The objective of this consultation was not to determine the number of citations, but rather to identify the origin of the plant material, whether it was "purchased" in a supermarket or "harvested." This approach aims to trace the distribution of the species in Algeria and the awareness of its existence.

Prospected survey study

Our first prospection was carried out in 2014, accompanied by a verbal survey addressed to 25 herbalists from the following towns: El Tarf, Annaba, Skikda, Algiers, and Boussaâda, concerning the use of "A'ud Ghrisse". This survey aimed to gather information on the knowledge of this plant and its most common traditional uses by the local population. This was supplemented by another or a second field survey in 2025 to understand better the origin of *Berberis's* root barks sold by herbal sellers herbalists. A total of 75 herbalists were interviewed in Algiers and Blida. This approach aimed to assess their knowledge about the existence of *Berberis* in Algeria, their geographical distribution and harvesting conditions.

Experimental Study

Meriel and method

Locations

In collaboration with the agents of the Djudjura National Park, we located a population of *Berberis* in May 2014. The harvest took place in Tikjda at the altitude of 1448 meters. The distribution of *Berberis* begins at the exit of the commune of Hizer, in Bouira, and is found along the road leading to the Tikjda mountains. Plants not exceeding 1,5 meters in height. They have also been spotted in the mountainous landscapes of on both sides of the road.

The identification of the subjects was carried out by Prof. Toumi Mohamed Salah, a teacher-researcher at the University of Algiers 1, as well as by Moussa Hadad, a forestry engineer at the Tikjda National Park. The identification confirmed that the species corresponds to *Berberis hispanica* synonym of *Berberis vulgaris ssp australis.*

Plant material

The plant material consists of root barks, Collected at maturity during the flowering period, in June-July 2014. The barks are carefully cleaned and then dried away from light and moisture. They are then ground using a coffee grinder until a fine powder is obtained, which is then stored in opaque bottles until use.

Preparation of the crude aqueous extract at 10%

The crude aqueous extract is prepared from the fine powder obtained after cleaning, drying, and grinding the root barks. The preparation is carried out by decoction, 100 grs of root bark powder are boiled for 20 minutes in 1000 ml of distilled water.

After filtration using hydrophilic cotton placed between two layers of gauze, then on Whatman No. 4 filter paper, the extract is centrifuged at 3000 revolutions per minute for 15 minutes. The obtained supernatant is then dehydrated by lyophilization using a CHRIST 1-4 Alpha lyophilizer, until a brown powder is obtained. This powder is stored at -4°C until use.

The extraction yield is calculated according to the following formula (Falleh et al., 2008):

Yield percentage (%) = (Mext / Mech) x 100

Where:
Mext is the mass of the extract after evaporation of the water in mg.
Mech is the dry mass of the plant sample in mg.

Animals

Swiss albino mice, both male and female, of the BLB/C strain, weighing between 25 and 30 g, were provided by the Pasteur Institute kouba, Algeria. They are housed in polypropylene cages, at room temperature. They are subjected to a photoperiodic cycle of 12 hours of light and 12 hours of darkness, with free access to water and standard feed provided by the National Office of Livestock Feed (ONAB) in Algiers. The entire experimental work was carried out at the Higher Normal School Chiekh Mohamed El-Bachir El-Ibrahimi, Kouba, Algiers, Algeria.

Acute toxicity study with LD50 determination of Berberis hispanica collected

The Acute toxicity study and LD50 determination was determined according to OECD 423 guidelines (2001), which recommend the use of a range of doses applied to groups consisting of 5 males and 5 females. The administration was carried out by oral administration using a gavage sond for mice.

Seven doses were tested, in increasing order: 500 mg/kg, 1000 mg/kg, 2000 mg/kg, 3000 mg/kg, 4000 mg/kg, 5000 mg/kg, and 6000 mg/kg.

The mice were observed for 24 hours after administration and during the experimental period. Behavioral changes, as well as the number of deaths, were noted.

The LD50, expressed in mg/kg of body weight, was determined using the graphical method of Miller and Tainter (1944).

Results and discussion

Ethnobotanical Study

Bibliographic Analysis

Vernacular names

The vernacular names attributed to this plant was analyzed through Trabut's book, (1935). *Répertoire des noms indigènes des plantes spontanées, cultivées et utilisées dans le nord de l'Afrique*". The scientific name attributed to the species found in Algeria is *Berberis hispanica*. This name corresponds to the vernacular names used by the Algerian population: «Beraris», «Amir Baris» (بربريس), «Boussamam», «Agheris», «Tazgouart», «Darrhis», «Arrhis», «Atezar», «Aïzara», «Ousmich», «Ksila», «Zerchoq». The regions where these names are used have not, however, been specified.

Ancient traditional use by the Algerian people

The passage in which *Berberis* is mentioned is shown in Figure 1. The vernacular name reported by *Ibn Hamadouche* is «Amir Baris», synonymous with «Aghris». in Turkish, it is called «Haradan», «Bahar», «Kadane», «Touz» in Berberis Irara (Fig 1).

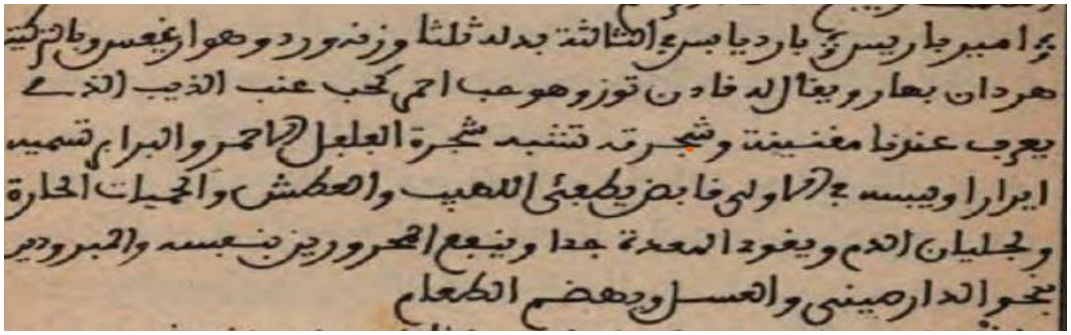

Figure 1: Excerpt from the Book of Ibn Hamadouche el-Djazaïri, "كشف الرموز في بيان الأعشاب" on the Use of Berberis in Traditional Medicine

Ibn Hamadouche describes the red fruit that resembles that of *Arctostaphylos uva-ursi.* He also compares the appearance of the *Berberis* tree to that of the red bell pepper.
The analysis of Ibn Hamadouche's text allows us to classify the species based on its pharmacological activity or therapeutic effects (Table 1) groups the effects described in Arabic, their pharmacological synonyms, as well as the systems treated.

Table 1: Pharmacological Analysis of Berberis According to Ibn Hamadouche: Therapeutic Effects and Systematic Classification

Word in Arabic	Synonym	Biological effect	System
قابض	Astringent	Narrowing to removal of epithelium and reducing secretions	Digestive system, skin and mucous membranes, cardiovascular system
يطفئ اللهب والعطش	Refreshing and hydrating	Antipyretic, anti-inflammatory	Immune system, Central nervous system
غليان الدم	Hypertension	Antihypertensive	Cardiovascular system
يقوي المعدة	Strengthen the stomach	Digestive tonic, gastrointestinal antiseptic	Digestive system

At the end of the text, *Ibn Hamadouche* describes that the properties of the *Berberis* fruit resemble those offered by الدّارصيني(or *cinnamon, Cinnamomum verum J. Presl*).
Ibn al-Baitâr cites the species *Berberis* under the name Berber "Aghris" (Fig 2) . He specifies the use of root bark, the term "root" being designated by the word "أصل".

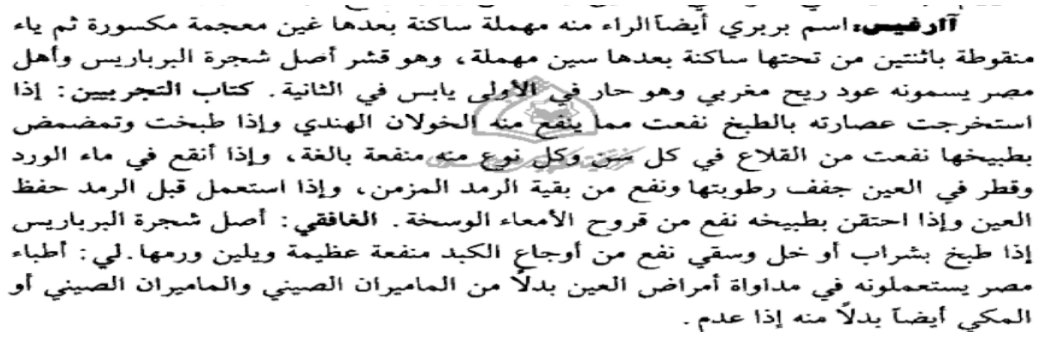
آرفيس: اسم بربري أيضاً الراء منه مهملة ساكنة بعدها غين معجمة مكسورة ثم ياء منقوطة باثنتين من تحتها ساكنة بعدها سين مهملة، وهو قشر أصل شجرة البرباريس وأهل مصر يسمونه عود ريح مغربي وهو حار في الأولى يابس في الثانية. كتاب التجريبين: إذا استخرجت عصارته بالطبخ نفعت مما ينفع منه الخولان الهندي وإذا طبخت وتمضمض بطبيخها نفعت من القلاع في كل سن وكل نوع منه منفعة بالغة، وإذا أنقع في ماء الورد وقطر في العين جفف رطوبتها ونفع من بقية الرمد المزمن، وإذا استعمل قبل الرمد حفظ العين وإذا احتقن بطبيخه نفع من قروح الأمعاء الوسخة. الغافقي: أصل شجرة البرباريس إذا طبخ بشراب أو خل وسقي نفع من أوجاع الكبد منفعة عظيمة ويلين ورمها. لي: أطباء مصر يستعملونه في مداواة أمراض العين بدلاً من الاميران الصيني والاميران الصيني أو المكي أيضاً بدلاً منه إذا عدم.

Figure 2: Excerpt from the Book of Ibn al-Baitâr on the Use of Berberis in ethnomedecin

He mentions several uses of the plant reported from three bibliographic sources, as well as the different methods of use. these bibliographic sources, the methods of use, as well as the fields of application in ethnomedicine are summarizes in (Table 2).

Li**: probably a Chinese person indicating the use of *Berberis* by doctors in Egypt for ophthalmological disorders and considers its effect better compared to *Chelidonium majus* (Chinese Celandine or Greater celandine).

The effects cited in * are deduced from the observations of Ibn al-Baitâr, who makes a comparison between the effects of the decoction of *Areca catechu* (called أهلندي أخلوالن).

The analysis of the work «Toxic Plants for Medicinal Use in the Mediterranean Region» (2013) edited by Hammiche, R. Mered and M. Azzouz reveals the use of "Aghris," a commercialized root, whose root bark is imported from South America, in a mixture combined with N*igella sativa* oil and honey. The dosage is codified rigorousuy , with a treatment duration set at three weeks, renewable if necessary. This combination was revealed following an investigation conducted by Victoria Hamiche through herbalists in the Algiers province.

Table 2: Ethnomedical uses of *Berberis* «Aghris» According to *Ibn al-Baitâr*: A Summary of Bibliographic Sources and Methods of Application.

Source	Methode	effect	Application area
Work of practitioners كتاب التجربيين	Decoction Aqueous extract Maceration in rose water used as eye drops	Anti-stomatitis* Anti-bleeding gums*, Anti-gingivitis*, Anti-conjunctivitis*, Effect on glaucoma*, Against diarrhea* and the improvement of halitosis Against hyperlacrimation Against conjunctivitis	Ophthalmic Gastric Ophthalmic
Al –Ghafiqi الغافقي	Decoction in vinegar	Use for liver	Gastroenterology
Li** لي			Ophthalmic

Data of survey study

The results of the verbal questionnaire conducted in 2014 at El Tarf, Annaba, Skikda, and Boussaâda revealed the widespread use of *Berberis* root barks in a traditional preparation combining this plant with the rhizomes of *Aristolochia longa* (became synonym of *Aristolochia fantanesii*) *called «Berostom»*. This combination, usually mixed with honey and administered in equivalent doses, is frequently used in a traditional medicine context.

The survey conducted among 75 herbalists in Algiers and Blida, regarding their knowledge of the existence of *Berberis* species in Algeria and their location, revealed that only 5 herbalists (or 6% of those asked) mentioned the existence of «Aghris» in the Djurdjura mountains.

The results obtained from the PubMed and Google Scholar databases identified 13 articles containing the keyword «*Berberis vulgaris*» and 3 articles with the keyword «*Berberis hispanica. Boiss. & Reut*». Among the 13 articles related to *Berberis vulgaris*, 2 of them (15.38%) collected their samples in «Adrar»and «Djelfa», while the other 11 (84.62%) purchased their plant material from the market. Regarding the 3 articles on «*Berberis hispanica*», 2 of them (66.67%) collected their samples in the «Djurdjura» and «Chéréa» mountains, while the rest do not specify the origin of their material, whether it was purchased or collected.

The Table 3 and 4 summarizes the works in which *Berberis vulgaris* and *Berberis hispanica* are mentioned, specifying the field of research as well as the origin of the plant material used.

Experimental study

Yield of the aqueous extract of harvested Berberis hispanica

The aqueous extract of *Berberis* root bark collected in Tikejda in 2014 was prepared by a 10% decoction, The crude yield of the aqueous extract, after lyophilization, was 15.62% (15.62 g for 100 g of bark).

Acute toxicity and determination of the LD50

Sign of toxicity of single high doses of Berberis hispanica in mice

After the oral administration of the aqueous extract 10% of *Berberis hispanica*, we observed that the signs of toxicity were directly related to the increase in dose, accompanied by a rise in the mortality rate. Consequently, we have grouped the different clinical signs observed in the following table 5.

Table 3: summarizes the works with keyword *Berberis vulgaris* in Algeria

Title	Origine	Area of researche	Reference
Hypoglycaemic effect of *Berberis vulgaris* L. in normal and streptozotocin-induced diabetic in rats	Root /purched	Experimental pharmacology	Meliani, N., and al. (2011)
Ethnopharmacological survey of medicinal plants used in the traditional treatment of diabetes mellitus in the North Western and South Western Algeria	Root/Purched	Ethnopharmacologycal	Azzi,R.,and al .(2012)
evaluation de l'activité antioxydant de *Berberis vulgaris*	Root/purched	Antioxydant	Mezouar, D.,and al. (2014)
Évaluation de l'activité antimicrobienne de *B. vulgaris* L.	Root/purched	Microbiology	Mezouar, D.,and al. (2014)
Use of medicinal plants by breast cancer patients in Algeria	Root/purched	Ethnobotanical	Benarba, B. (2015).
Medicinal plants used by traditional healers from South-West Algeria: An ethnobotanical study	Root/purched	Ethnobotanical	Benarba, B. (2016)
Evaluation of antidiabetic activity of two plants: *Berberis vulgaris* and *Zygophyllum geslini*	Root /collected Adrar	pharmacology	Boudjelthia, W.O.,and al. (2017)
Ethnopharmacological study of natural products used for traditional cancer therapy in Algeria	Root/purched	Ethnopharmacological	Benarba, B. (2015).
Phytoconstituents effects of traditionally used herbs on dissolution and inhibition of kidney stones (CaOx)	Root/purched	phytochimical	Belabdelli, F.,and al. (2023)
Phytochemical study of two plants: *Calendula officinalis* and *Berberis vulgaris* and evaluation of their antioxidant activities with DPPH test	Root/collected Djelfa	Antioxydant	Gougue, F., & Boutaiba, S. (2024).
Combination evaluation of some Algerian medicinal plant extracts in association with antibiotics.	Root /purched	pharmacology	Bereksi, M. S.,and al.(2017)
New trends in the use of medicinal plants by Algerian diabetic patients, considerations of herb-drug interactions	Root /purched	Pharmacology	Chelghoum, M.,and al .(2021)
Ethnobotanical study of medicinal plants used for the treatment of diabetes mellitus in Sidi Bel Abbes region (North-west Algeria).	Root /purched	ethnobotanical	AissaL.,et and al .(2019)

Table4: summarizes the works withe keyword *Berberis hispanica* in Algeria

Isolation of berberine tannate using a chromatography activity-guided fractionation from root bark of *Berberis hispanica* Boiss. & Reut.	Root/no mention	Chromatography	Aribi, I.,and al (2017)
Isolation of phytoconstituents and evaluation of biological potentials of *Berberis hispanica* from Algeria	Root and leavs collected	Phytochemical	Lemoui, R.,and al (2018)
Berberis hispanica alkaloids extract induced cell death and apoptosis in human laryngeal cancer cells Hep-2	Root /collected Tikijeda	Cancer traitement	Boudjlida, A.,and al.(2019)

Table 5: Toxicity signs related to the different single doses administered of *B. hispanica*

Dose (mg/k	mice		Toxic effect	
	Sexe	Mortality	The time of death after administration	Symptom of toxicity
500	Male female	0/5 0/5	/ /	No signs of toxicity
1000	Male female	1/5 0/5	More then 24h	-Alignment of the hairs, drowsiness.
2000	Male female	2/5 0/5	More then 8h	-Hair standing on end, drowsiness, weakness, respiratory distress, cardiac distress
3000	Male female	2/5 2/5	8h≤M≤6h	Straightening of the hair, respiratory trouble, weakness, loss of appetite
4000	Male female	4/5 3/5	Less than 5h	Hair standing on end, respiratory distress, increased heart rate, loss of appetite, nasal itching, visual disturbance, convulsion, coma, death
5000	Male female	5/5 3/5	5h≤ M≤3h	Respiratory distress, increased heart rate, visual disturbance, convulsion, coma, total paralysis, nasal itching, death
6000	Male female	5/5 5/5	Less than 1 hour	Convulsion, total paralysis, death

The first mice observed dead, related to the dose of 6000 mg/kg, exhibited signs of severe toxicity. The animals exhibited respiratory dyspnea, increased heart rate, locomotion disorders, muscle contractions, convulsions, total paralysis, coma, and then death. The lethal dose for the entire population of males was 5000 mg/kg, while the lethal dose for the population of females was 6000 mg/kg. It is observed that the signs of toxicity appear more quickly in males than in females, and that the mortality rate is also higher in males.

Respiratory disorders appeared at 2000 mg/kg in both sexes, males and females, with dark yellow to brown urine, and the signs intensified with the increase in dose. For the high doses of 5000 and 6000 mg/kg, very intense apnea was observed.

Seizures, total paralysis, and muscle contractions appeared from high doses, starting at 4000 mg/kg. The mice first trembled, then intense muscle contractions occurred, leading to a loss of voluntary movement coordination, followed by convulsions, total paralysis, coma, and then death.

Determination of DL50

After calculating the mortality percentages for each dose tested from 500mg/kg to 6000mg/kg, the LD50 was determined using the graphical method of Miller and Tainter (1944). by plotting a semi-logarithmic curve representing the mortality of the mice (in probits unit) as a function of the logarithm of the ad ministered dose (in milligrams per kilogram of body weight).

The linearization of this curve allows determining the LD50 from the ordinate corresponding to a mortality percentage of 50% (Fig 3). La DL50 was calculted at 3162,27 mg/kg (Fig 1).

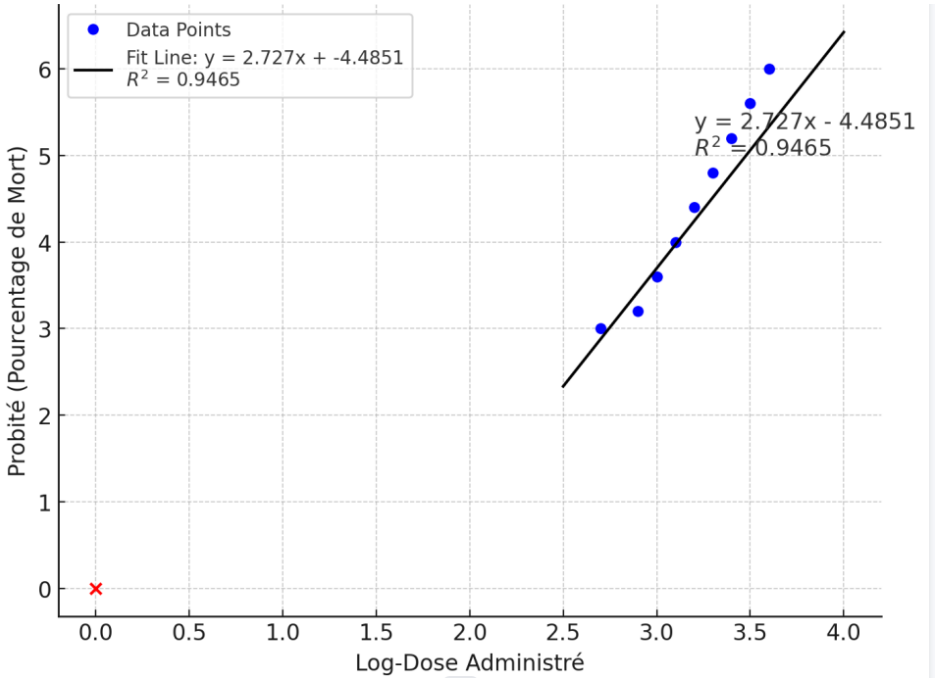

Figure 3: Mortality Rate by Oral Administration in Mice as a Function of the Logarithm of the Dose (mg/kg) of *Berberis hispanica*

According to Diezi's classification (1989), substances are classified based on their LD50 as follows:
DL50 < 5 mg/kg: Highly toxic substance
5 mg/kg < DL50 < 500 mg/kg: Toxic substance
500 mg/kg < DL50 < 5000 mg/kg: Slightly toxic substance
DL50 > 5000 mg/kg: Non-toxic substance
In our study, the LD50 of *Berberis hispanica* was determined to be 3162.27 mg/kg, which places this species in the category of slightly toxic substances according to Diezi's classification (1989).it deserves to be used with caution in humans.

Discussion

In Algeria, traditional remedies was influenced by Islamic culture. The empirical knowledge of local populations has been enriched. This combination had a significant impact on the traditional Algerian pharmacopoeia (Bertherand 1859).

Botanical studies highlighted a wide variety of scientific names attributed to the Berberis in Algeria: *Berberis vulgaris*, *Berberis hispanica* ssp. *australis*, or even *Berberis vulgaris* ssp. *australis* (Cosson 1879; Battandier and Trabut 1888; Maire 1964).

The vernacular names attributed to Berberis by the Algerian population, as reported by Trabut (1935), reflect significant linguistic diversity, raising an issue of botanical identification. The taxonomic ambiguity can compromise therapeutic use. Pharmacological properties vary from one species to another (Li et al., 2025). Of the 13 scientific publications analyzed, the plant material varies between *B. vulgaris* and *B. hispanica*, illustrating a persistent scientific uncertainty. The lack of standardization in the collection of roots and the traceability of the material sold by herbal sellers', often imported without identification and increase the risk of poisoning (Hammiche et al., 2013). This problem is highlighted by the survey conducted among 75 herbalists, from which 5 only, recognize the existence of *Berberis* in Djurdjura mountains. This ignorance shows the limit of empirical knowledge and certifies the impact of the imported market material. The risk of plant poisoning is not necessarily as high as the risk associated with the combined use of plants recommended by certain herbalists or plant sellers. They may recommend combinations of species they are not necessarily familiar with, nor their origin (introduced or spontaneous). Herbalists orally prescribe genuine prescriptions, with dosage, treatment duration, and administration route, while ignoring adverse effects, interaction risks, and overdoses (Hammiche et al., 2013).

According to Ibn Hamadoucha, Berberis fruits were traditionally used as astringents, antipyretics, hypotensives, and tonics. These same uses are reported in several countries such as Iran, France, India, Bulgaria, and Belgium, in different forms: dried fruits, decoctions, infusions (Imanshahidi and Mohseinzada 2008). The bark of Berberis roots has also been indicated by Ibn Al-Baytar for use in ophthalmology and enterogastrology. The study by Imanshahidi and Mohseinzada (2008) confirms these traditional uses, highlighting the use of roots and leaves in several countries, notably Iran. China (Li et al., 2025), Nepal, and Vietnam (Harber 2020) The pharmacological effects are mainly attributed to Berberine, an alkaloid present in the bark of the roots, the bark of the stems, the wood, the flowers, the fruits, and the stems of the plant (Imanshahidi and Mohseinzada 2008).

Ethnobotanical surveys conducted in El Tarf, Skikda, Annaba, and Boussaâda show that Berberis is often used in association with the rhizomes of *Aristolochia longa* (*Aristolochia fantanesii*)), locally known as Berostom. However, this association poses a major risk due to the presence of aristolochic acids, nephrotoxic compounds responsible for irreversible renal fibrosis. One of the first experimental observations on the renal toxicity of these acids' dates back to 1963 (Peters G. et al., 1963). This combination has also been documented (Benarba 2015) on the use of medicinal plants in breast cancer patients in Algeria, highlighting the persistence of such practices despite the toxic risks.

The aqueous extract of Berberis root barks, collected in Tikjda, was prepared by decoction at 10%. The gross yield after lyophilization was 15.62 % (15.62 g for 100 g of bark). For comparison, Shamsa et al. (1999) obtained a yield of 11.4 % from the fruits of *Berberis vulgaris*. This difference is explained by the variation in chemical composition between the fruits and the roots. The latter contain more alkaloids (Wierzchowski and Budicz 1969; Parlamarchuk et al., 1973; Suan et al., 1998; Sharad Srivastava et al., 2015).

The toxicological study conducted on BALB/c mice determined an LD50 of 3162.27 mg/kg. This result differs from that of Peychev (2005), who reported an LD50 of 2.6 ± 0.22 g/kg for *Berberis vulgaris*, as well as from the study byEl-Fakir et al. (2021), who reported an LD50 of 1016.16 mg/kg for *Berberis hispanica* collected in Morocco. These differences may be due to inter- and intra-species variations, pedoclimatic effects and extraction conditions from material obtained within markets.The observed toxicological signs ranged from drowsiness and weakness to dyspnea, which could lead to death. These effects were found to be dose-dependent. The comparison with the study by El-Fakir et al. (2021) shows similar symptoms, notably dyspnea and urine discoloration, with increasing intensity starting from 1400 mg/kg.

The dose that kills the entire male population is 5000 mg/kg, and the one that kills the female population is 6000 mg/kg. It is observed that the signs of toxicity appear earlier in males than in females, as well as the mortality rate is recorded higher in males than in females. it can therefore be assumed that one or more compounds in the aqueous extract interfere in competition with estrogens.

Jing Liu et al. (2008), confirmed that Berberine belonging to the families of alkaloids, contained in the aqueous extract of *Berberis vulgaris*, is an estrogen antagonist that competes to bind to estrogen receptors, which explains the use of chemotherapy coupled with estrogen antagonists in the case of breast cancer.

The convulsions, the almost cut-off breathing that leads to apnea, the paralysis, and the accelerated heart rate are probably due to damage to the central nervous system. The Berberidaceae family contains alkaloids that are known for their neurological effects. Several studies have shown that the presence of alkaloids in plant extracts is the cause of their toxicity, such as ~~plants~~ from the Fabaceae family (Bousahel 2013). High doses of Berberine can also cause cardiac damage due to increased muscle contracion and decreased blood pressure (Anonymous 2000).

Conclusion

These study highlights both the richness and the complexity of the traditional use of *Berberis* spp. in Algerian folk remedies. By combining ethnobotanical, bibliographic, and toxicological approaches, we not only reveal the deep-rootedness of this plant in the local therapeutic heritage but also the potential risks associated with its non-standardized use.

The results showed poorly defined taxonomic diversity, maintained by confusion between morphologically closed species and reworked biosystematically. Thus, complicates exact identification and compromises the reliability of medicinal practices. We suggest domestication of target accessions and thorough identification of plant materiel. The toxicological analysis of the aqueous extract of Berberis root bark revealed moderate acute toxicity, with an LD50 of 3162.27 mg/kg, and increased sensitivity observed in male mice compared to females. These data confirm the necessity of considering sex as a biological factor in the evaluation of the toxicity of plant extracts.

The observed association of *Berberis* with Aristolochia longa (*Aristolochia fantanesii*)), a plant known for its severe renal toxicity, constitutes a major public health alert, especially since this combination is still practiced in certain regions of the country.

We emphasis the urgency of rigorous standardization in the botanical recognition, collection, and use plants in Algeria. It is desirable to strengthens the training of herbalists and integrate toxicological evaluation into phytotherapeutic practices in order to guarantee safe, effective, and scientifically-based traditional medicine.

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Conflict of interest

There is no conflict of interest to be declared.

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