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Original Article

Vernacular names of plants between diversity and potential risks of confusion: Case of toxic plants used in medication in the central Middle Atlas, Morocco

[Nombres vernáculos de las plantas entre la diversidad y los posibles riesgos de confusión: caso de las plantas tóxicas utilizadas en la medicación en el Atlas Medio central, Marruecos]

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Abstract

Context: Knowledge of medicinal plants is the first step in preserving traditional use and preventing intoxication.

Aims: To highlight the risks of intoxication related to the similarities of vernacular names between medicinal plants and to confusion during harvesting.

Methods: Indigenous knowledge on the traditional use of toxic plants for medicinal purposes was gathered through direct interviews with practitioners of herbal medicine and field surveys in the Central Middle Atlas. The vernacular names were collected from the respondents and through various bibliographical sources relating to the flora and the traditional Moroccan Pharmacopoeia.

Results: Giving The results identified 83 toxic species, divided into 39 families and 75 genera. These plants have different vernacular names in Arabic or Berber dialects. 60 species out of the 83 plants inventoried have at least 3 vernacular names. The study also revealed that a vernacular name could correspond to several species of the same genus or even of different genera and families; only 27 species of the 83 inventoried have their own vernaculars that they do not share with any other species throughout the country. Because of this similarity of vernacular names, medicinal plants could be confused, which would be the cause of the ineffectiveness of related treatments or even others' toxicity. The risk of intoxication is aggravated by confusion during the harvesting.

Conclusions: The identification of plants based on affirmed taxonomic criteria and a charter regulating the collection and use of plants is imperative to avoid any risk of intoxication.

Keywords: confusion; diversity; ethnobotany; Moroccan Central Middle Atlas; intoxication risks; vernacular names.

Resumen

Contexto: El conocimiento de las plantas medicinales es el primer paso para preservar el uso tradicional y prevenir la intoxicación.

Objetivos: Destacar los riesgos de intoxicación relacionados con las similitudes de los nombres vernáculos de las plantas medicinales y con la confusión durante la cosecha.

Métodos: Los conocimientos indígenas sobre el uso tradicional de las plantas tóxicas con fines medicinales se reunieron mediante entrevistas directas con profesionales de la medicina herbaria y estudios de campo en el Atlas Medio central. Los nombres vernáculos se recogieron de los encuestados y a través de diversas fuentes bibliográficas relacionadas con la flora y la farmacopea tradicional marroquí.

Resultados: Los resultados identificaron 83 especies tóxicas, divididas en 39 familias y 75 géneros. Estas plantas tienen diferentes nombres vernáculos en árabe y/o dialecto bereber. 60 especies de las 83 plantas inventariadas tienen al menos 3 nombres vernáculos. El estudio también reveló que un nombre vernáculo podría corresponder a varias especies del mismo género, o incluso de diferentes géneros y familias; sólo 27 especies de las 83 inventariadas tienen sus propias lenguas vernáculas que no comparten con ninguna otra especie en todo el país. Debido a esta similitud de los nombres vernáculos, las plantas medicinales podrían confundirse, lo que sería la causa de la ineficacia de los tratamientos relacionados, o incluso de la toxicidad de otros. El riesgo de intoxicación se ve agravado por la confusión durante la recolección.

Conclusiones: La identificación de las plantas sobre la base de criterios taxonómicos afirmados, así como una carta que regule la recolección y el uso de las plantas son imperativos para evitar cualquier riesgo de intoxicación.

Palabras Clave: confusión; diversidad; etnobotánica; Atlas Central Marroquí; riesgos de intoxicación; nombres vernáculos.

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INTRODUCTION

In the Middle Atlas Mountains, herbal medicines are omnipresent in view of the general ecology, offering a rich and diversified flora and making activities in contact with nature such as pastoralism and agriculture, the main sources of income for the population. Herbalism is also very frequent in the permanent markets as well as in the weekly markets' "souks" where freshly picked or dried plants are sold on display (Najem et al., 2020a).

According to Trabut (1935), the naming of plants has always been practiced with fairly great precision by the indigenous populations of North Africa; the use of these popular names are so common that it is even preferred to the Latin nomenclature of botanists. Thus, many names are derived from the plant properties and characters such as color, smell, appearance, special secretion, and habitat, among others. Also, in several cases, analogies with animal organs, ears, tails and legs are at the origin of some plant's popular names.

However, despite the fact that many people have accumulated herbal therapeutic knowledge by diagnosing and recommending remedies and medicinal recipes, the risks in this field are not negligible. These can be divided into two categories; the first one is due to the confusion between plants because of their nomenclature (Najem et al., 2019). In general, the native takes into account only one dominant character; that is why he calls zatter both fragrant thyme, oregano, and all *Labiatae* with thymol (Trabut, 1935). Similarly, some common or vernacular names are often imprecise and refer under the same name to several species or even to different genera; for example, ghassoul "taghassoult" covers two genera and at least three species: *Aizoon canariense* L., *Aizoon hispanicum* L. and *Mesembryanthemum nodiflorum* L. (Fennane and Rejdali, 2016). Ethnobotanical investigations carried out by Bachiri et al. (2015) revealed that in addition to the attribution of vernacular names to different species, the same species could have several local names.

The risks incurred by the multitude or the disparity of vernacular names are aggravated by confusion during the harvest due to the morphological resemblance between certain plants and others' ecological convergence. Thus, in the Middle Atlas region, *Rhamnus alaternus* L., from the *Anacardiaceae* family, is often confused with *Phyllerea latifolia* L. belonging to the *Oleaceae* family (Bouiamrine et al., 2017) although their vernacular names are different, respectively "amlires" and "imtutel". These confusions are amplified, even difficult to notice when the plants are offered in a dried state (Bouiamrine et al., 2017). In some cases, plants are very similar in their vegetative state and are confused when they are picked before flowering; for example, in Europe, *Allium ursinum* L., which belongs to the *Amaryllidaceae* family and has medicinal properties, is often confused with the highly toxic *Colchicum autumnale* L. from the *Colchicaceae* family (Pilegaard, 2012). In addition, if medicinal plants are herbaceous, they are often sold in their entirety and are easy to identify; but, with trees and shrubs, only branches, bark, or leaves are sold, which makes plant identification difficult and increases the risk of confusion (Bouiamrine et al., 2017).

The second category of risks is due to the confusion between parts of plants to be used, their mode of preparation, administration or conservation (Najem, 2020b). Indeed, it has been noticed in the Middle Atlas region that the growing interest in medicinal plants has led some people without knowledge in phytotherapy, to become roadside plant vendors or herbalists; that results in several errors in plant identification and therapeutic use (Bouiamrine et al., 2017).

Thus, the present work is a part of a series of ethnobotanical investigations carried out by our research team in the central Middle Atlas; first, an inventory of the main medicinal plants commonly used in the region has been done and the plants declared toxic have been listed. Then, the origin, the diversity and the significance of the vernacular

names attributed to these inventoried plants were investigated. So, this study focuses on the similarity of vernacular names between species and the inherent risks of confusion. Also, the confusion encountered during plant harvesting is considered.

MATERIAL AND METHODS

Study area

The Middle Atlas is a mountainous massif that extends over about 450 km and covers an area of 27 550 km² (El Jihad, 2016). Its population was estimated at 268 098 inhabitants according to the 2014 national census report (HCP, 2018).

The human component is made up of different tribes, typically Berber of Amazigh culture; sylvo-pastoralism and agriculture in the plains constitute the essential part of the socio-economy of the inhabitants. Also, as the Middle Atlas is a very large region, six main cities were chosen to conduct this study; these are the city of EL Hajeb (province of El Hajeb), the cities of Azrou, Ifrane and Timahdite (province of Ifrane), the cities of Khenifra and M'rirt (province of Khenifra) (Fig. 1).

Research strategy

The present work is based on the results of ethnobotanical investigations previously carried out by our research team in the central Middle Atlas region; these have made it possible to inventory the main medicinal plants administered or recommended by the phytotherapists interviewed in the study area, as well as those of them that have been declared toxic by these practitioners of traditional medicine. In addition, the vernacular names of these plants were collected both from the interviewees and through an extensive literature search.

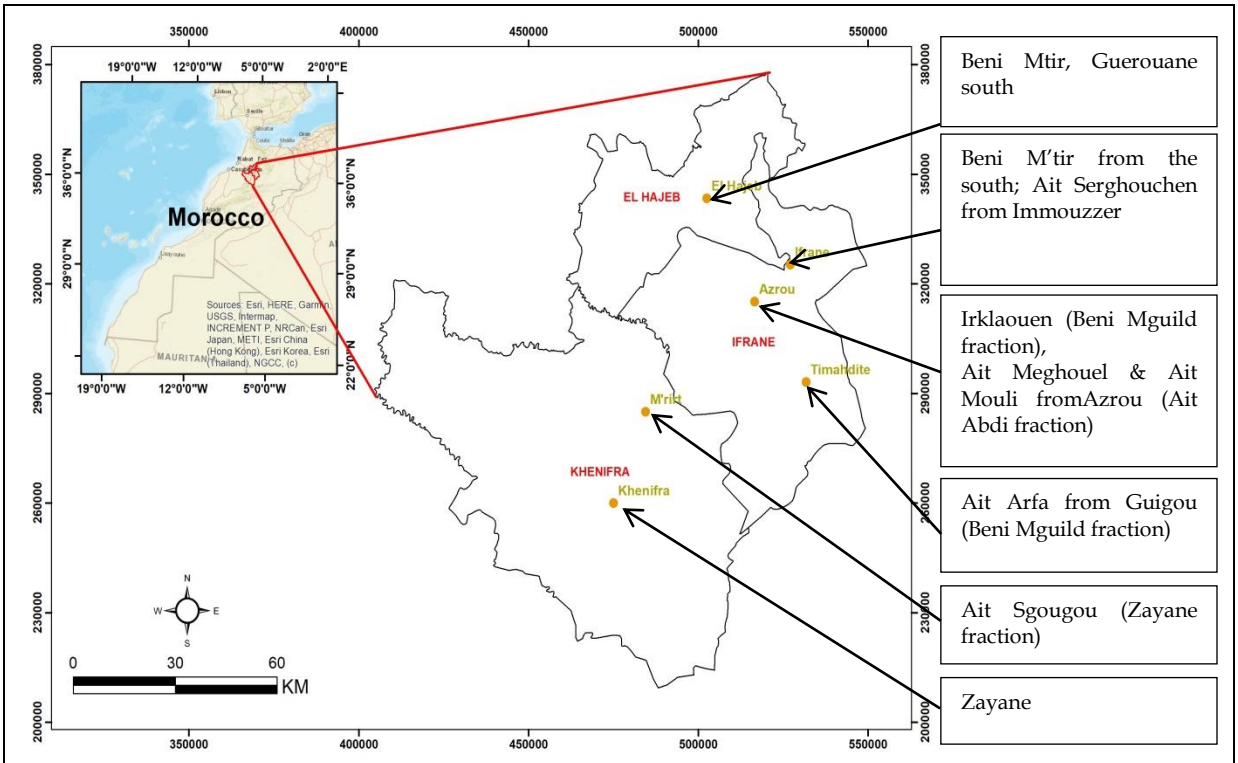

Figure 1. Study area and main tribes occupying the region.

General methodological information

In order to collect information about toxic plants used in phytotherapy in the central Middle Atlas, interviews were conducted over 7 months with traditional medicine practitioners in the study area. The fieldwork was spread over 12 months to be able to harvest each plant used by the informants in its appropriate season. During each field visit, we were accompanied by several traditional medicine practitioners to be able to locate in the field the plants used in medicinal recipes.

Botanical information

For each plant inventoried, samples were collected during several field visits in the different regions of the study area. Each collected plant material was dried, numbered, and preserved. Taxonomic identification was carried out in the botany laboratory at the Sciences Faculty of Meknes, referring to manuals of the vascular plant's determination "Practical flora of Morocco" (Fennane et al., 1999; 2007; 2014). All specimens were deposited in the herbarium of Environment and Valorisation of Microbial and Plant Resources Unit, Faculty of Sciences, Moulay Ismail University of Meknes. All scientific names and families have been revised according to The Plant List (2020) http://www.theplantlist.org/.

Anthropological information

Sample size and inclusion and exclusion criteria

To determine the sample size (N), we compiled a list of 290 traditional medicine practitioners in the study area, which corresponds to the parent population (P). To obtain a representative sample (N), the ratio (N/P) must be between 15% and 20% (Nacoulma et al., 2006). So, in our case, we retained a ratio equal to 20%, and the sample size (N) was equal to 58 phytotherapists. The inclusion criteria were people from the study area, knowledgeable about the practice of phytotherapy or the trade of aromatic and medicinal plants; they are therefore likely to provide correct and original information on the use of medicinal plants. While the exclusion criteria were informants who are not traditional medicine practitioners or who are not from the study area.

Ethics statement and consent

The approval of this study was granted by the Scientific Research Commission of the Sciences Faculty of Meknes, the Ethical Research Committee of the aromatic and medicinal plants pole of Moulay Ismail University of Meknes, and the Directorate of Water and Forestry and the Fight against Desertification.

At the beginning of each interview, we obtained oral consent and agreement from each interviewee to participate in the survey. All respondents were informed that the purpose of the research is purely academic and not commercial. Also, they were informed that their answers will be published anonymously and that they have the right to withdraw their information at any time during the survey.

Survey and data collection

Using questionnaire cards (Appendix 1), an ethnobotanical survey was conducted with different actors of traditional medicine: traditional healers, herbalists and druggists. Using the "Free listing" technique, participants were asked to answer closed, and semi-closed questions considered more efficient for data collection. Each respondent delivered an average of 18 plants; this made it possible to complete 1042 questionnaire forms.

After obtaining the consent of the traditional medicine practitioners surveyed, they were interviewed in Amazigh or Arabic dialects depending on the language spoken by each informant. The surveys were rarely completed in a single visit because the informants did not provide all the information in one session. So, we sometimes had to return several times to an informant and show patience and availability in order to collect and document the maximum of indigenous knowledge about medicinal plants.

Background review of the literature

The second step consisted of researching the vernacular names of the listed plants to see if they

are shared with other species in the study area or elsewhere in Morocco. The main literature consulted was:

- The three volumes of the practical flora of Morocco (Fennane et al., 1999; 2007; 2014),
- The traditional Moroccan Pharmacopoeia, ancient Arab medicine and popular knowledge (Bellakhdar, 1997),
- Aromatic and Medicinal Plants of Morocco: Wealth, Diversity and Threats (Fennane and Rejdali, 2016),
- Toxic effects of some medicinal plants used in Moroccan traditional medicine (Bnouham et al., 2006),
- Inventory of medicinal plants of the commune of Aguelmouss - Province of Khenifra-Morocco (Daoudi et al., 2013),
- Profile on medicinal plants used by the people of North Eastern Morocco: Toxicity concerns (Kharchoufa et al., 2018),
- Practice of phytotherapy in the south-east of Morocco (Tafilalet) (El Rhaffari and Zaid, 2002),
- Contribution to the elaboration of an ethnobotanical catalog of the rural commune of Aguelmous (Province of Khenifra, Morocco) (Nassiri et al., 2016),
- Flora of North Africa: repertory of native names of spontaneous, cultivated and used plants in North Africa (Trabut, 1935),
- Toxic plants for medicinal use around the Mediterranean (Hammiche et al., 2013),
- Tuhfat Al-Ahbab: Glossary of Moroccan Medical Matters. Anonymous, translated from Arabic by Renaud HPJ and Collins G (Anonymous, 1934).

RESULTS AND DISCUSSION

Among the inventoried medicinal plants in the study area, 83 species were declared to be toxic by the practitioners of traditional medicine. These species belong to 75 genera from 39 families. The data reported in Table 1 shows that among these 83 plants, 60 (72%) have at least three vernaculars. The species *Ferula communis* L. has at least 15 different popular names. Only 7 species have a single vernacular throughout Morocco; these are: *Angelica archangelica* L., *Carum carvi* L., *Pimpinella anisum* L., *Buxus balaerica* Lam., *Astragalus gummifer* Labill., *Astragalus lusitanicus* Lam., and *Peganum harmala* L. The other 16 species (Table 1) have two vernaculars, often one in Arabic and the other in Berber; they are: *Acanthus mollis* L., *Chenopodium ambrosioides* L., *Coriandrum sativum* L, *Atractylis cancellata* L., *Chrysanthemum parthenium* (L.) Bernh., *Brassica napus* L. subsp. rapifera Metzg., *Ajuga iva* (L.) Schreb., *Clinopodium nepeta* subsp. *glandulosum* (Req.) Govaerts, *Trigonella foenum-graecum* L., *Mentha pulegium* L., *Ocimum basilicum* L., *Origanum majorana* L., *Salvia verbenaca* L., *Arundo donax* L., *Delphinium staphisagria* L. and *Agrimonia eupatoria* L.

Similarity of vernacular names

The comparison of Tables 1 and 2 reveals that only 27 species from the 83 inventoried (33%) have their own vernacular that they do not share with other species throughout the country; for the remaining 56 species, a given vernacular name is used to designate more than one species belonging to the same genus or to different genera and even to different families (Table 2). This similarity of names may be due to the similarity of certain plants' uses, the resemblance, or the polymorphism of certain others (El Rhaffari and Zaid, 2002). This can also be observed when changing regions or even within the same region, for the same language, or for different languages (Adam, 1970).

It should also be pointed out that the 7 species with only one vernacular previously mentioned may share their names with other plants. It is the case of both *Buxus balaerica* Lam., and *Astragalus lusitanicus* Lam.; the vernacular is shared with one species of the same genus for the first plant and with species of the same genus and different genera but of the same family for the second. On the other hand, some species, even though they have a

Table 1. List of toxic plants used in traditional medicine in the Central Middle Atlas.

Family	Scientific name	English common name	Moroccan vernacular
Acanthaceae	*Acanthus mollis* L.	bear's breeches	sabounia, sebbana
Adoxaceae	*Sambucus nigra* L.	elderberry	sembuqa, bourwabez, khaman, waruri
Amaranthaceae	***Chenopodium ambrosioides* L.**	Mexican-tea	**mkhinza**, touijante
Anacardiaceae	*Pistacia lentiscus* L.	lentisk	drou, trou, darw, tidekt, titekt, imitek, fadis, ifavisen, afavis
	***Pistacia atlantica* Desf.**	Atlas mastic tree	**lebtem, ijj, igg**, tasmalt, qwawache, atnû, tatnut (fruit), smagh lebtem (gum), zerriat lebtem, habba khadra (green seed)
Apiaceae	***Ammi majus* L.**	greater ammi	ich omlal, **âthrilâl**, thrilan, thlilan, tlaylân, tirilal, kryu, tribal, blala
	***Ammi visnaga* (L.) Lam.**	toothpick-plant	**khela**, bou okmam bechnikha, tabeshnikht, kessiba, jazar barri
	***Anethum graveolens* L.**	dill	**chibt**, lkarwiya el-amiya, aslouj, **kamoun el habchi**
	Angelica archangelica L.	garden angelica	hachichat malaeka
	Carum carvi L.	caraway	karwiya
	Coriandrum sativum L.	coriander	kesbour, bakhur ej-jnun
	Ferula communis L.	giant fennel	boubal, aboubal (unopened inflorescence) fassoukh (for gum-resin), awli, anli, kelkha (dry stem), el-kelkh, **lkelikha**, uffal, tûffalt, taggult, takoult, al mubatil (gum resin), tebtil, anbi, anslal
	Foeniculum vulgare Mill.	fennel	besbas, lbesbas, amsa, wamsa, chamar, **nafaa** (for the fruit)
	Pimpinella anisum L.	anise	habat hlawa
Apocinaceae	*Nerium oleander* L.	oleander	ddefla (defla)/alili, anini, ariri, aligi, arili
Aristolochiaceae	***Aristolochia paucinervis* Pomel**	long aristolochia	**berreztem**, buruchtam, **ajrarkhi**, qa'qa riba, qitta'lehmir l- berri, aarifi, arifis
Asparagaceae	***Urginea maritima*** (L.) Baker	squill	**aansal**, ikfil, **ichkkil**, **bsal ed-dib**, azalim- u-wuchchen, bçal el-far, bsel el-khanzir, bessila, bsel l-fer 'awn, fer'una, lbruwaj idan, ibuel ivan
Berberidaceae	*Berberis hispanica* Boiss. & Reut.	barberry	arghis, ighris, argis, busman, barbaris, ambarbaris, azaghnat, izirki,
Boraginaceae	***Borago officinalis* L.**	borage, starflower	**harcha**, harriecha (**horraycha**), thamen, **bouchenaf,** bou-assal, ils-uuzger, ils-uaghwi, **lisan attur, lisan l-bger**, iles ufunas, uzgar, **bou-hamdoune**, benni-hamduna
	***Heliotropium europaeum* L.**	european heliotrope	**khuniza**, khuniza ratba, **hebbaliya**, **sikran**, akerir
Brassicaceae	*Brassica napus* L. *subsp. Rapifera* Metzg.	rutabaga, swede	lifiti, left fajli
	***Brassica nigra* (L.)K.koch**	black mustard	ashnab, achnaf, khardal, khardal aswad, **bu-hamu**, **kerkaz**, zeriit shan, hebb l-mchebek (seeds)
	***Diplotaxis* harra (Forssk.) Boiss.**	wall rocket	asheryad (cheryat), **l-kerkaz**, **l-harra**, waifs, **bu-hammu**
	Lepidium sativum L.	cress	habb- er-rchad, lharf (heurf)

Table 1. List of toxic plants used in traditional medicine in the Central Middle Atlas (continued…)

Family	Scientific name	English common name	Moroccan vernacular
Buxaceae	***Buxus balearica* Lam.**	buis des Baléares	**baqs**
Caryophyllaceae	***Vaccaria hispanica* (Mill.) Rauschert**	cow soapwort	**tighighest,** tighighecht, **hamrat er-ras**, sabun el-fqar, tuf essabun
Cistaceae	***Cistus ladanifer* L.**	gum rockrose	**touzzalt (touzzal)**, targla, ftah, ftakh, bû-zegzaw, ladan, ladan'aanbari (for aromatic resin)
Compositae	***Achillea millefolium* L.**	common yarrow	alkhala (**khela**), shwihiya, qort
	***Anacyclus pyrethrum* (L.) Lag.**	spanish chamomile	tigentast (**igentus**, igentas, gentus, tagendest), **hallala**, arq-echlouh, oud al aattass, aqir qarha
	***Chamaemelum nobile* (L.) All.**	english or roman chamomile	**babunaj rumi**, **babounj**, babunaj, **ghegwan**
	***Artemisia arborescens* (Vaill.) L.**	tree wormwood	chiba (shibat al ajuz), **chajarat Meryem,** chih er-roumi
	***Artemisia herba-alba* Asso**	white wormwood	**chih**, **ifsi,** chih abiad, izri, chih dwida (chih for worms), **chih khorassani**
	Atractylis cancellata L.	common Atractylis	asnnan wado, najma
	Atractylis gummifera Salzm. ex L.	bird-lime	addad, aghfyoun akhfyun, ishkhis
	***Chrysanthemum parthenium* (L.) Bernh.**	feverfew	**uqhuwan**, **l-gahwan**
	***Echinops spinosus* L.**	thorny-headed globe thistle	taskra asekra, **chouk lehmar**, timat, **chouk ajjmal**, lkherchuf
	***Launaea arborescens* (Batt.) Murb.**	arborescent launaea	intrim, îfreskel, iferskil, mmu-lbeyna (**moulbina**), bu chlaba
	***Santolina rosmarinifolia* L.**	holy flax	**ayrar, ouazwaza, tayrart**
	***Senecio vulgaris* L.**	groundsel	**achbat salma**, lachba salma, **chiba salma**, taanana, hiyara
Cyperaceae	*Cyperus longus* L.	galingale	arouk esaad, as-sa'd,tara (tagha), sokait
Ericaceae	*Arbutus unedo* L.	strawberry tree	bakhannou, sasnu, el-lenj, katil abih, metrun, jina, 'unnich (the fruit)
Euphorbiaceae	***Euphorbia helioscopia* L.**	sun spurge	halib assou, mmughî, **oum-lbina**, tafura, tanougha, el-hlibiya, reda'at lebger
	***Euphorbia resinifera* O. Berg**	resin spurge	luban al maghribi, **zgoum (zaggum,** zaqqum), **tikiût**, **ddeghmus,** banan el-ard, **chajart el ferbyun**, ferbyun (for the resin)

Table 1. List of toxic plants used in traditional medicine in the Central Middle Atlas (continued…)

Family	Scientific name	English common name	Moroccan vernacular
Lamiaceae	***Ajuga iva* (L.) Schreb.**	bugleweed	**chandgoura**, tûf tolba
	***Clinopodium nepeta* subsp. *glandulosum* (Req.) Govaerts**	lesser calamint	**menta** (mentha), nebeta (nâbta)
	***Hyssopus officinalis* L.**	hyssop	azoufa yabsa, **zoufa**, souf el-yabes, tefrourd
	***Lavandula pedunculata* subsp. *atlantica* (Braun-Blanq.) Romo**	french lavender	**halhal**, izri, amezzir, **timerza**, **khzama,** muqef rwah, chelchel
	***Marrubium vulgare* L.**	white horehound	merriwa, **merriwut**, **mariouta,** merrou, imourine, ifzi, iffegh
	***Mentha pulegium* L.**	pennyroyal	fliyou dyal lma, **fliyou**, afilgou
	***Ocimum basilicum* L.**	basil	**lahbak**, hbak el-aynin
	Origanum majorana L.	marjoram	merdadouch, merdaquch
	***Origanum vulgare* L.**	oregano	**zaatar** (sahatar, zateur), **izoukenni**, zer **azoui**, azekount, ouaz'ouy, zouchenchen
	Rosmarinus officinalis L.	rosemary	yazir (azir), klil, iklil al-jabal, aklel, ozbi, tamezzerya, barkkela, hachicht lerneb.
	Salvia officinalis L.	common sage	salmiya, (salma, es-salima), al mufassiha (salma al mufassiha), tamejjut
	***Salvia verbenaca* L.**	wild clary	khiyata (kheyata), **keff ejjmel**
	***Teucrium polium* L.**	felty germander	**jaada,** jaydiya **chendgura**, **ayrar, tayrart**, ayn al-hejla
Lauraceae	***Laurus nobilis* L.**	bay laurel	chajrat sidna-Moussa (**wrak Moussa**, aassa Moussa**), er-rand**, el-ghar, chjrate el-ghar, habbet el ghar (for the bay)
Leguminosae	***Astragalus lusitanicus* Lam.**	iberian milk-vetch	fouila (**fwila**)
	Astragalus gummifer Labill.	gum tragacanth milkvetch	ktîrâ
	Trigonella foenum-graecum L.	fenugreek	l-helba, tifidas
Molluginaceae	*Corrigiola telephiifolia* Pourr.	strapwort	sarghina, tasserghint, tawsargine
Nitrariaceae	*Peganum harmala* L.	wild rue	harmel
Pinaceae	*Cedrus atlantica* (Endl.) Manetti ex Carière	Atlas cedar	l-arz, larz, iddil, lblez, berda (for wood), qitran-er-raquiq (le goudron)
Plantaginaceae	***Digitalis mauretanica* (Humbert & Maire ex Emb. & Maire) Iva**ina	common foxglove	addabi, **zhar el-kchatbin**, kamiya
Poaceae	***Arundo donax* L.**	giant cane	**kseb** (l-gçeb), **aghanim**
	***Agropyron repens* (L.) P.BeauV.**	couch grass	**njem** (nedjem, en-najam), **en-njil**, **afar**, **agesmir**

Table 1. List of toxic plants used in traditional medicine in the Central Middle Atlas (continued...)

Family	Scientific name	English common name	Moroccan vernacular
Poeoniaceae	***Paeonia coriacea* Boiss.**	corsican peony	habersis, **fawaniya,ward al-hamir, ward ez-zwani**
Portulacaceae	*Portulaca oleracea* L.	common purslane	rejla (rjila) baqla el-hamqa, baqla- elmubarilca, farfah, agertim, tazelluzt
Ranunculaceae	***Delphinium staphisagria* L.**	stavesacre	**habb r-ras**, zbib ejjbel
Rhamnaceae	*Ziziphus lotus* (L.) Lam.	jujube	sedra, nbeg (for fruits: jujubes), azar, azuggwar, tazuggwart, bazeggur, amezmem
Rosaceae	***Agrimonia eupatoria* L.**	common agrimony	**kabba,** gaiit
	***Crataegus monogyna* Jacq.**	common hawthorn	**admam, buzorulu**, bousorolo, mesnaghten
Rubiaceae	***Rubia peregrina* L.**	wild madder	**fuwa, tarubia**, lhamri, tigmit
Rutaceae	***Ruta montana* (L.) L.**	wild rue	**l-figel, awermi**, iwurmi, awerma, sadab, sudab
Scrophulariaceae	***Verbascum sinuatum* L.**	scallop-leaved mullein	**meslah ndar**, aberdudn-izem; thit yezm, bussir
Solanaceae	***Atropa belladonna* L.**	belladonna	**zbib lidur**, **aadil- wuchchen**, balaydur, al laydur, zbib elkhidus, bûqunini, bûqnina, **tiddilla**
	***Hyoscyamus albus* L.**	white henbane	**sikran**, shikran, **gengit, benj**, **bu narjuf**, bu ranjuf, **betina (lebtina)**, afelehleh, afelezlez, barbar
	***Solanum sodomeum* L.**	apple of Sodom	**hadja** (**lhdej**, hdej, hdija), lim en nçara, mathesha del-hmir, taffah el-ghoul
Taxaceae	*Taxus baccata* L.	common yew	igen (igni), imerwil, adgham, eddahek, dakhch, takhche
Thymelaeaceae	***Daphne gnidium* L.**	flax-leaved daphne	**lezzaz** (alezzaz), elzaz, **methnane**, inif
	Daphne laureola L.	spurge-laurel	walidrar, lili w-adrar, alili w-adrar, addufayla, talidrar
Urticaceae	***Urtica urens* L.**	burning nettle	**harriga (**l-hurrga), thissarkmaz, leariga, tikzinin, tizmekt, imezri, timezrit, tazelekta, tayizint, buqsas, tikzinin u-uccen
Xanthorrhoeaceae	***Asphodelus microcarpus* Salzm. & Viv.**	common Asphodel	**l-berwag, inghri**, ighri, tigri, imeghri, ingri, bliluz, abliluz (floral scape), agellus (for the scape), haydeli, khuntha, taziwt

Pink background: one vernacular; Blue background: two vernaculars; Yellow highlighting: specific vernaculars; **Bold**: shared vernaculars.

The scientific names were proposed according to The Plant List (2020) (http://www.theplantlist.org/)

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco.

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
aadil wuchchen	***Atropa belladonna* L.**	*Atropa*	*Solanaceae*	E
	Atropa baetica Willk.			
	Solanum americanum Mill.	*Solanum*		G
aansal ichkkil/bsal eddib	***Urginea maritima* (L.) Baker**	*Urginea*	*Asparagaceae*	G
	Drimia noctiflora (Batt. & Trab.) Stearn =*Urginea noctifora* Batt. & Trab.	*Drimia*		
admam/buzorulu	***Crataegus monogyna* Jacq.**	*Crataegus*	*Rosaceae*	E
	Crataegus laciniata Steven ex besser			
admam	*Rhamnus lycioides* L.	*Rhamnus*	*Rhamnaceae*	F
achbat salma	***Senecio vulgaris* L.**	*Senecio*	*Compositae*	E
	Senecio leucanthemifolius Poir.			
	Senecio massaicus (Maire) Maire			
agesmir	***Agropyron repens* (L.) P.BeauV.**	*Agropyron*	*Poaceae*	G
	Festuca sp.	*Festuca*		
as-sa'd/tarra (tagha)	***Cyperus longus* L.**	*Cyperus*	*Cyperaceae*	E
	Cyperus rotundus L.			
	Cyperus conglomeratus Rottb.			
athrilal	***Ammi majus* L.**	*Ammi*	*Apiaceae*	G
	Carum ammoides (L.) Benth. & Hook.f. ex Arcang.	Carum		
ayrar/tayrart	***Santolina rosmarinifolia* L.**	*Santolina*	*Compositae*	E
	Santolina africana Jord. & Fourr.			
	Santolina pectinata Cav.			
	***Teucrium polium* L.**	*Teucrium*	*Lamiaceae*	E
	Teucrium campanulatum L.			
	Teucrium fruticans L.			
	Nepeta atlantica Ball.	*Nepeta*		G
azoui	***Origanum vulgare* L.**	*Origanum*	*Lamiaceae*	E
	Origanum compactum Benth.			
	Origanum elongatum (Bonnet) Emb. & Maire			
	Thymus satureioides L.	*Thymus*		G
	Thymus munbyanus Boiss. & Reut.			
	Asparagus albus L.	*Asparagus*	*Asparagaceae*	E
	Asparagus acutifolius L.			

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
azoukni	***Origanum vulgare* L.**	*Origanum*	*Lamiaceae*	**G**
	Thymus saturejoides Coss.	*Thymus*		
	Thymus munbyanus Boiss. & Reut.			
	Thymus zygis L.			
	Thymus leptostachys Ehrh.			
babounj/babunaj rumi	*Chamaemelum nobile* (L.) All.	*Chamaemelum*	*Compositae*	E
	Chamaemelum fuscatum (Brot.) Vasc.			G
	Matricaria chamomilla L.	*Matricaria*		
	Ormenis praecox (Link) Briq. & Cavill	*Ormenis*		
	Cotula coronopifolia L.	*Cotula*		
	Matricaria pubescens (Desf.) Sch. Bip.	*Matricaria*		
	Matricaria chamomilla L.			
	Matricaria aurea Loefl.) Sch.Bip.			
baqs	***Buxus balearica* Lam.**	*Buxus*	*Buxaceae*	E
	Buxus sempervirens L.			
benj	*Conium maculatum* L.	*Conium*	*Apiaceae*	F
	***Hyoscyamus albus* L.**	*Hyoscyamus*	*Solanaceae*	E
	Hyoscyamus niger L.			
bereztam/ajrarkh	***Aristolochia paucinervis* Pomel**	*Aristolochia*	*Aristolochiaceae*	E
	Aristolochia baetica L.			
betina/lebtina	***Hyoscyamus albus* L.**	*Hyoscyamus*	*Solanaceae*	E
	Hyoscyamus muticulis Rech.f. & Edelb			
bouchenaf	***Borago officinalis* L.**	*Borago*	*Boraginaceae*	E
	Borago trabutii Maire			
	Echium plantagineum L.	*Echium*		G
bou-hamdoune	***Borago officinalis* L.**	*Borago*	*Boraginaceae*	G
	Cynoglossum officinale L.	*Cynoglossum*		
bû-hammû	***Brassica nigra* (L.) k.koch**	*Brassica*	*Brassicaceae*	E
	Brassica sp.			
	Diplotaxis harra (Forssk.) Boiss.	*Diplotaxis*		G
	Diplotaxis spp.			
	Sinapis sp.	*Sinapis*		
	Eruca vesicaria (L.) Cav.	*Eruca*		
bûqnina	***Atropa belladonna* L.**	*Atropa*	*Solanaceae*	G
	Solanum americanum Mill.	*Solanum*		

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
bunarjuf	***Hyoscyamus albus* L.**	*Hyoscyamus*	*Solanaceae*	E
	Hyoscyamus niger L.			
chandgoura	***Ajuga iva* (L.) Schreb.**	*Ajuga*	*Lamiaceae*	G
	Teucrium polium L.	*Teucrium*		
chajart el ferbyûn	***Euphorbia resinifera* O.** Berg	*Euphorbia*	*Euphorbiaceae*	E
	Euphorbia officinarum subsp. *echinus* (Hook.f. & Coss.) Vindt			
	Euphorbia officinarum var. *beaumieriana* (Hook.f. & Coss.) Maire			
chajart Meryem	***Artemisia arborescens* (Vaill.) L.**	*Artemisia*	*Compositae*	E
	Artemisia absinthium L.			
	Matricaria chamomilla L.	*Matricaria*		G
	Anacyclus radiatus Loisel.	*Anacyclus*		
cheryat	***Diplotaxis harra* (Forssk.) Boiss.**	*Diplotaxis*	*Brassicaceae*	E
	Diplotaxis sp.			
	Farsetia aegyptia Turra	*Farsetia*		G
	Hirschfeldia incana (L.) Lagr.-Foss.	*Hirschfeldia*		
	Eruca vesicaria (L.) Cav.	*Eruca*		
chiba salma	***Senecio vulgaris* L.**	*Senecio*	*Compositae*	E
	Senecio leucanthemifolius Poir.			
	Senecio massaicus (Maire) Maire			
chibt	***Anethum graveolens* L.**	*Anethum*	*Apiaceae*	G
	Ridolfia segetum (L.) Moris	*Ridolfia*		
chih/ifsi, ifssi	***Artemisia herba-alba* Asso**	*Artemisia*	*Compositae*	E
	Artemisia mesatlantica Maire			
	Artemisia ifranensis J.Didier			
	Artemisia flahaultii Emb. & Maire			
	Artemisia negrei Ouyahya			
	Artemisia atlantica Coss. & Dur. var. maroccana (Coss.)			
chih khorassani	***Artemisia herba-alba* Asso**	*Artemisia*	*Compositae*	E
	Artemisia cina Berg ex Poljakov			
chiba/chibat al ajuz)	***Artemisia arborescens* (Vaill.)L.**	*Artemisia*	*Compositae*	E
	Artemisia absinthium L.			
chouk lehmar	***Echinops spinosus* L.**	*Echinops*	*Compositae*	G
	Silybum marianum (L.) Gaertn.	*Silybum*		

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
chouk ajjmal	***Echinops spinosus* L.**	*Echinops*	*Compositae*	E
	Echinops sphaerocephalus L.			
	Silybum sp.	*Silybum*		G
	Carduus sp.	*Carduus*		
	Onopordon sp.	*Onopordon*		
ddeghmous	***Euphorbia resinifera* O. Berg**	*Euphorbia*	*Euphorbiaceae*	E
	Euphorbia officinarum subsp. *echinus* (Hook.f. & Coss.) Vindt			
	Caralluma europaea (Guss.) N.E.Br.	*Caralluma*	*Apocynaceae*	F
fawaniya/ward al-hamir	***Paeonia coriacea* Boiss.**	*Paeonia*	*Paeoniaceae*	E
	Paeonia officinalis L.			
figel, awermi	***Ruta montana* L.**	*Ruta*	*Rutaceae*	E
	Ruta chalepensis L.			
	Ruta tuberculata Forssk.			
	Ruta graveolens L.			
	Haplophyllum vermiculare Hand.-Mazz.	*Haplophyllum*		G
fliyou	***Mentha pulegium* L.**	*Mentha*	*Lamiaceae*	G
	Ziziphora hispanica L.	*Ziziphora*		
	Satureja granatensis (Boiss. & Reut.) Sennen & Mauricio = *Clinopodium alpinum* (L.) Kuntze.	*Clinopodium*		
fuwa/tarûbia	***Rubia peregrina* L.**	*Rubia*	*Rubiaceae*	E
	Rubia tinctorum L.			
fwila	***Astragalus lusitanicus* Lam.**	*Astragalus*	*Leguminosae*	E
	Astragalus gombo gombo Bunge			
	Crotalaria saharae Coss.	*Crotalaria*		G
	Crotalaria vialettei Batt.			
gengit	***Hyoscyamus albus* L.**	*Hyoscyamus*	*Solanaceae*	E
	Hyoscyamus muticus L.			
	Hyoscyamus niger L.			
ghegwan (l-gahwan)	*Chamaemelum nobile* **(L.) All.**	*Chamaemelum*	*Compositae*	G
	***Chrysanthemum parthenium* (L.) Bernh.**	*Chrysanthemum*		E
	Chrysanthemum coronarium L.			
	Chrysanthemum segetum L.			
habb r-ras	***Delphinium staphisagria* L.**	*Delphinium*	*Ranunculaceae*	E
	Delphinium pubescence DC.			

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
hadja/lhdej	***Solanum sodomeum* L.**	*Solanum*	*Solanaceae*	F
	Citrullus colocynthis (L.) Schrad.	*Citrullus*	*Cucurbitaceae*	
halhal	***Lavandula pedunculata* subsp. *atlantica* (Braun-Blanq.) Romo**	*Lavandula*	*Lamiaceae*	E
	Lavandula dentata L.			
	Lavandula stoechas L.			
hallala	***Anacyclus pyrethrum* (L.) Lag.**	*Anacyclus*	*Compositae*	G
	Glebionis coronaria (L.) Cass. ex Spach	*Glebionis*		
	Cladanthus mixtus (L.) Oberpr. & Vogt	*Cladanthus*		
	Bellis sylvestris Cirillo	*Bellis*		
	Bellis annua L.			
hamrat erras	***Vaccaria hispanica* (Mill.) Rauschert**	*Vaccaria*	*Caryophyllaceae*	F
	Calendula sp.	*Calendula*	*Compositae*	
	Perralderia coronopifolia Coss.	*Perralderia*	*Compositae*	
	Cuscuta sp.	*Cuscuta*	*Cuscutaceae*	
harcha (al horraycha)	***Borago officinalis* L.**	*Borago*	*Boraginaceae*	E
	Borago trabutii Maire			
	Echium italicum L.	*Echium*		G
	Echium angustifolium Mill.			
	Echium humile Desf.			
	Echium horridum Batt.			
	Anchusa azurea Mill.	*Anchusa*		
harriga	***Urtica urens* L.**	*Urtica*	*Urticaceae*	E
	Urtica pilulifera L.			
	Urtica membranacea Poir. ex Savigny			
	Urtica dioica L.			
hebbaliya	***Heliotropium europaeum* L.**	*Heliotropium*	*Boraginaceae*	E
	Heliotropium supinum L.			
	Heliotropium crispum Desf.			
	Heliotropium crispum Desf.			
	Heliotropium bacciferum Forssk.			
	Lotus jolyi Batt.	*Lotus*	*Leguminosae*	F
	Lotus glinoides Delile			

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
igentus	***Anacyclus pyrethrum* (L.) Lag.**	*Anacyclus*	*Compositae*	G
	Chrysanthemum coronarium L.	*Chrysanthemum*		
jaâda	***Teucrium polium* L.**	*Teucrium*	*Lamiaceae*	E
	Teucrium decipiens Coss. & Balansa			
	Lavandula dentata L.	*Lavandula*		G
	Ballota deserti (Noë) Jury, Rejdali & A.J.K.Griffiths	*Ballota*		
	Daucus carota subsp. Sativus (Hoffm.) Arcang.	*Daucus*	*Apiaceae*	F
kabba	***Agrimonia eupatoria* L.**	*Agrimonia*	*Rosaceae*	F
	Andrachne telephioides L.	*Andrachne*	*Euphorbiaceae*	
kamoun el-habchi	***Anethum graveolens* L.**	*Anethum*	*Apiaceae*	G
	Trachyspermum ammi (L.) Sprague	*Carum*		
	Ptychotis verticillata Duby	*Ptychotis*		
keff ejjmel	***Salvia verbenaca* L.**	*Salvia*	*Lamiaceae*	E
	Salvia aegyptiaca L.			
kerkaz	***Diplotaxis* harra (Forssk.) Boiss.**	*Diplotaxis*	*Brassicaceae*	G
	Sinapis sp.	*Sinapis*		
	***Brassica nigra* (L.) K.koch**	*Brassica*		
	Eruca sp.	*Eruca*		
	Raphamus sp.	*Raphamus*		
	Erucastum sp.	*Erucastrum*		
khela	***Ammi visnaga* (L.) Lam.**	*Ammi*	*Apiaceae*	F
	***Achillea millefolium* L.**	*Achillea*	*Compositae*	
khzama	***Lavandula pedunculata* subsp. *Atlántica* (Braun-Blanq.) Romo**	*Lavandula*	*Lamiaceae*	E
	Lavandula stoechas L.			
	Lavandula angustifolia subsp. *pyrenaica* (DC.) Guinea			
khuniza	***Heliotropium europaeum* L.**	*Heliotropium*	*Boraginaceae*	E
	Heliotropium bacciferum Forssk.			
	Heliotropium supinum L.			
	Heliotropium crispum Desf.			
	Heliotropium crispum Desf.			
kseb/l-gseb/ aghanim	***Arundo donax* L.**	*Arundo*	*Poaceae*	G
	Phragmites australis (Cav.) Trin. ex Steud.	*Phragmites*		

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
lahbak	***Ocimum basilicum* L.**	*Ocimum*	*Lamiaceae*	E
	Ocimum sp.			
	Ocimum minimum L.			
l-berwag/inghri	***Asphodelus microcarpus* Salzm. & Viv.**	*Asphodelus*	*Xanthorrhoeaceae*	E
	Asphodelus tenuifolius Cav.			
	Asphodelus fistulosus L			
lebtem/iij/igg	***Pistacia atlantica* Dsf.**	*Pistacia*	*Anacardiaceae*	E
	Pistacia therebinthus Scop.			
lezzaz	***Daphne gnidium* L.**	*Daphne*	*Thymeleaceae*	G
	Thymelaea microphylla Meisn.	*Thymelaea*		
l-harra	***Diplotaxis harra* (Forssk.) Boiss.**	*Diplotaxis*	*Brassicaceae*	E
	Diplotaxis acris (Forssk.) Boiss.			
	Diplotaxis duveyrierana Coss.			
	Diplotaxis pendula (Desf.) DC.			
	Eruca vesicaria (L.) Cav.	*Eruca*		G
	Lepidium lepidioides (Coss. & Durieu) Al-Shehbaz	*Lepidium*		
	Lepidium coronopus (L.) Al-Shehbaz			
lkelikha	***Ferula communis* L.**	*Ferula*	*Apiaceae*	G
	Cachrys libanotis L.	*Cachrys*		
lissan attur/lisan l-bger	***Borago officinalis* L.**	*Borago*	*Boraginaceae*	G
	Echium sp.	*Echium*		
	Anchusa sp.	*Anchusa*		
mariouta (merriwût)	***Marrubium vulgare* L.**	*Marrubium*	*Lamiaceae*	E
	Marrubium echinatum Ball			
	Marrubium ayardii Maire			
	Marrubium alysson L.			
	Marrubium supinum L.			
menta	***Clinopodium nepeta* subsp. *glandulosum* (Req.) Govaerts**	*Clinopodium*	*Lamiaceae*	E
	Clinopodium grandiflorum subsp. *baborense* (Batt.) Govaerts			
meslah ndar	***Verbascum sinuatum* L.**	*Verbascum*	*Scrophulariaceae*	E
	Verbascum dentifolium Delile			
	Verbascum thapsum St.-Lag.			

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
methnane	***Daphne gnidium* L.**	*Daphne*	*Thymeliaceae*	G
	Thymelaea sp	*Thymelia*		
mkhinza	***Chenopodium ambrosioides* L.**	*Chenopodium*	*Amaranthaceae*	G
	Amaranthus blitoides S. Watson	*Amaranthus*		
	Cleome arabica L. (in the Saharan region of Draa, Morocco)	*Cleome*	*Cleomaceae* (*Capparaceae*)	F
moulbina	***Launaea arborescens* (Batt.) Murb.**	*Launaea*	*Compositae*	G
	Lactuca virosa Habl.	*Lactusa*		
nafaâ	*Foeniculum vulgare* Mill.	*Foeniculum*	*Apiaceae*	E
	Foeniculum dulce DC.			
njem/en-njîl/afar	***Agropyron repens* (L.) P.Beauv.**	*Agropyrum*	*Poaceae*	E
	Agropyron occidentale (Scribn.) Scribn.			
	Cynodon dactylon (L.) Pers.	*Cynodon*		G
oum-lbina	***Euphorbia helioscopia* L.**	*Euphorbia*	*Euphorbiaceae*	E
	Euphorbia falcata L.			
	Euphorbia retusa Forssk.			
	Euphorbia calyptrata Coss. & Kralik			
	Euphorbia guyoniana Boiss. & Reut.			
	Euphorbia granulata Forssk.			
	Euphorbia nicaeensis All.			
ouazwaza	***Santolina rosmarinifolia* L.**	*Santolina*	*Compositae*	G
	Cotula anthemoides Lour.	*Cotula*		
	Aaronsohnia pubescens (Desf.) K.Bremer & Humphries	*Aaronsohnia*		
sikran	*Conium maculatum* L.	*Conium*	*Apiaceae*	F
	***Heliotropium europaeum* L**	*Heliotropium*	*Borraginaceae*	
	Withania somnifera (L.) Dunal	*Withania*	*Solanaceae*	G
	***Hyoscyamus albus* L.**	*Hyoscyamus*		E
	Hyoscyamus niger L.			
	Hyoscyamus muticus L.			
tiddilla	***Atropa belladonna* L.**	*Atropa*	*Solanaceae*	G
	Datura stramonium L.	*Datura*		
tighighest	***Vaccaria hispanica* (Mill.) Rauschert**	*Vaccaria*	*Caryophyllaceae*	G
	Saponaria glutinosa M.Bieb.	*Saponaria*		
	Silene sp.	*Silene*		

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
tikiout (tikiut)	***Euphorbia resinifera* O. Berg.**	*Euphorbia*	*Euphorbiaceae*	E
	Euphorbia officinarum subsp. *echinus* (Hook.f. & Coss.) Vindt			
timerza	***Lavandula pedunculata* subsp. *atlantica* (Braun-Blanq.) Romo**	*Lavandula*	*Lamiaceae*	E
	Lavandula coronopifolia Poir.			
touzzalt	***Cistus ladanifer* L.**	*Cistus*	*Cistaceae*	E
	Cistus albidus L.			
	Cistus salviifolius L.			
	Cistus monspeliensis L.			
uqhuwan	***Chrysanthemum parthenium* (L.) Bernh.** = *Tanacetum parthenium* (L.) Sch.Bip.	*Chrysanthemum*	*Compositae*	G
	Glebionis coronaria (L.) Cass. ex Spach = *Chrysanthemum coronarium* L.	*Glebionis*		
	Endopappus macrocarpus (Coss. & Kralik ex Batt. & Trabut) Sch. Bip.	*Endopappus*		
	Matricaria chamomilla L. = *Matricaria recutita* L.	*Matricaria*		
	Anacyclus radiatus Loisel.	*Anacyclus*		
ward ezzwani	*Alcea rosea* L.	*Alcea*	*Malvaceae*	F
	***Paeonia mascula* (L.) Mill.**	*Paeonia*	*Paeoniaceae*	E
	Paeonia officinalis L.			
wrak Moussa, er-rand/el-ghar	***Laurus nobilis* L.**	*Laurus*	*Lauraceae*	E
	Laurus azorica (Seub.) Franco			
zaatar	***Origanum vulgare* L.**	*Origanum*	*Lamiaceae*	E
	Origanum compactum Benth.			
	Origanum elongatum (Bonnet) Emb. & Maire			
	Origanum grosii Pau & Font Quer			
	Thymus pallescens Noë	*Thymus*		G
	Thymus lanceolatus Desf.			
	Thymus capitatus. (L.) Hoffmanns. & Link			
zaggûm (zgoum)	***Euphorbia resinifera* O. Berg.**	*Euphorbia*	*Euphorbiaceae*	E
	Euphorbia beaumieriana Hook.f. & Coss.			
	Euphorbia officinarum subsp. *echinus* (Hook.f. & Coss.) Vindt			
	Balanites aegyptiaca (L.) Delile	*Balanites*	*Zygophyllaceae*	F

Table 2. The similarity of vernacular names between the plants identified in the present study and other aromatic and medicinal plants in Morocco (continued...)

Vernacular name	Species with the same vernacular name	Genus	Family	Level of difference
zhar el-kchatbin	***Digitalis mauretanica* (Humbert & Maire ex Emb. & Maire) Iva**ina	Digitalis	*Scrophulariaceae*	E
	Digitalis atlantica Pomel			
	Digitalis obscura L.			
zbib lidur	***Atropa belladonna* L.**	*Atropa*	*Solanaceae*	E
	Atropa baetica Willk.			
zoufa	***Hyssopus officinalis* L.**	*Hyssopus*	*Lamiaceae*	E
	Hyssopus aristatus (Godr.) Nyman			

E: The vernacular names are common between species of the same genus and therefore of the same family.
G: The vernacular names are common between species of different genera but belonging to the same family.
E & G: The vernacular names are common between species of the same genus and others of different genera but in all cases the family is the same.
E & F: The vernacular names are common between species of the same genus, and to species of different families and therefore the genera are different.
F: The vernacular names are common between species of different families and therefore the genera are different.
E/G/F: Vernacular names are common between species of the same genus, of different genera but belonging to the same family and species of different families.
G/F: Vernacular names are common between species of different genera but belonging to the same family and species of different genera and families.
The scientific names were proposed according to The Plant List (2020) (http://www.theplantlist.org/)

multitude of vernaculars, do not share them with other plants; there are many examples such as *Pistacia lentiscus* L., *Arbutus unedo* L., and *Rosmarinus officinalis* L.

Moreover, the French vernaculars, often generic, include many species, except for monospecific genera (case in Morocco of the genera *Cedrus*, *Taxus*, *Argania*, and others). For example, in Morocco, the oregano "zaatar" designates *Origanum vulgare* L., *Origanum compactum* Benth (zaatar tadlawi: Tadla Origanum); *Origanum elongatum* (Bonnet) Emb. & Maire (zaatar rifi: Rif Oregano) and *Origanum grosii* Pau & Font Quer.

Similarly, "calamint" designates a dozen species of perennial plants from the *Lamiaceae* family; this vernacular is from the Latin *Calamintha*, itself derived from the Greek *kalámínthos,* and it refers to a kind of mint. However, taxonomic investigation revealed that the calamints belong to the genera *Acinos* and *Calamintha*, which have been then grouped in the genus *Clinopodium*. Thus, we can distinguich the calamint of the Alps - *Acinos alpinus* (L.) Moench or *Clinopodium alpinum* (L.) Kuntze, 1891, the calamint of the fields - *Acinos arvensis* (Lam.) Dandy or *Clinopodium acinos* (L.) Kuntze, 1891, the calamint of Corsica - *Acinos corsicus* (Pers.) Getliffe or *Clinopodium corsicum* (Pers.) Govaerts, 1999, the nepeta calamint - *Calamintha nepeta* (L.) Savi or *Clinopodium nepeta* (L.) Kuntze, 1891 and the small calamint- *Calamintha officinalis* Moench or *Clinopodium nepeta* (L.) Kuntze.

Also, both with oregano and calamint, adjectives or descriptors are used to specify and differentiate their respective species. So, for oregano, a species is related to the Rif region, whereas another is attached to the region of Tadla. For calamint, there is an opposition between the species from the Alps and Corsica.

Moreover, in the study area as well as elsewhere in Morocco, four species of the genus *Urtica* from the *Urticaceae* family are grouped under the name “harriga” relating to nettle. These are *Urtica membranacea* Poir., *Urtica urens* L., *Urtica pilulifera* L. and *Urtica dioica* L. This uniqueness of the vernacular name is due to their common property, namely the presence of stinging hairs on the whole plant. It is also the presence of hairs, in addition to the triangular shape of the leaves, that gave the same vernacular "harriga" to *Lamium album* L. "white nettle" belonging to the *Lamiaceae* family, except that the plant does not sting. *Mercurialis annua L.* and *Mercurialis perennis* L. from the *Euphorbiaceae* family are also called "harriga melssa" or smooth nettle.

In the same sense, the vernacular name "chih" which is a generic name for several sagebrushes in

the Arab world (Bellakhdar, 1997), corresponds in Morocco to several species of the genus *Artemisia*, such as *Artemisia herba-alba* Asso., *Artemisia mesatlantica* Maire, *Artemisia ifranensis* J.Didier, *Artemisia flahaultii* Emb. & Maire, *Artemisia negrei* Ouyahya and *Artemisia atlantica* Coss. & Dur. var. *maroccana* (Coss.).

For its part, the vernacular name "jaada" designates three species belonging to three different genera of the same family of *Lamiaceae*; they are respectively *Teucrium pollium* L., *Lavandula dentata* L. and *Marrubium deserti* Denoe.

Finally, the similarity of vernacular names can take on greater dimensions through extending to species from different families; for example, the name "sikran" is used to designate both *Conium maculatum* L. and *Hyoscyamus* sp. who belong respectively to the *Apiaceae* and *Solanaceae* families. Moreover, all plants that produce delirium or drunkenness (sekra) such as thornapples, henbanes, heliotropes, withania, and ryegrass are named "sikran".

Another example is that of "zaggum" which corresponds to three species belonging to the same genus *Euphorbia* and to the *Euphorbiaceae* family; there are *Euphorbia resinifera* Berg., *Euphorbia beaumierana* Hook.f. & Coss, *Euphorbia echinus* Hook.f. & Coss. and also, by the species *Balanites aegyptiaca* (L.) Del. from the *Zygophyllaceae* family. These plants are thorny and proverbial for their bitterness, which may be why they have the same popular name (Bellakhder, 1997).

This similarity of names is not without consequences; indeed, it could be the cause of the ineffectiveness of some medicinal recipes, or even the toxicity of others, especially as plants are often recommended orally on the basis of their vernacular name. There is already a variation in the chemical composition both qualitatively and quantitatively between edaphic or climatic races of the same species; so, this will surely be amplified between different species (Zougagh et al., 2019).

In 1992, in Belgium, the confusion in a slimming preparation between two Chinese plants with very similar vernacular names, *Stephania tetrandra* S. Moore (hanfangji) with medicinal virtues and *Aristolochia fangchi* YC Wu ex LD Chou & SM Wang (guangfangchi), a very toxic species, caused severe nephropathy and sometimes ureteric cancer to many consumers; in fact, aristolochic acid, a bioactive molecule present in *Aristolochia fangchi* Y.C Wu ex L.D Chou & S.M Wang is a nephrotoxic and carcinogenic agent (Martinez et al., 2002).

In the study area, the different parts of nettles, especially *Urtica urens* L. are indicated in traditional therapy. Their local use is mainly related to their use against rheumatism, eczema, allergic, rheumatoid rhinitis, and the roots are used to treat benign prostate hyperplasia (Farag et al., 2013); whereas, white nettle *Lamium album* L. is used in cases of mild bleeding, diarrhea, anemia, cystitis, painful periods and bronchitis. Therefore, the confusion between these two species leads to the ineffectiveness of the therapeutic treatment. *Balanites aegyptiaca* (L.) Del, commonly known as "zaggum" has food and medicinal uses; while its bark cures tonsillitis, bronchitis, and various lung diseases, the leaves are used to prepare sauces for tooth decay prevention are recommended for the treatment of goiter (Bellakhder, 1997). However, if somebody refers only to the vernacular name, there is a risk to use for these purposes *Euphorbia resinifera* O. Berg., which is not food and whose therapeutic virtues are completely different. Everywhere in Morocco, *Euphorbia resinifera* O. Berg has an external use; its resin is used to treat rheumatism and dental pain, and it is applied as a repellent against poisonous stings (Bellakhder, 1997). The plant, the fresh latex, and the resin are harmful products due to the presence of diterpene esters; the latex is a powerful and dangerous purgative, and the resin is an abortifacient (Bellakhder, 1997). In other Moroccan regions, *E. resinifera* O. Berg. is named "daghmouss"; this vernacular is shared with *Caralluma europaea* (Guss.) N.E. Br, an abundant species in the study region, belongs to the *Apocynaceae* family and used to treat urogenital diseases.

Nevertheless, in many other cases, the vernaculars are very precise; for example, in the lavenders group, *Lavandula pedunculata* (Mill) cav., *Lavandula*

stoechas L. and *Lavandula atlantica* (Br.-Bl.) Br.-Bl. & Maire have the same vernacular name "lhalhal"; that is very well-founded from a systematic point of view, as these three taxa remain very affine and are sometimes considered just subspecies of *Lavandula stoechas* L.

On the other hand, the species *Lavandula maroccana* Murb., *Lavandula dentata* L., and *Lavandula multifida* L., which are not affine with *Lavandula stoechas* L., have their own vernacular names, respectively, timzouria, halhal marakchiya and kohyla (Bachiri et al., 2015).

Confusion during harvesting

In addition to the risks of confusion between plants having common names, other errors may occur during harvesting, when non-specialists collect species. In fact, plant identification is not always easy, especially in certain families, such as the *Apiaceae,* which is rich in medicinal or edible species and in toxic plants that are difficult to distinguish (Dolivo, 2003).

In the Eastern Pyrenees, a man died after consuming the leaves of the *Aconitum napellus* subsp. *napellus* L. belonging to the *Ranunculaceae* family, instead of *Molopospermum peloponnesiacum* (L.) W.D.J. Koch belonging to the *Apiaceae* family. *A. napellus* is a very toxic plant called vegetal arsenic as it is very rich in powerful alkaloids such as aconitine. At the vegetative stage, the two plants are easily confused, and only the appearance of the typical purplish-blue flowers in the shape of a Jupiter's helmet or a monk's helmet allows the distinction of aconite (Sinno-Tellier, 2018). Similarly, in Switzerland, during 2002, a person died after eating the leaves of *Colchicum autumnale* L. "autumn colchicum", a *Cochicaceae* that he confused with leaves of *Allium ursinum* L. "wild garlic" belonging to the *Amaryllidaceae* family (Dolivo, 2003).

In our study, the list of the species presented in Table 1 is not exempt from cases of confusion; these are generally due to the similarities between the plants' ports or some of their specific parts, such as the inflorescence fruit and leaves (Table 3).

Atractylis gummifera Salzm. ex L. is a poisonous species that can be easily confused either with certain edible plants (the edible parts are stems or receptacle) such as *Carlina acaulis* L. and *Cynara humilis* L. belonging to the same family of *Compositae*, or with medicinal plants such as *Centaurea chamaerhaponticum* Ball. and *Scolymus hispanicus* L. also from the *Compositae* family (Fig. 2). The consumption of *Atractylis gummifera* Salzm. ex L. can induce inhibition of oxidative phosphorylation and the Krebs cycle (Daniele et al., 2005), digestive disorders (Georgiou et al., 1988), and multivisceral disorders (Hamouda et al., 2004) because of its chemical composition containing mitochondrial poisons, notably diterpenic heterosides such as atractylosides, carboxyatractylosides or gummiferin, parquine and carboxiparquine (Skalli et al., 2002; Hammiche et al., 2013). According to the Moroccan Poison Control and Pharmacovigilance Center, there were 240 cases of poisoning by *Atractylis gummifera* Salzm. ex L. during the period 1981-2004 due to its direct use for therapeutic purposes or its confusion with other plants (Mouaffak et al., 2013).

Also, the leaves of *Taxus bacata* L. may be confused with those of *Abies* sp. because of their resemblance (Fig. 3); in this case, the intoxication is unavoidable due to the significant toxicity of the leaves of *Taxus bacata* L. containing taxine A and B (Sinn, 1991; Panzeri et al., 2010), which cause digestive, neurological and cardiac disorders (Flesch, 2005).

Furthermore, the very poisonous bacciform fruits of *Atropa belladonna* L. "belladonna" can be confused with those of *Vaccinium myrtillus* L. "blueberry" used in food and therapy (Fig. 4). The five starry-lobed calyces surrounding the fruit is a characteristic of *Atropa belladonna* L. (Dolivo, 2003). The intoxication causes vomiting, convulsions, coma, and respiratory depression (Flesch, 2012) due to a high content of alkaloids in *A. belladonna* L., such as atropine, L-hyoscyamine, and scopolamine (Goullé et al., 2004). Fruit confusion may also occur between *Sambucus nigra* L. and *Sambucus ebulus* L., as both species have blackberries (Fig. 5).

Table 3. Examples of cases of confusion between plants during harvesting.

Species considered	Possible confusion	Parts confused	Fig.
Atractylis gummifera Salzm. ex L.	*Carlina acaulis* L., *Centaurea chamaerhaponticum* Ball., *Scolymus hispanicus* L. and *Cynara humilis* L.	Vegetative apparatus	2
Taxus baccata L.	*Abies pinsapo* subsp. *marocana* (Trab.) Emb. & Maire	Leaves	3
Atropa belladonna L.	*Vaccinium myrtillus* L.	Fruit	4
	Solanum nigrum L.	Fruit/Vegetative apparatus	
Sambucus nigra L.	*Sambucus ebulus* L.	Fruit	5
Euphorbia resinifera O.Berg.	*Caralluma europaea* (Guss.) N.EBr., *Euphorbia officinarum* subsp. *echinus* (Hook.f. & Coss.) Vindt	Vegetative apparatus	6
Urtica urens L.	*Mercurialis annua* L., *Lamium album* L.	Leaves	7
Ammi majus L.	*Ammi visnaga* (L.) Lam.	Inflorescence	8
Chrysanthemum parthenium (L.) Bernh. = *Tanacetum parthenium* (L.) Sch.Bip.	*Matricaria chamomilla* L. = *Matricaria recutita* L.	Inflorescence	9

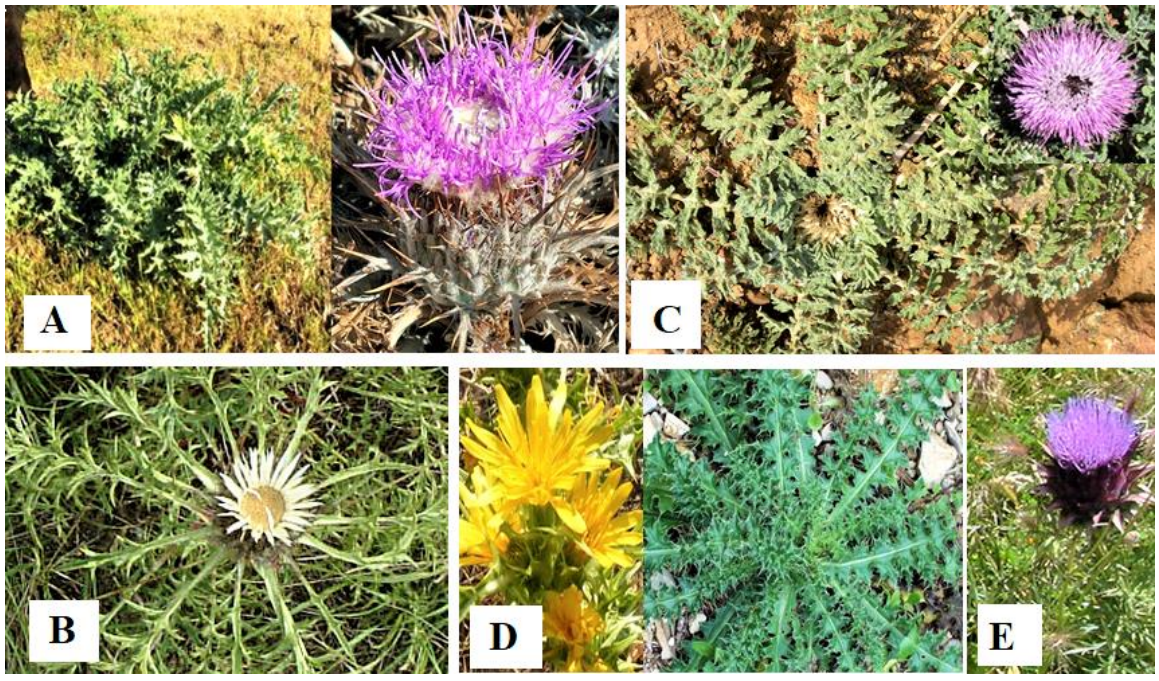

Figure 2. (**A**) *Atractylis gummifera* Salzm. ex L.; (**B**) *Carlina acaulis* L.; (**C**) *Centaurea chamaerhaponticum* Ball.; (**D**) *Scolymus hispanicus* L.; (**E**) *Cynara humilis* L.

Image source: Photo taken by Najem M, August 2018.

Figure 3. (**A**) *Taxus baccata* L.; (**B**) *Abies pinsapo* subsp. *marocana* (Trab) Emb & Maire.

Image source: Photo taken by Najem M, July 2018.

Figure 4. (**A**) *Atropa belladonna* L.; (**B**) *Vaccinium myrtillus* L.

Image source: Photo taken by Najem M, **(A)** August 2018, **(B)** May 2019.

Figure 5. (**A**) *Sambucus nigra* L.; (**B**) *Sambucus ebulus* L.

Image source: Photo taken by Najem M, August 2018.

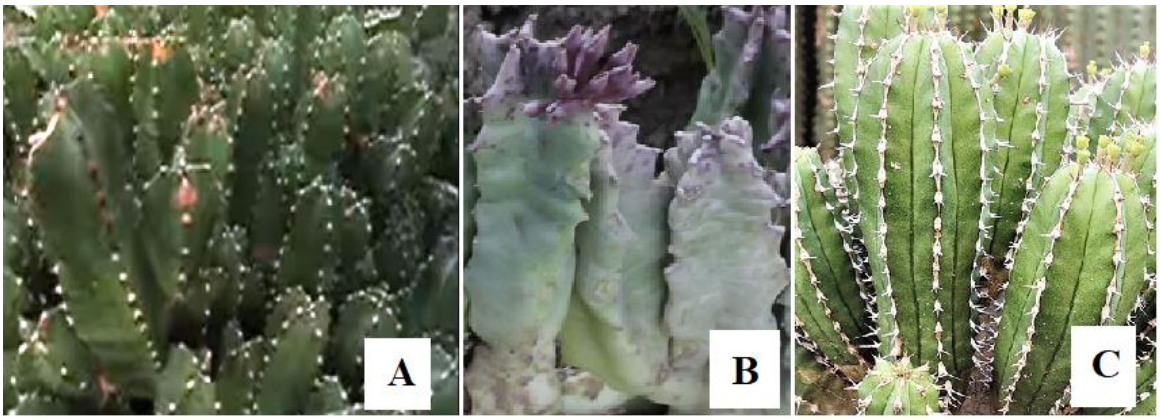

Figure 6: (**A**) *Euphorbia resinifera* O.Berg. (**B**) *Caralluma europaea* (Guss.) N.EBr. (**C**) *Euphorbia officinarum* subsp. *echinus* (Hook.f. & Coss.) Vindt.

Image source: Photo taken by Najem M, May 2019.

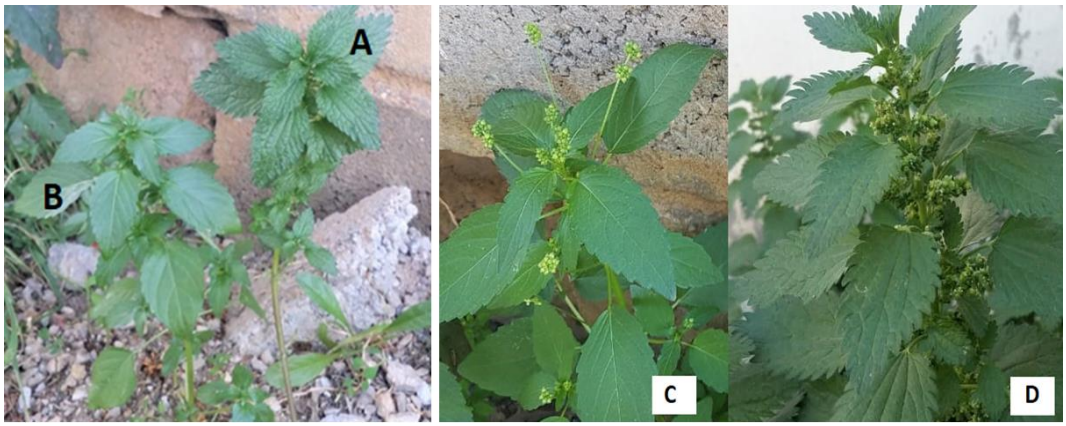

Figure 7. (**A**) *Urtica urens* L. before flowering; (**B**) *Mercurialis annua* L. before flowering (Guss.); (**C**) Flowering *Mercurialis annua* L; (**D**) Flowering *Urtica urens* L.

Image source: Photo taken by Najem M, February 2019.

Figure 8. (**A**) *Ammi visnaga* (L.) Lam.; (**B**) *Ammi majus* L.

Image source: Photo taken by Najem M, June 2019.

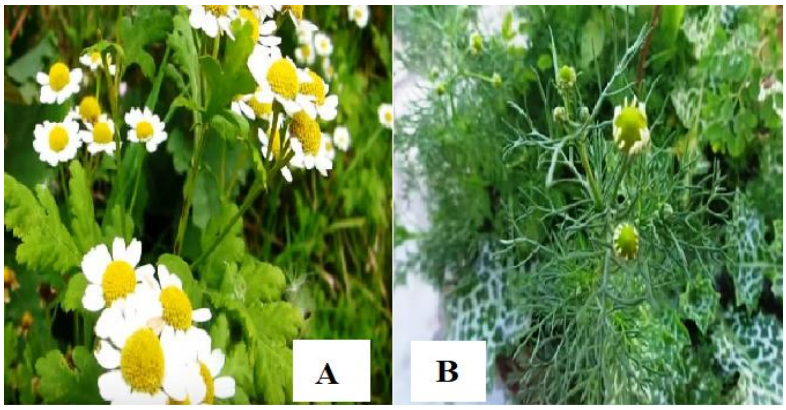

Figure 9. (**A**) *Chrysanthemum parthenium* (L.) Bernh.; (**B**) *Matricaria chamomilla* L.
Image source: Photo taken by Najem M, April 2019.

It is also possible to confuse *Euphorbia resinifera O.*Berg. widely used for the treatment of cysts, with *Euphorbia officinarum* subsp. *echinus* (Hook.f. & Coss.) Vindt and with *Caralluma europaea* (Guss.) N.EBr. belonging to the *Apocynaceae* family (Fig. 6). This confusion is due to their morphological similarity and their same common name "daghmouss".

Finally, the occupation of similar biotopes in addition to the morphological resemblance promotes confusion between *Urtica urens* L. and *Mercurialis perennis* L. belonging respectively to the *Urticaceae* and *Euphorbiaceae* families (Fig. 7) as well as between *Ammi majus* L. and *Ammi visnaga* (L.) Lam. F from the *Apiaceae* family (Fig. 8) and between *Chrysanthemum parthenium* (L.) Bernh. and *Matricaria chamomilla* L. from the *Compositae* family (Fig. 9).

In addition, it is fundamental to know precisely the plant to be used in order to avoid harvesting rare or very rare taxa; unfortunately, there are many inaccuracies about vernacular names and their corresponding scientific names (Fennane and Rejdali, 2016) and very rare and endemic species may disappear irreversibly. So, when considering oregano, it appears that *Origanum vulgare* L., *Origanum grosii* Pau & Font Quer, and *Origanum elongatum* (Bonnet) Emb. & Maire are strongly exploited; while the first species is widespread in Morocco, the two others are endemic and located respectively in the Chaouen region and in Rif, Tazekka and Bou Iblane (Belakhder, 1997). The example of "chih", usually corresponding to *Artemisia herba-alba* (sensu lato) is also significant; indeed, in Morocco, at least five species among which *Artemisia mesatlantica* Maire is an endemic share this denomination; however, all of them are widely exploited without any special precaution to the endemic one (Fennane and Rejdali, 2016).

Limitation of the study

This study was undertaken only in a part of Morocco (central Middle Atlas); it would be interesting to extend it to other Moroccan regions.

Also, during the present study, there were some difficulties, especially with the language; as most of the survey participants are Berber, the help of interpreters was essential. Similarly, older people needed more time than younger ones to become confident before delivering information about herbal remedies.

Otherwise, the collection of voucher specimens was not an easy issue, given the geographical location of the study area; the field is not always a safe environment. Also, seasonal variations were a determining factor in the collection of these specimens.

CONCLUSIONS

In the present work, we have tried to highlight the richness, the diversity, and the originality of the popular nomenclature of toxic plants used in herbal medicine in the central Middle Atlas region. It appears that there are several risks related to the multitude of vernaculars attributed to a given species as well as to the attribution of the same ver-

nacular to different species having different phytochemical profiles, virtues, and uses. The consequences of confusion are serious, especially when the interest in herbalism or the practice of phytotherapy for some people is justified only by a pure material need without concern for the health of the population.

However, it should be noted that our objective is neither to discuss the effectiveness of medicinal plants nor to pronounce their harmlessness. We aim essentially to draw attention that the medicinal plant sector must be regulated and the actors of herbalism and traditional phytotherapy must be competent and very vigilant to avoid any confusion between plants and the inherent risks of toxicity. In all cases, whether the purpose is culinary, cosmetic, medicinal, or other, mastering the identification of plants is a key step in its success. Also, a charter regulating the collection and medicinal plants' use is imperative to avoid any risk of intoxication.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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AUTHOR CONTRIBUTION:

Contribution	Najem M	Nassiri L	Ibijbijen J
Concepts or ideas	x	x	
Design	x	x	
Definition of intellectual content	x	x	
Literature search	x	x	
Experimental studies	x	x	
Data acquisition	x	x	
Data analysis	x	x	
Statistical analysis	x	x	
Manuscript preparation	x	x	x
Manuscript editing	x	x	x
Manuscript review	x	x	x

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Appendix 1. Questionnaire sheets.

1- Code	
2- Date	

3- Municipality

◯ 1. Azrou; ◯ 2. El Hajeb; ◯ 3. Ifrane; ◯ 4. Khenifra; ◯ 5. Timehdit; ◯ 6. Mrirt

4- Age

5- Profession

◯ 1. Druggist; ◯ 2. Herbalist; ◯ 3. Traditional healers

6- Gender

◯ 1. Female; ◯ 2. male

7- Locality

◯ 1. Nomadic; ◯ 2. City; ◯ 3. Douar; ◯ 4. Village

8- Level of education

◯ 1. Illiterate; ◯ 2. Primary; ◯ 3. Secondary; ◯ 4. University

9- Family

10- Genus

11- Species

12- Arabic vernacular name

13- French vernacular name

14- Tamazight vernacular name

15- Type

◯ 1. Cultivated; ◯ 2. Wild
You can check multiple boxes

16- Use

◯1. Therapeutic; ◯ 2. Cosmetic; ◯ 3. Other
You can check multiple boxes

17- State of the plant

◯ 1. Fresh; ◯ 2. Dried
You can check multiple boxes

18- Used part

◯ 1. Leaf; ◯ 2. Fruit; ◯ 3. Root; ◯ 4. Stem; ◯ 5. Seeds; ◯ 6. Resin; ◯ 7. Flowers; ◯ 8. Capsules; ◯ 9. Others
You can check multiple boxes

19- Method of preparation

◯ 1. Decoction; ◯ 2. Infusion; ◯ 3. Maceration; ◯ 4. Powder; ◯ 5. Poultice; ◯ 6. Essential oil; ◯ 7. Extract; ◯ 8. Cooked; ◯ 10. Others
You can check multiple boxes

20- Used dose

◯ 1. Spoonful ◯ 2. Pinch ◯ 3. Handle
You can check multiple boxes

21- Administration mode

◯ 1. Oral; ◯ 2. Massage; ◯ 3. Rinsing; ◯ 4. Bandaging; ◯ 5. Others
You can check multiple boxes

22- Duration of use

◯ 1. One-day; ◯ 2. One-week; ◯ 3. One-month; ◯ 4. Until healing
You can check multiple boxes

23- Treated disease

◯ Dermatological disorders	◯ Respiratory disorders	◯ Cardiovascular diseases
◯ Urogenital disorders	◯ Osteoarticular disorders	◯ Digestive tract disorders
◯ Affections of glands	◯ Neurological disorders	◯ Metabolic disorders
◯ Appendices of digestive tract	◯ Ophthalmic disorders	◯ Oral disorders

You can check multiple boxes

24- Toxicity

◯ 1. Yes; ◯ 2. No

25- Source of their knowledge of the plants

◯ 1. Parent; ◯ 2. Media; ◯ 3. Personal experience; ◯ 4. Other actors of traditional medicine