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Medicinal and cosmetic use of plants from the province of Taza, Northern Morocco

[Uso medicinal y cosmético de las plantas de la provincia de Taza, Norte de Marruecos]

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Abstract

This work aims to make an inventory of plants and their medicinal and cosmetic uses in the Pre-Rif (foothills of the Rif, a massif in Northern Morocco) of the province of Taza. Following ethnobotanical investigations, carried out with the local population and field surveys, 73 plant species used locally in traditional medicine have been identified, as well as six species which have ethno-veterinary properties. They belong to 39 botanical families and were collected essentially in the study area. Most remedies are prepared as decoctions (40 species) or with an aqueous base (infusion, aqueous macerate-8 species); more species are used for internal or oral administration (61 species) compared with external or local ones (27 species). These plants, 14.8% of which are central to herbalists' activity in the region, are widely used in indigenous pharmacopoeia to treat common symptoms, such as gastrointestinal disorders (33 species), articular-system disruption, ENT (Ear, Nose and Throat) diseases and headaches (24 species), and skin problems (11 species). Moreover, 13 species in particular are used by women for cosmetic purposes. The local population uses medicinal plant species for daily care which may increase the pressure on natural resources, e.g. vulnerable species such as *Origanum compactum* and *Rosmarinus officinalis*. Hence, the adoption of a sustainable-management approach to safeguard and preserve the local medicinal flora is urgent.

Keywords: Morocco, flora, traditional medicine, cosmetic, preparation, administration.

Resumen

El propósito de este trabajo es el de realizar un inventario de plantas, sus usos medicinales y cosméticos en el Pre-Rif (estribaciones del Rif, un macizo en el norte de Marruecos) de la provincia de Taza. A partir de investigaciones etnobotánicas realizadas con la población local y de estudios de campo, se han identificado 73 especies de plantas (pertenecientes a 39 familias), utilizadas localmente en la medicina tradicional, seis de las cuales tienen además usos etno-veterinarios. La mayor parte de estas especies fueron recolectadas en la región. La mayoría de los remedios se preparan en decocciones (40 especies), o con una base acuosa (infusión, maceración acuosa - 8 especies). Del mismo modo, la mayor parte de las especies se administran por vía oral o interna (61 especies), en comparación con aquellas aplicadas de modo externo o local (27 especies). Estas plantas, 14,8% de las cuales son en el centro de la actividad de los herbolarios de la región, son ampliamente utilizadas en la farmacopea indígena para atenuar síntomas comunes, tales como trastornos gastrointestinales (33 especies), alteraciones articulares, enfermedades otorrinológicas (oído, nariz y garganta), dolores de cabeza (24 especies) y problemas de la piel (11 especies). Además, 13 especies son especialmente utilizadas por las mujeres para fines cosméticos. El uso cotidiano de la población local de estas especies medicinales podría acentuar la presión sobre los recursos naturales, es decir, las especies vulnerables tales como *Origanum compactum* y *Rosmarinus officinalis*. Por lo tanto, es urgente gestionar un manejo sostenible de estos recursos de modo de garantizar su protección y preservación.

Palabras Clave: Marruecos; flora medicina tradicional; uso cosmético; preparaciones; administración.

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INTRODUCTION

The Moroccan flora include around 8000 species (CEIB, 2006a). Little information is available for some plant groups of high ecological and socioeconomic interest and many sites in Morocco have almost never been surveyed (FAO-Morocco, 2006). Morocco has one of the highest proportion of endemic vascular-plants in Euro-Mediterranean countries and 800 to 951 taxa are endemic out of over 4500 native or naturalized taxa (Benrahmoune Idrissi & Dubruille, 2003; El-Hilaly *et al.*, 2003; Fougrach *et al.*, 2007).

Studies of plant diversity are usually concerned with taxonomic richness and factors influencing it, as well as the direct-use values of plant diversity (wood cutting, gathering, etc.) that are sometimes discussed beyond its actual value (indirect use, option, etc.).

The intensive exploitation of plant species for medicinal purposes can be detrimental when this exceeds the regeneration threshold. The use of medicinal plants, which is part of the livelihood of the local population, can lead to the reduction and/or loss of biodiversity, decrease in productivity, etc. (Mehdioui & Kahoudji, 2007).

Furthermore, there is a cultural expression resulting from the environment exploitation, and therefore, a rich culture that is expressed in a mosaic of folklore and architecture, a variety of local products, diverse handicrafts and various customs (Benrahmoune Idrissi & Dubruille, 2003). The use of these plants by humans is based on thousands of years of experience, as people have learned to recognize and use plants by "trial and error", including those with magic and religious functions (Camejo-Rodrigues *et al.*, 2003). Local or indigenous knowledge is as old as human civilization (Aleem Qureshi *et al.*, 2009). Moreover, since ancient times, people have been closely related to their habitats, and they have altered their natural environments while, at the same time, being influenced by nature that surrounds them, which is the result of this two-way process of biodiversity management (Angels Bonet & Vallès, 2007).

The advance of western medicine in some areas does not negate the fact that 80% of the world population benefits from the contributions of traditional medicine in terms of health care (in El Rhaffari & Zaid, 2002), and these drugs have less side effects than synthetic drugs (Sardar & Khan, 2009). The use of medicinal plants provides a source of medical care in developing countries in the absence of a modern medical system (in Mehdioui & Kahoudji, 2007). Morocco is one of the Mediterranean countries with a long medical tradition and traditional know-how of herbal medicine (in Mehdioui & Kahoudji, 2007); 20% of the population lives, at least partly, on forest products and more than 500 medicinal plants are economically important (in Ennabili *et al.*, 2000).

Unfortunately, knowledge regarding the use of traditional plants is lost from one generation to another (e.g. Ennabili *et al.*, 2000; Tabuti, 2002). Factors such as migration, acculturation, alteration of the physical and biological environments, the rural exodus, new media, expertise loss due to death of the elderly, etc. are causing a rapid loss of traditional knowledge, which would make such studies primordial (González-Tejero *et al.*, 2008).

In keeping with the context of conservation and ecosystem protection on one hand and to promote the development of this region on the other hand, our work is a contribution to the inventory of cosmetic and medical knowledge, and the identification of plants used by local people of Pre-Rif of Taza in traditional medicines.

MATERIALS AND METHODS

Study Area

The province of Taza covers a total area of 15,020 km² (Figure 1); its population is around 720,000 inhabitants (CEIB, 2006b). It is bounded to the north, east, south and west by the provinces of Al Hoceïma and Nador, the province of Taourirt, the province of Boulmane and the provinces of Taounate and Sefrou respectively (Délégation du MEN à Taza, 2009).

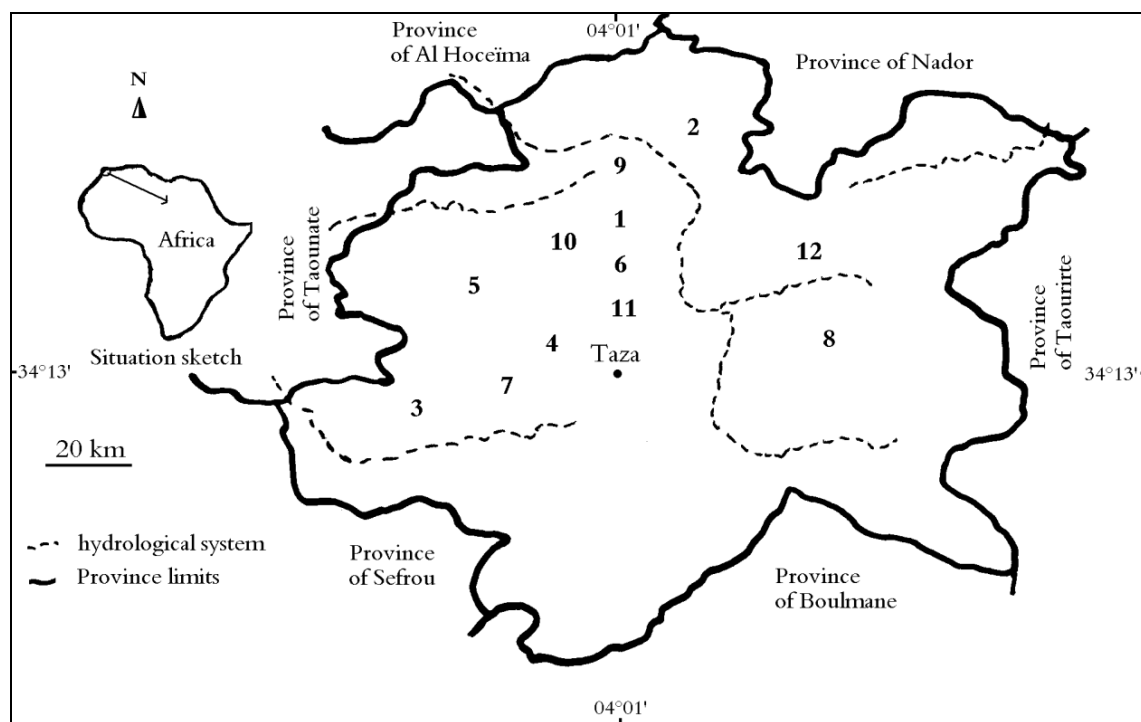


Figure 1

Location of surveyed stations in the province of Taza. Source: Région de Taza-Al Hoceïma-Taounate (2004).

Caption: 1-Aknoul; Ajdir 2; 3-Oued Amlil; 4-Taza city 5-Had Msila; 6-Jbarnes; 7-Merzouka; 8-Mezguitem; 9-Malal; 10-Bouhdoud; 11-Sebt Boukalal; 12-Tizi oukli.

The survey area is characterized by a rugged relief, constituting a constraint for its development. The main mountains are Jbel Akechars (around 2009 m), Jbel Kouine (1883 m) and Jbel Aberchane (1774 m). The substrates are soft and impervious (Loukili *et al.*, 2006). The climate is of Mediterranean type, particularly semi-continental to Mediterranean influence, humid in winter and semi-arid in summer (Délégation du MEN à Taza, 2009).

Forests and alfa grass [*Macrochloa tenacissima* (L.) Kunth] occupy 42.5% of the area (468,000 ha) in the province of Taza; 401,339 ha of which correspond to forests. Holm oak (*Quercus ilex* L.), thuja [*Tetraclinis articulata* (Vahl) Mast.], Aleppo pine (*Pinus halepensis* Mill.), cork oak (*Quercus suber* L.) and cedar [*Cedrus atlantica* (Endl.) Carrière] (especially from the national park of Tazekka) are found in 130,704 ha, 50,151 ha, 30,028 ha, 11,737 ha and 9,907 ha respectively. The grazing and uncultivated lands spread on 644,000 ha, i.e. 44.7% of the province (Service provincial des Eaux et Forêts, 2008). In addition, soil erosion has increased due to

man's activities, i.e. overgrazing and clearing the forests (Loukili *et al.*, 2006).

The foothills of the Rif are among the early settlement regions, which together with the Moroccan mountains are considered as the Moroccan cradle of humanity. The southern sides of eastern Rif have been long neglected and marginalized. These mountain areas are seriously subjected to natural, economic and spatial imbalance (Binane, 1999).

Agriculture constitutes a fundamental economic sector in the province of Taza, and is the main occupation of the farming population (i.e. source of income for 80% of the local population), in the form of cereal-based subsistence farming, livestock and arboriculture, mainly olive (*Olea europaea* L.), almond [*Prunus dulcis* (Mill.) D.A.Webb] and fig trees (*Ficus carica* L.) (CEIB, 2006b; Délégation du MEN à Taza, 2009).

The Pre-Rif Taza is one of many Moroccan rural regions remaining unexplored in terms of ethnobotanical research, even though it might have an important phytotherapeutic potential. In addition to the National Park Tazekka, there is another four sites of

biological and ecological interest, namely Tidighin Koudiat - Ghafasai Tainaste, Azrou Akechar - Aknoul, Jbel Ouarirt - Msoun (Ministère de l'Aménagement du Territoire de l'Eau et de l'Environnement, 2003) and El Kifane forest (Binane, 1999).

METHODS

In order to document local knowledge in terms of plants exploitation, we used pre-established survey forms, with 45 inputs related to ethnobotanical and demographic data (local names and parts of the plants used; age, gender and social identity of the people interviewed, among others).

In this work, we referred to other studies on plants used in Morocco, including medicinal plants (Ennabili *et al.* 1996, 2000, 2006; El Rhaffari & Zaid, 2002; El-Hilaly *et al.*, 2003; Merzouki *et al.*, 2003; Hseini & Kahouadji, 2007; Mehdioui & Kahoudji, 2007; El Mansouri *et al.*, 2011; Libiad *et al.*, 2011), and in other countries (e.g. Marc *et al.*, 2008; Aleem Qureshi *et al.*, 2009; Sardar & Khan, 2009; Devarkar *et al.*, 2011).

Land surveying and plants sampling for identification were carried out repeatedly from April 2008 at April 2011 in 12 stations (Figure 1). Selected people, elderly, rural women healers and herbalists in particular, were interviewed about which parts were used in each species, as well as the practices of plants preparation and administration, and diseases treated. In parallel, we have identified the sampled species by using the available flora and other specific studies (Quezel & Santa, 1962-1963; Fennane *et al.*, 1987; Bertrand 1991; Valdés *et al.*, 2002; Bellakhdar, 1997, 2006; Ennabili *et al.*, 2000, 2006; Fennane *et al.*, 1999-2007; Base de Données des Plantes à fleurs d'Afrique, 2010). All data collected was processed and analyzed.

RESULTS AND DISCUSSION

Interviewees

Information was gathered at 12 stations in the study area (Figure 1), at a rate of 21.2 ± 15.9 informers per station. This survey led to 255 "interview-medicinal species-station" combinations.

The interviewees (29.8% female and 70.2% male) have an average age of 51.2 ± 14.9 years (61.1 ± 17.8 years for women and 47 ± 11.1 years for men). This factor is much higher in Europe, where the average age of interviewees ranges from 63 to 72 years (Camejo-Rodrigues *et al.*, 2003; Angels-Bonet & Vallès, 2007; González-Tejero *et al.*, 2008; Parada *et al.*, 2009), v. from 50 to 65 years for the Northern Africa people (González-Tejero *et al.*, 2008).

Local knowledge in terms of the popular use of medicinal plants was sufficient, and a number of medicinal plant uses were scarcely reported by the middle-aged and older-aged women. Some herbal applications are promising and encourage scientists and actors in the field to enhance this local know-how.

Medicinal flora

Seventy-three medicinal species have been identified (Table 1). In other Moroccan regions, the medicinal flora is more important and varies from 76 to 180 species, depending on climatic and socio-economic conditions and the land area concerned (Ennabili *et al.*, 2000, 2006; El-Hilaly *et al.*, 2003; El Mansouri *et al.*, 2011; Libiad *et al.*, 2011). The high number of species having medicinal properties in the watershed of Oued Laou (northwest of Morocco) could be explained by its rich plant diversity and/or a backup of the local know-how (Ennabili *et al.*, 2006).

Table 1

Preparation and administration of vascular plants in traditional medicine and cosmetics (Province of Taza).

Caption: **B**, bulb. **Bf**, fruit bark. **Br**, root bark. **Bs**, stem bark. **C**, cauterization. **D**, decoction. **F**, flower. **Fr**, fruit. **Fu**, fumigation (dried plant part or powder thrown into the fire). **I**, inflorescence. **If**, infusion. **Ih**, inhalation. **L**, leaf. **La**, latex. **Lo**, local application. **M**, mush. **P**, powder. **Pa**, aerial part. **Po**, pollen. **R**, root. **Re**, resin. **Rh**, rhizome. **S**, seed. **St**, stem. **T**, tubercle. **Uf**, use frequency. **Up**, plant part used. **V**, veterinary use.

Taxon	Vernacular	Up	Recipes/Preparation processes	Therapeutic	Uf (%)
<i>Lamiaceae</i>					36.
<i>Origanum compactum</i> Benth.	zaâtar, zouy	L	- drink and beverage preparation - milling and refinement of leaves and taken mixed with honey, or ingested in water - oregano honey used against intoxication and taken in hot water/D, Fu	purgative, stomachic, carminative, analgesic, anti-emetic, anti-rheumatic, anti-rheum, analgesic for articulation, anti-diabetic, anti-ulcer, anti-diarrheal, against menstrual pain, anti intoxication	11 36
<i>Rosmarinus officinalis</i> L.	azir	L	Beverage/D, Fu	purgative, sedative (aorta palpitations, called locally "Boumzoui"), anti-rheum, anti-rheumatic, liver protection	
<i>Mentha suaveolens</i> Ehrh.	m'chichro	Pa	drink preparation (mixed with honey)/C, D, Ih	carminative, favoring conception and fertility	2
<i>Calamintha sylvatica</i> Bromf.	t'mința, manța	Pa	drink preparation (mixed with milk)/D	anti-rheum, antitussive, stomachic	2
<i>Thymus zygis</i> L.	z'douchan, z'âitra	Pa, L	drink preparation (mixed with honey)/D	carminative, purgative, stomachic, anti-flu, anti-rheum	2.74
<i>Ajuga iva</i> (L.) Schreb.	changoura, chandgoura	Pa	- dried, crushed and taken with honey or butter - beverage preparation/If	stomachic, anti-diabetic, vulnerary, measles treatment for, V (against rabies in dogs)	2.74
<i>Mentha pulegium</i> L.	fliyou, flayou, friyou	Pa	beverage preparation (mixed with milk)/D	against angina, anti-rheum, anti-flu	3
<i>Marrubium vulgare</i> L.	marouy, m'riwa	L, R	- drink made from boiled roots/D - leaves are crushed	- R: stomachic - L: ophthalmic collyrium treatment, anti-allergic, anti-	1.96

			and applied locally/M	diabetes, against headaches, against abscess, cessation of breastfeeding in babies, hair treatment	
<i>Lavandula stoechas</i> L.	r'harhar, l'halhal, l'hashas	L	beverage preparation/D	rheum and flu treatment, anti-diarrheal in pediatric, anti-anemic	7
<i>Lavandula multifida</i> L.	L'khzama	L	- beverage/D - preparation (mixed with henna for hair treatment)/P	- tonic, stimulant and anti-rheum - hair treatment	
<i>Salvia officinalis</i> L.	salmiya	L	beverage preparation/D	anti-diabetes, carminative, purgative	0.78
Asteraceae					12.
<i>Artemisia herba-alba</i> Asso	achiḥ	L	- hot drink preparation/D - direct application of mash/M, Fu	anti-rheumatic, anti-rheum, stomachic, sedative (against the aorta palpitations), anti-diabetes, depurative, vulnerary	
<i>Dittrichia viscosa</i> (L.) Greuter	bayramane	L, R, Pa, Po	- beverage made from boiled leave, to take in the morning/D - drink made from washed and boiled roots/D, C	- L: carminative, purgative, vulnerary, hemostatic - R: stomachic - Po: allergenic - tonic, body warming in pediatric	3.93
<i>Artemisia absinthium</i> L.	chiba, ch'hiba	L	Beverage/D	anti-rheumatic, anti-rheum, emetic, V (carminative, purgative in cows)	1.
<i>Achillea odorata</i> L. subsp. <i>pectinata</i> (Lamk) Briq.	tizriṭ, ch'wiḥa, daqrat achiḥ	L, Pa	beverage preparation/D	anti-rheum, tonic, stimulant, V (remedy for some chicken epidemics, insecticide)	
<i>Cynara cardunculus</i> L.	ar'ḥak, r'khorchaf, l'khorchef	F	maceration in milk, chew before swallowing/If	anti-diarrhea, stomachic	0.78
<i>Tanacetum annuum</i> L.	timarsad	L, F	mixed with henna for migraine treatment/Lo	F: labial herpes (lip button) treatment, anti-migraine	
<i>Chamaemelum fuscatum</i> (Brot.) Vasc.	babounej	Pa	beverage preparation/D, Lo	- antidepressant, against anemia - against hair loss	0.39
<i>Taraxacum erythrospermum</i> Andr. ex Besser	talma, tar'ma	La	Lo	wart treatment	
Fabaceae					3.5
<i>Trigonella foenum-graecum</i> L.	l'halba, r'ḥorbat	S	- drink made from seeds macerate/If - swallow seeds with	- stomachic, appetite stimulant, depurative - treating and coloring hair	17

			water/If - mixed with grenade bark for hair treatment/Lo		
<i>Ononis natrix</i> L.	afzaz	Pa	- beverage preparation/D - mash/Lo	- stomachic, sedative (treatment of palpitation of the aorta) - haemostatic, V (ophthalmic collyrium in livestock)	1.17
<i>Glycyrrhiza glabra</i> L.	âar'ksous	St		regulator of blood pressure	0.3
<i>Vicia ervilia</i> (L.) willd.	qarsana, q'r'sana	S	oven-dried seeds are crushed and swallowed/P	stomachic	
<i>Lens culinaris</i> Medik.	raâ'das, laâ'das	S	drink made from seeds macerate/If	liver protective, anti-icterus	
Cupressaceae					3.13
<i>Tetraclinis articulata</i> (Vahl) Mast.	l'âarâar, amr'zi	L	- beverage preparation/D - mixed with milk in anti-rheumatic use/Lo, Fu	locally analgesic, stomachic, anti-rheumatic	3
Anacardiaceae					2.74
<i>Pistacia lentiscus</i> L.	fadis, aṭrou	L	dried leaves are, crushed and refined (mixed with honey or water)/D, Ih	- anti-rheum, carminative, purgative, anti-diarrheal - anti-migraine	4
Apocynaceae					2.74
<i>Nerium oleander</i> L.	ariri, adafila	L, St	- dried, crushed and refined/Fu, Ih - cauterization/C - beverage preparation/D, If	- anti-migraine, treatment mouth-ulcers treatment - dental and ENT analgesic, anti-migraine - antidiabetic - against hair loss	4
Fagaceae					2.35
<i>Quercus ilex</i> L.	Qourich, adran	Br	beverage preparation/D, Lo	stomachic, anti-rheumatic anti-hemorrhoid	2.35
Globulariaceae					2.35
<i>Globularia alypum</i> L.	tasr'gha, âinlarnab	L	- beverage made from boiled leaves/D - dried and crushed leaves (mixed with honey)/D	stomachic, purgative, carminative, anti-rheum, anxiolytic, anti-diabetic, menstrual-pain analgesic	2.35
Myrtaceae					2.34
<i>Eucalyptus globulus</i> Labill,	kalitous	L	beverage made from boiled leaves/D, Ih	anti-rheum, anti-rheumatic, anti-flu	1.56

<i>E. camaldulensis</i> Dehnh					
<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry	âoud anwar, qronfal	Fr	local application/Lo	dental analgesic	
<i>Myrtus communis</i> L.	riḥane	L, Fr	- Dried fruits, powdered and boiled/D - L are mixed with henna for hair treatment/Lo	- Fr : stomachic - L : hair care	39
Rosaceae					2.34
<i>Cydonia oblonga</i> Mill.	s'farjal, s'farz'r	R	drink made from washed and boiled roots/D	anti-rheum	78
<i>Eriobotrya japonica</i> (Thunb.) Lindl.	lamzaḥ, ramzaḥ	L	drink made from boiled leaves/D	anti-diabetic	0.78
<i>Rubus fruticosus</i> L.	aṣṭif	R	washed roots are, dried, crushed and consumed/P	treatment of cardiovascular diseases	0.39
<i>Crataegus monogyna</i> Jacq.	admam	L	liquid from crushed leaves is instilled into eyes/Lo	ophthalmic collyrium	0.39
Poaceae					1.95
<i>Arundo donax</i> L.	laqsab, ghanime	Rh	ashes of burnt rhizomes are used with olive oil/Lo	hair treatment	17
<i>Cynodon dactylon</i> (L.) Pers.	an'jam	Pa		stomachic	0.39
<i>Pennisetum glaucum</i> (L.) R.Br.	ilan	S		help fracture healing	0.39
Rutaceae					5
<i>Ruta montana</i> L.	awram, fījal	L, St	- carrying a stem fragment/Fu - beverage preparation/If	abscesses treatment, against evil spirits, emetic in pediatric	6
<i>Citrus limon</i> (L.) Burm.f.	l'ḥamd	Fr	mixed with warm milk	anti-flu/D	39
Apiaceae					1.56
<i>Ammi visnaga</i> (L.) Lam.	Bachnikha, tab'chnikh't	S	- dried seeds are powdered and swallowed/P - beverage preparation/D	anti-diabetic	

<i>Carum carvi</i> L.	l'karwiya	S	- Dried seeds are powdered and boiled/D	- stimulant, tonic - culinary	0.39
<i>Pimpinella anisum</i> L.	ḥabat ḥlawwa	S	beverage preparation by adding hot water mixed (mixed with seeds of <i>Foeniculum vulgare</i> and <i>Daucus carota</i> subsp. <i>Sativus</i>)/D	- stomachic, purgative - culinary	
Chenopodiaceae					1.56
<i>Chenopodium ambrosioides</i> L.	m'khinza	L, Pa	- grinding of aerial part (mixed with onion bulbs)/Lo - beverage preparation/D - boiled leaves/D	Pa : antipyretic and topical against sunstroke, anti-emetic, stomachic L : mouthwash	6
Moraceae					1.56
<i>Ficus carica</i> L.	alkarmous, r'ghar's	Fr, La	- dried fruits are powdered and boiled/D - La is mixed with water/Lo	- Fr : carminative, purgative - La : warts treatment	6
Oleaceae					1.56
<i>Olea europaea</i> L. subsp. <i>europaea</i>	zachtoun, zayṭoun	Re	powdered resin is burned/P, Lo	dental analgesic, ophthalmic collyrium	0.78
<i>Phillyrea latifolia</i> L.	m'riras	L	boiled leaves in water/D	stomachic, carminative, purgative, diuretic, liver protection, anti-icterus	0.78
Punicaceae					1.56
<i>Punica granatum</i> L.	armane	Bf	- fruit bark is dried and crushed (mixed with honey)/P - drink preparation/D	stomachic, anti-ulcer	56
Rhamnaceae					1.56
<i>Ziziphus lotus</i> (L.) Lam.	asadra, an'bag	Fr, L	dried leaves are crushed (mixed with henna)/P	Fr: stomachic L: hair treatment	6
Solanaceae					1.56
<i>Solanum tuberosum</i> L.	baṭaṭa	L, T	leaves or tubercles are heated/Lo	burn treatment	
<i>Hyoscyamus albus</i> L.	bounarjounf	Pa, S	seeds aqueous macerate/If, Ih	S: eyes anti-allergic Pa: V (treatment of some poultry diseases)	
Aristolochiaceae					1.17

<i>Aristolochia fontanesii</i> Boiss. & Reut.	bar'ztem	Pa	aerial part is dried and crushed (mixed with honey) P	vulnerary, anticancer, anti-ulcer	7
<i>Caryophyllaceae</i>					1.17
<i>Herniaria hirusta</i> DC.	harast laħjar	Pa	drink preparation/D	analgesic nephritis, depurative	7
<i>Ericaceae</i>					1.17
<i>Arbutus unedo</i> L.	Sasnou, mrouna, bakhnou	R	- drink made from boiled roots/D - washed roots are crushed (mixed with honey)/P	stomachic, anti-asthmatic/D, P	7
<i>Alliaceae</i>					0.78
<i>Allium sativum</i> L.	tichart, atouma	B	cooked with olive oil/D	anti-rheum, anti-flu	78
<i>Boraginaceae</i>					0.78
<i>Borago officinalis</i> L.	ħandoun, bouħamdoun	Rh	Rh are dried, powdered and mixed with water/Lo	fixing sprains (articular reboutage)	
<i>Cactaceae</i>					0.78
<i>Opuntia maxima</i> Miller	l'handiya, tahandach't	St, F	- F: dried flowers are crushed (mixed with honey)/P	- F : stomachic, purgative - St (cladodes): V (carminative in cows)	
<i>Cistaceae</i>					0.78
<i>Cistus ladanifer</i> L.	touzaħch	F	beverage made from boiled leaves/D	stomachic	
<i>Lauraceae</i>					0.78
<i>Cinnamomum verum</i> J.Presl	l'qarfa	Bs	boiled bark stem/D	against menstrual pain	
<i>Leguminosae</i>					0.78
<i>Ceratonia siliqua</i> L.	Kharoub, tasrighwa	Fr	consumed with honey/P	anti-diarrheal, stomachic	
<i>Lythraceae</i>					0.78
<i>Lawsonia inermis</i> L.	l'ħana, r'ħani	F	D, P, Lo	- anti-migraine - treatment hair	
<i>Myristicaceae</i>					0.78
<i>Myristica fragrans</i> Houtt.	al gouza	S	beverage preparation (mixed with warm milk)/D	antitussive	
<i>Vitaceae</i>					0.78
<i>Vitis vinifera</i> L.	tzayarat, adir, Laâ' nab, dalya	F	heated leaves/Lo	against abscesses	
<i>Zygophyllaceae</i>					0.78
<i>Peganum harmala</i> L.	l'ħarmal, r'ħar'mar	S, F	P, Lo, Fu	- dental analgesic - against evil eyes	

Juncaceae					0.39
<i>Juncus acutus</i> L.	azraf	I	consumed with honey/P	stomachic	
Linaceae					0.39
<i>Linum usitatissimum</i> L.	zriâat al katan	S	consumed with honey/P	stomachic	
Pinaceae					0.39
<i>Pinus halepensis</i> Mill.	tayda	F	drink preparation/If	stomachic, anti-diarrheal	
Piperaceae					0.39
<i>Piper cubeba</i> L.f.	L'kababa	S	D	- tonic, stimulant - culinary	
Ranunculaceae					0.39
<i>Nigella sativa</i> L.	sanouj	S	consumed with honey/P	anti-rheumatic, analgesic	
Typhaceae					0.39
<i>Typha latifolia</i> L.	tbouda	F	drink made from boiled leaves/D	analgesic, carminative	
Verbenaceae					0.39
<i>Aloysia citriodora</i> Palau	l'wiza	F	warm drink made from boiled leaves/D	analgesic in pediatric, stomachic, purgative	

The most used plant parts are foliage (32.8%), followed by aerial parts (16.4), fruit (16.4%), underground parts (8.21%), inflorescences (6.84%), latex (2.73 %) and resin (1.36%). The importance of aerial parts (stem, leaf, flower and/or fruit) in traditional medicine was also underlined by ethnobotanical studies conducted in Morocco or in Mediterranean countries (Ennabili *et al.*, 2000, 2006; Camejo-Rodriguez *et al.*, 2003; El-Hilaly *et al.*, 2003; Mehdioui & Kahoudji, 2007; González-Tejero *et al.*, 2008; Parada *et al.*, 2009).

Most of these species are spontaneous (60.2%) and are therefore collected from natural habitats in the region, as also reported by Ennabili *et al.* (2000) and El-Hilaly *et al.* (2003). Cultivated species are second (20.8%), followed by imported species, or their by-products (19.4%).

The species most used in local therapy belong to 39 botanical families, of which 29 families are represented by only one species and only four families exceed 5% of the total richness of local medicinal species (Figure 2): *Lamiaceae* (15 %), *Asteraceae* (10.9%), *Fabaceae* (6.84%), *Myrtaceae* (5.47%) and *Rosaceae* (5.47%).

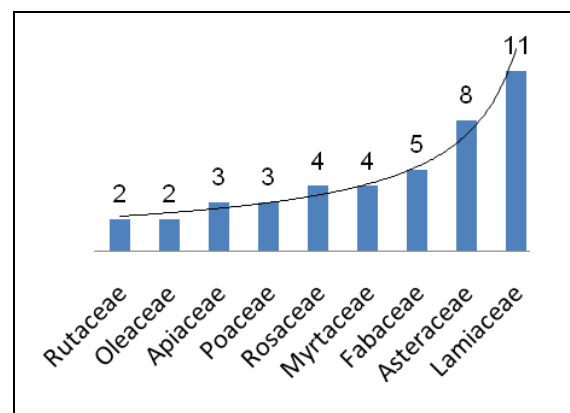


Figure 2

Number of medicinal species per botanical family in the province of Taza.

The medicinal flora is dominated mainly by *Lamiaceae* and *Asteraceae* (Ennabili *et al.*, 2000, 2006; El-Hilaly *et al.*, 2003; Hsein *et al.*, 2007; Mehdioui & Kahoudji, 2007; Parada *et al.*, 2009), which are among the nine main families in the spontaneous flora of Morocco, with a large number of species (Fennane, 2004). Other studies under the Mediterranean climate also show that *Asteraceae* and *Lamiaceae* are the most exploited in traditional medicine (e.g. Parada *et al.*, 2009).

Depending on the use frequency of local plants in traditional medicine, 15 spontaneous species come to the forefront (Table 1, Figure 3). *Origanum compactum* and *Rosmarinus officinalis* are the most sought-after species for therapeutic applications, and

are also important for apiculture, herbalists and merchants. However, the intensity and manner of collection of these species must be studied to prevent their possible degradation.

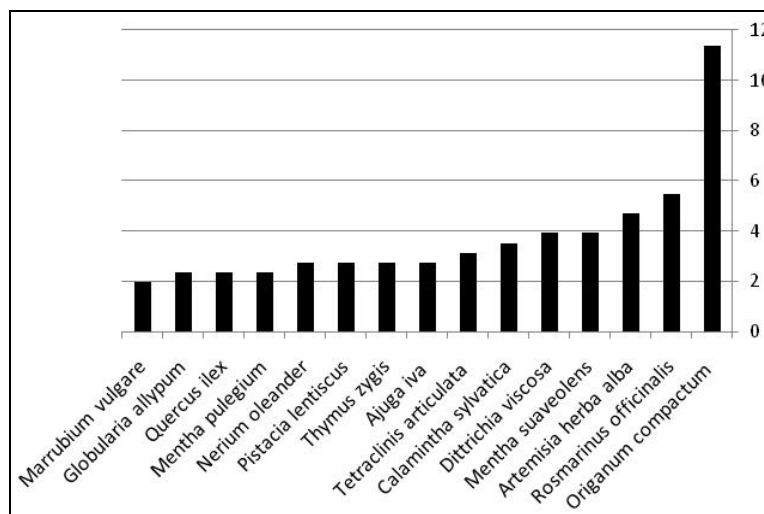


Figure 3

Use frequency of the most popular medicinal plants in the province of Taza.

Moreover, medicinal plants are infrequently used by the local population, due mainly to the following factors:

- ✓ Importation and local sale of by-products of some plants, e.g. *Aloysia citriodora*, *Carum carvi*, *Cinnamomum verum*, *Glycyrrhiza glabra*, *Lawsonia inermis*, *Linum usitatissimum*, *Myristica fragrans*, *Nigella sativa*, *Peganum harmala*, *Pennisetum glaucum*, *Pimpinella anisum*, *Piper cubeba*, *Syzygium aromaticum* and *Trigonella foenum-graecum*.
- ✓ Certain species are used as food or condiments, e.g. *Allium sativum*, *Cydonia oblonga*, *Cynara cardunculus*, *Eriobotrya japonica*, *Ficus carica*, *Lens culinaris*, *Olea europaea* subsp. *europaea*, *Punica granatum*, *Solanum tuberosum* and *Vitis vinifera*.
- ✓ Some plants have a bad taste, e.g. *Aristolochia fontanesii*, *Chenopodium ambrosioides*, *Phillyrea latifolia* and *Tanacetum annuum*.

Preparation and administration of medicinal plants

Medicinal plants are generally prepared as infusions and decoctions and they are administered primarily

through direct oral ingestion or as an external compress. However, administration of herbal preparations for hair washing and treatment requires special know-how (Table 1).

In this study, internal and external uses of medicinal plants concern 61 and 27 species respectively; these results differ slightly to those of Parada *et al.* (2009). Plant preparations for internal use are mainly water-based decoctions (65.6%) or aqueous infusions or macerations (13.1%). Inhalation, sniffing of hot water charged with active substances, is practiced in the cases of *Mentha suaveolens*, *Nerium oleander* and *Eucalyptus* spp.

Many medicinal plant species are traditionally used for more than one disease. Thus, 16.4% of the medicinal species listed are considered as antiseptics and are used for skin disinfection (vulnerary, warts, hemostatic and abscesses) (Table 1). The listed medicinal plants are commonly used alone (single use of each plant). However, they are also used in combination, and sometimes with honey, olive oil or milk, due to the common synergistic effects, as reported by Ennabili *et al.* (2000) and/or El Mansouri *et al.* (2011). 13.7% of species identified are associated with hair treatment, mixed with henna, and

19.2% of the listed species are used in a mixture with honey. In addition to these medicinal uses, some species would present cosmetic and cleaning uses. We also recorded plant species that are useful in veterinary medicine (8.21%) (Table 1)

Moreover, we identified 44 diseases treated by popular herbal medicine, as well as other related uses (diet to lose weight, appetite, body warming, weaning the baby, evil eye ...). The diseases or disorders most often treated were classified into seven major categories, according to the main body systems: (i) gastrointestinal disorders (45.8%), (ii) symptoms related to colds, ENT diseases and headache (33.3%), (iii) dermatological problems (15.3%), (iv) diabetes (12.5%), (v) cardiovascular diseases (11.11%), (vi) liver disease (4.2%) and (vii) urinary infections (2.77%). The most affected health-systems have also been underlined by El Rhaffari et al. (2002) and Mehdioui & Kahoudji (2007).

We also recorded plant species useful in veterinary medicine (8.21%; Table 1). In many cases, this ethno-veterinarian know-how is fully compatible with its human equivalent (Angels Bonet & Vallès, 2007).

This popular wisdom calls for fighting against the current acculturation, and ethnobotanical researches in collaboration between different stakeholders of medicinal plants sector are necessary for sustainable management of the environment, including the development of these disadvantaged areas and as a contribution to the development of new drugs (Ennabili *et al.*, 2000, El-Hilaly *et al.*, 2003; Angels Bonet & Vallès, 2007; Parada *et al.*, 2009).

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