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Ethnobotanical studies and economic evaluation of medicinal plants in Taounate province (Northern Morocco)

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Abstract
An ethnobotanical survey was carried out among the Taounate population in Northern Morocco to identify plants used in folk-medicine. Two distinct physiographic regions of the province, populated by two ethnic groups, were surveyed. Extensive investigation undertaken during the past 5 years has brought to light 102 medicinal plants belonging to 48 families. The scientific and vernacular names of plants, their ecological distribution, and the popular uses of the plant, the part of the plant used, the preparation and mode of administration are presented. Plants are widely used in indigenous pharmacopoeia to alleviate the common symptoms of cardiovascular (5.8%), gastrointestinal (24.9%), bronchopulmonary systems (9.8%), urogenital (12.2%) and skin (9.2%) diseases, and other disorders which are often associated with magic. The majority of medicinal plants grow in the wild (61%), while others are cultivated (37%) and some (1.9%) are domesticated. These plants are more abundant in the northern part (62%) of the province where they grow in forested areas. Among the 102 species inventoried, 13(12.7%) medicinal plants are widely commercialised in the region and exploited outside of the province. The data collected from 17 wholesalers, show the income derived from medicinal plants to be about US$ 1,826,900 per year. This survey demonstrates that the medicinal plant sector in the province is a promising economic resource for developing this region, but it needs planned exploitation, and that the tribes should continue to master the folk-medicine.
Author Keywords: Medicinal plants; Ethnobotanical survey; Traditional medicine; Taounate ethnobotany

2. Material and methods

2.1. Study area

Taounate, the widest northern province of Morocco with an area of 5616 km^2, is covered by three bioclimatic strata that favour the development and diversity of medicinal aromatic plants. Geographically, Taounate has two distinct physiographic sections, the northern and southern parts. Its population is mainly rural (92%) and has few services, with most of the tribes closed in without electricity and roadways. The province is known for heavy exodus of the population to big cities. Taounate is populated by two ethnic groups: the Berbers in the north and the Arabs in the south. The main income of the population is derived from traditional agriculture. The illiteracy rate is very high, especially among women; more than 89% of young girls are illiterate. The poverty of the northern part and its isolation have favoured, more recently, the fast spread of cannabis agriculture which threatens the region both ecologically and socially.

2.2. Ethnobotanical survey

In order to overcome any difficulties in gathering data, we adapted the survey to local characteristics of the region following the administrative map (Fig. 2). A multidisciplinary team was assembled and the political and agricultural authorities were contacted for further guidance. A group of forest agents were mobilised to help in interviews and collection of plant samples. The questionnaire consisted of three sections: (a) utilisation survey of plants for medicinal purposes, (b) ecological repartition of specimen in two sections of the province, (c) approximate income derived from important medicinal plants in the region.

Field studies required us to deal with two groups: (1) those who knew and/or used plants for medicinal purposes and (2) those who used plants and plant products for commercial purposes (plant collectors, wholesalers, retailers). The survey, starting in 1995, was carried out in each tribal

area by the local native researcher J. El-Hilaly, who is aware of all local conditions. After frequent visits to the rural communes and weekly-markets of each tribal area, and having several conversations with and questioning of users and learning the trading practices, the verbal information collected was registered on to a form. If a plant (or plant product) was used for medicinal purposes, a voucher herbarium specimen was collected. These samples were pressed and preserved for later identification by botanists in the National Scientific Institute.

Based on the information gathered, a list of the most frequently reported illnesses and the plant (or plant product) used for their treatment was compiled (Table 1). Also, the approximate income generated from medicinal plants in the sector was estimated (Table 3).

TABLE 1
VOIR Photo ZZZMoroco1

00680	**Agave sisalana Perr.**	**Agavaceae**	**sabra**	**H(014) skin disease, leaf latex, washing**
01330	**Apium graveolens L.**	**Apiaceae**	**krafese**	**H(179) kidney stones, leaf decoction, VO.**
06060	**Foeniculum vulgare Mill.**	**Apiaceae**	**nâfac**	**H(135) digestive system, H(171) diabetes, H(179) kidney, seeds decoction, VO.**
09040	**Nerium oleander L.**	**Apocynaceae**	**defla**	**H(171) diabetes, leaf decoction, washing**
09250	**Opuntia ficus-indica (L.) Mill.**	**Cactaceae**	**hindiya**	**H(104) stomach pain, powder of flowers, VO.**
02400	**Capparis spinosa L.**	**Capparidaceae**	**i-kebâr**	**H(113) rheumatism, maceration of flowers and fruits, VO.**
02900	**Chenopodium ambrosioides L.**	**Chenopodiaceae**	**mhinza**	**H(051) fever, H(018) headache, raw leaves, poultice**
02050	**Brassica oleracea L**	**Brassicaceae**	**kruma**	**H(091) anemia, renal disease, flower, leaf, decoction, VO.**
04310	**Cucurbita pepo L.**	**Cucurbitaceae**	**grac l-hamra**	**H(068) anthelmintic, diuretic, raw seeds, VO.**
07800	**Lagenaria siceraria (Molina) Standley**	**Cucurbitaceae**	**grac slawiya**	**H(201) maidhood preservation, raw fruit, VO.**
12420	**Thuja articulata Vahl = Tetraclinis articulata (Vahl) Masters**	**Cupressaceae**	**ei - carcâr**	**H(201), bad spirit, evil eye, magic, burned leaves, fume**
05826	**Euphorbia sp.**	**Euphorbiaceae**	**lubina**	**H(014) skin deseases, H(092) toxic, latex ointment**
10870	**Ricinus communis L.**	**Euphorbiaceae**	**krenk**	**H(092) toxic, raw seeds, VO.**
04480	**Cynodon dactylon (L.) Pers.**	**Poaceae**	**njem**	**H(104) stomach disorders, root decoction, VO.**
13250	**Zea mays L.**	**Poaceae**	**dra sqûbi**	**H(179) kidney diseases, seeds decoction, VO.**
02855	**Ceratonia siliqua L.**	**Caesalpiniaceae**	**el-harûb**	**H(008) anti diarrheal, H(068) intestinal parasites, H(135) digestive system, decoction leaves, fruits, VO.**
10735	**Retama retam (Forssk.) Webb.**	**Fabaceae**	**rjem**	**H(014) skin diseases, toxic, seeds powder, VO.**
12600	**Trigonella foenum-graecum L.**	**Fabaceae**	**el-halfa**	**H(171) diabetes, H(196) scurvey digestive system, seeds maceration, VO.**
09160	**Ocimum basilicum L.**	**Lamiaceae**	**el-hbâk**	**H(094) hemoroïde, heart disease, seeds decoction, VO.**
00840	**Allium cepa L.**	**Alliaceae**	**el-besla**	**H(014) skin abces, bulb heated, poultice - -**

				- H(036) vertigo, syncope, inhalation raw bulb
00860	**Allium sativum L.**	**Alliaceae**	**tüma**	**H(020) scorpion, snake bites, rubbing with raw bulb - - - H(008) + H(104) intestinal pain, high hypertension, raw bulb, VO.**
12755	**Urginea maritima L.**	**Hyacinthaceae**	**el-bessile**	**Vb(000), cattle ailments (indisposition)**
12755	**Urginea maritima L.**	**Hyacinthaceae**	**el-bessile**	**H(014) skin disorders, raw bulb, rubbing**
02310	**Cannabis sativa L.**	**Cannabinaceae**	**el-kif**	**H(210) narcotic, leaves smoked - - - H(014) skin disease, leaves burned in poultice - - - H(175x) hair strengthening, seeds crushed, local application**
05570	**Eucalyptus sp.**	**Myrtaceae**	**kalittûse**	**H(037) cough, H(108) influenza, burned leaves, inhalation - - - H(037) cough, H(082) respiratory canal, leaves infusion, VO.**
03220	**Citrus limon (L.) Burm. f.**	**Rutaceae**	**limûn**	**H(175x) cosmetic, crushed flowers, local application**
04660	**Datura stramonium L.**	**Solanaceae**	**krenk**	**H(092) toxic, raw seeds, VO.**
02875	**Chamaerops humilis L.**	**Palmaceae**	**düm**	**Vo(000), ovin ailments, crushed leaves, fruits, VO.**
02875	**Chamaerops humilis L.**	**Palmaceae**	**düm**	**H(102) bile stones, H(126) liver diseases, H(171) diabetes, decoction leaves, fruits, VO.**

3. Results and discussions

3.1. General data

Our survey, conducted in 47 rural communes covering 5617 km^2 and populated by 616,718 inhabitants, found that almost all of the families knew and/or used the plants for medicinal purposes. In this area, there are no stores or shops selling medicinal plants. The plants and herbs are collected, for folk-medicine or trading purpose, in open areas and fields by the patients, healers, herbalists, folk-medicine practitioners, and collectors. All members of an extended-family live in the same house in which an elder woman acts as the head of the family. The folk-medicine is practised by the elderly woman who has received the empirical knowledge of medicinal and toxic plants and the medicinal prescriptions based upon these plant products passed down to her from generation to generation. In some tribes, certain men and women function as herbalists, witches or sorcerers. Their relationship to health care in the community is somewhat tangential. The indigenous population of this area has a lot of trust for folk-medicine even if modern medicine is available, which however, is usually inaccessible to the majority of people except in serious emergencies.

3.2. Inventory of medicinal plants and phytotherapy

The information gathered during this survey included the common name of the voucher specimen, its botanical name, the geographical and ecological distribution of the species in the two sections of the province, and the part

of the plant used and the medicinal indication for which it is used. The data recorded in a synoptic table (Table 1) are arranged in alphabetical order according to family name.

During the field study in Taounate, 102 local plants belonging to 48 families were found to be used for medicinal purposes. Of the plants inventoried, 62 (61%) are wild species, 38 (37%) are cultivated and 2 (1.9%) are cultivated as well as spontaneous. Wild species are more abundant in the northern section of the province (62%) than in the south (35%). This phenomenon is attributed to the bioclimatic strata: semi-arid in the south, humid and sub-humid in the north.

Table 2, with 174 entries, summarises the claimed relationship between medicinal plants and pathologies for which they are used. The major illnesses which are treated by the indigenous people by plant products include digestive disorders (43 plants), renal disease (20 plants), bronchopulmonary problems (17 plants), skin disease (16 species), diabetes (13 plants), vascular system disorders (10 plants), nervousness and psychiatry problems (10 plants) and other divers diseases (45 plants).

TABLE 2
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Often, people use more than one plant either separately or mixed together. The plant products are consumed raw or in the form of a decoction, macerated material or as infusion for oral treatment and as burnt product, ointments or raw paste when applied externally. The indigenous population also uses folk-medicines derived from mineral and animal origin.

It is worthy of note that many of the alleged therapeutic indications in folk-medicine have already been demonstrated to be such by experimental studies. For example, several plants included in the present survey and reported to be useful in renal disease have been shown to have a diuretic effect in experimental studies: *Centaurium erythraea* and *Rosmarinus officinalis* (Haloui et al., 2000), *Zea mays* (Dat et al., 1992) and *Foeniculum vulgare* (El Bardai et al., 2001; Susplugas et al., 1991 and Tanira et al., 1996). The anti-diabetic and hypoglycaemic plants reported in the present compilation, *Trigonella foenum-graecum*, (Amin Riyad et al., 1988; Raghuram et al., 1994); *Ammi visnaga* (Alaoui et al., 1992); *Nigella sativa* (Ettaib et al., 1994) and *Ajuga iva* (El-Hilaly and Lyoussi, 2002) have proven to have such properties.

Some of the plants reported in this survey are also used in treating animals (for example, *Chamaerops humilis*, and *Urginea scilla*), and as preservatives for foodstuffs: *Myrtus communis* for meat, *Calamintha officinalis*, *Origanum compactum* and *Thymus* sp. for milk and olive, and *Nerium oleander* for grain.

3.3. Economical importance of the medicinal plant sector

During this research, we had problems in gathering information in some sectors not under formal Government control that are being exploited by a network of collectors who were less willing to cooperate because they avoid taxes. The merchandise (plants and plant products) is purchased from farmers in the mountain regions at a very low price by retailers who sell with large profit to wholesalers. Many of the collectors have direct connections with herbalists or industrial companies in the big towns such as Casablanca, Fez and Rabat. Most of the collected material is exported abroad. Intense exploitation is going on in this sector and many plant species are becoming scarce.

As shown in Table 3, among 102 plants inventoried, only 13 (12.7%), are actually commercialised on a large scale, with an estimated value of about 56,269,000 Dh per year (US$ 1,826,900 per year). It appears that *Capparis spinosa*, a plant domesticated in the southern part of the province, generates more income (11%) than other plants of the region.