

Ethnobotanical Study of *ARTEMISIA IFRANENSIS* J. DIDIER in Timahdite Region (Central Middle Atlas of Morocco)

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Abstract

With the purpose of valorizing the aromatic and medicinal plants, essentially the Asteraceae family, and ethnopharmacological heritage in the area of Timahdite province of Ifrane, Morocco. An fieldwork has been carried and consists of conducting an ethnobotanical survey on *Artemisia ifranensis* J. Didier, endemic species, in the region of Timahdite, located in the Moroccan Middle Atlas.

The Ethnobotanical study realised in June-July 2012 beside 82 different respondents permitted to describe their medicinal use at the local scale based on the local Known-how, and constitute a source of very precious information for the area studied and for subsequent researches for the domains of the phytochemistry and pharmacology in order to search for new natural substance. In tyhis study, the survey targeted men (70 %) and women (30 %), aged 30 to 50 years and The data Analysis showed that the overall level of schooling of the town was low (64% of the illiterate). The results of the study also had allowed to notice that the leaves was the usual used part (61 %). Most remedies are prepared in decoction (72%). Either, the survey revealed that the medicinal specie was mainly used against diseases of the digestive tract (63%), as well as for other treatment of various diseases as dermatological affection, and for relieving headaches or neuralgia.

Moreover, it also comes out from it that the conservation and the sustainable management of the medicinal species identified should be ensured through a management plan.

Keywords: Ethnobotany survey, Medicinal plants, *Artemisia ifranensis*, Endemic, Timahdite

Introduction

For several years, the man who lives side by side with plants, is used to consuming them for their medicinal and nutritional properties.

However, the development of medicinal plant research has been oriented towards obtaining phytomedicaments and is an essential step for the development of an entire sector related to the needs not only of the therapy, and the agri-food industry but also of cosmetics and perfumery.

Today, many studies carried out in the field of ethnobotany and ethnopharmacology, show us that the most modern scientific research has only confirmed the validity, on the one hand, of the therapeutic virtues of the most medicinal plants used empirically for millennia, and on the other hand would be almost devoid of toxicity^[1]. This traditional knowledge transmitted through generation became today a mine of extremely valuable information for all the researchers of especially pharmaceutical industry [1].

Morocco is one of the Mediterranean countries with a long medical tradition in the field of phytotherapy. The local traditional pharmacopoeia continues to be an important source of remedies for primary healthcare in the country [2,3]. Among the scientific disciplines which are interested in traditional phytotherapy, the ethnobotany, it is considered as a science of translating the popular know-how knowledge to scientific knowledge. In fact, various studies have been published in recent decades on the Moroccan ethnobotanic knowledge among which we mention: Kahouadji, (1995) [4], Bellakhdar (1997) [5], Hseini et al., (2007) [6], Mehdioui, (2007) [7], etc.

For this purpose, this work concerns an ethnobotanical research of a target medicinal plant via a prior description of their methods of valorization in phytotherapy by the local population, to pursue any biological activity, and orients towards a later chemical study, *Artemisia ifranensis* J. Didier, known for their medicinal properties since antiquity and endemic very present in the Middle Atlas and particularly in the region of Timahdite Morocco⁸. So we will try by this contribution to elucidate the mysteries of the therapeutic traditions confirmed in a long use very answered by the users and the healers. Implicitly one of the socioeconomic benefits is the enhancement of the local pharmacopoeia and the management of natural resources in the steppe environment of Timahdite, for a future interest as well ethnobotanical, pharmaceutical and phytotherapeutic.

Materials and Methods

Presentation of the Studied Area

The municipality of Timahdite (33° 14' 13' North 5° 03' 36° West) is placed under the administrative authority of Ifrane province (Figure 1). Located at 1800 m of altitude in full heart of the Middle Atlas 35km to the South of Azrou⁹, and extends over an area of 63375 ha with a population estimated at 6790 inhabitants, and a density of 14 inhabitants/km² under to the census 1994 [10].

As well, this region it has a semi-arid climate[11], a cold winter and a hot summer with a dry season during the period from May until early October, and a season cold from December to March[12]. The region is favoured by important and a diverse forest vegetation[13], sometimes of vast asylvatic pastures[14] which is a ideal traverses the farms mainly 'race Timahdite' which dominates, and is the main economic resource of the rural population[15].

Timahadite is located on a Liassic calcaireo-dolomitic substrate[14], and generally above this training a basaltic layer resulting from volcanic activity of quaternary[9].

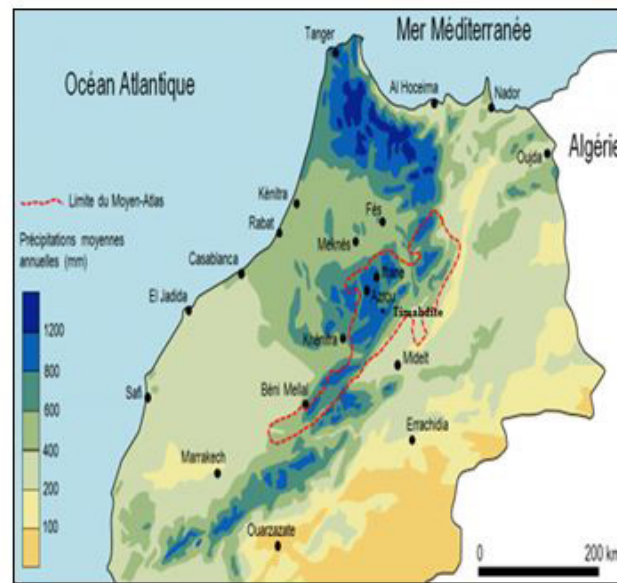


Figure 1: Map situation of the Timahdite town

Working Method of the Ethnobotany Study

To know the uses of *A. ifranensis* in traditional medicine, the visits were carried out in the town of Timahdite and were spread over a duration more than one month and started during June 2012. Information was obtained through the ethnobotany interviews with people born and/or who have lived long in the town. During the first phase, we proceeded to an exploratory survey without a questionnaire preset in order to become familiar with the terrain and the local vocabulary mixed Arabic and Berber. During the meetings with the inhabitants, we have tried to obtain general information on our plant. The second phase is based on an ethnobotany survey sheet (Annex. 1) submitted to the respondents in individual interviews. During this work, 82 interviews were performed with many different people, the survey was also conducted near the sellers of the medicinal species in the weekly local market "souk".

The data collected were analyzed using the Microsoft Office Excel 2010 for best viewing of the results.

Results and Discussion

The registered data on sheets of raw data were transferred in a database, treated and analyzed to get a data indexed and standardized bearing on the following aspects:

- Frequency of use of the medicinal plant in the area according in particular to the kind, the age, academic level, family situation, and income,
- Therapeutic uses attributed to the plant species,
- Modes of preparation and administrations most commonly mentioned,
- Marketing of the plant.

Frequency of use of the Medicinal Plant According to the Profile of Respondents

Distribution by Sex: In the region, there is still an involvement of local communities in the conservation of popular know-how in traditional phytotherapy. However, the men have more knowledge about the medicinal species compared to women (70% versus 30%) (Figure 2). These results confirm other ethnobotanical researches carried out at the national scale [16,17]. Dissimilar findings were also reported in other works [2,18,19,20,21]. However, the intensive use of this species in generation activities of income push people specially men to collect the plant in the town and its exploitation for the marketing.

Distribution According to the Age Groups : The data processing allowed to obtain the graph in figure 3 which shows that in the rural town of Timahdite, the persons that age belonging to the slices [30-40] years and [40-50] years, have the same frequency of plant use estimated toward 26%. Followed by the age groups [20-30], [50-60], [>60] and that less than 20 years with frequencies 23%, 18%, 5% and 2% respectively. The results obtained show effectively like other works already performed locally that people who belong to the class-age from 30 to 50 years have more knowledge of medicinal plants than the other age classes [18,21,22]. Knowledge of the properties and uses of medicinal plants are generally acquired following a long accumulated and transmitted experience from generation to another. The transmission of this knowledge is in danger now because it is not always assured, so traditional medicine affects the quality and sustainability of the natural environments [2,23].

Distribution According to the Level of Schooling : Interestingly, the frequency of use of medicinal plant was inversely related to the level of education of the interviewed population. Most users of the plant are illiterate with a percentage of 64% (Fig. 4). This result is similar to national data and show that the practice of medicinal plants is the prerogative of the poor[24], in other work the illiterate are the least[25]. However, persons, with a primary school level, have a percentage of use about 24%, while the use of pyrethrum was very little with a secondary (secondary 7%) or university education level (university 5%). These results accord those realized by Rachida Mehdioui and Azzedine Kahouadji in the rural town of Imi n'Tlit, (2007) [7], Lahsissene et al., (2010) [20], Benkhniqne et al., (2011) [21], and Abouri et al., (2012) [2]. The data analysis shows that the low schooling level of medicinal plants users may hinder the local development and promotes the degradation of the natural resources of the region. It's certainly related to poverty of families, geographical enclosure and to weakness of means of transport and of infrastructures.

Distribution According to the Family Situation : Wormwood plant is more used by married persons (68%) than singles (21%), widowers (6%) and divorced (5%) to avoid or minimize the financial loads required by the doctor and the pharmacist [20] (Figure 5).

Distribution According to the Income : Agriculture and livestock are the main socio-economic activities of population in the town [12]. Thus, The increase of poverty has pushed the population to seek additional incomes for a daily life [19], and they are obliged to resort to traditional phytotherapy and to use abusively medicinal plants. Our results obtained from our ethnobotanical surveys actually show that the income less than 1500dh/month of the most of respondents (70%) (Figure 6). Indeed, the persons earning less than 1500dh/month become attached more and more to traditional medicine.

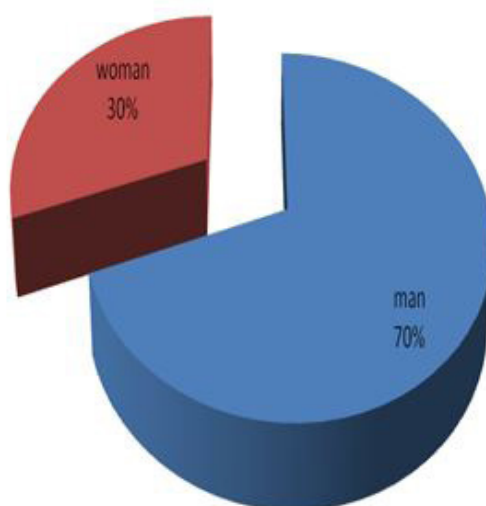


Figure 2: Distribution of use frequency of the species by sex in the rural town of Timahdite

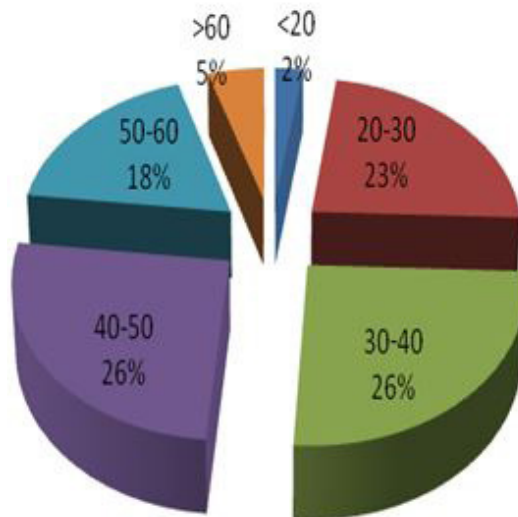


Figure 3: Distribution of use frequency of the species by age-classes in the rural town of Timahdite

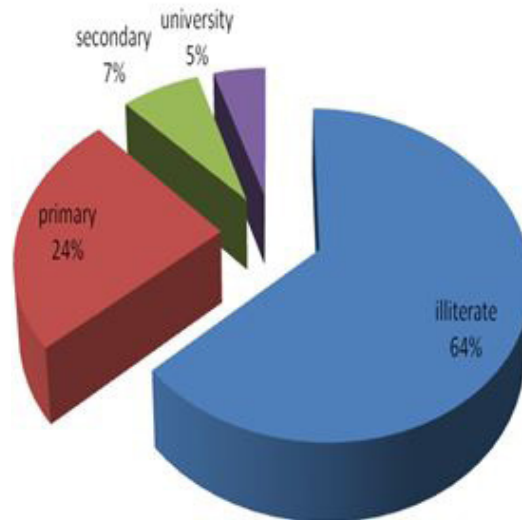


Figure 4: Distribution of use frequency of the species according to the level of study in the rural town of Timahdite

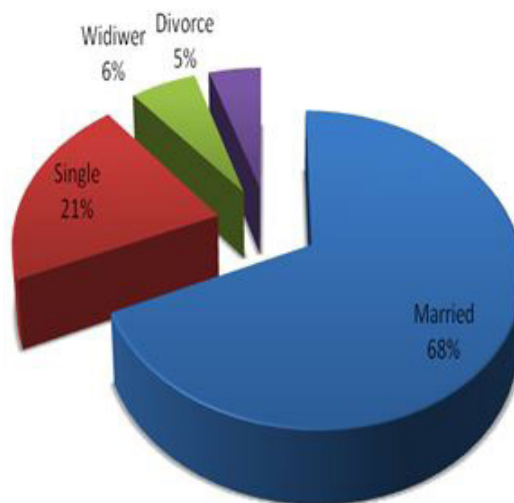


Figure 5: Distribution of use frequency of the species according to the family situation in the rural town of Timahdite

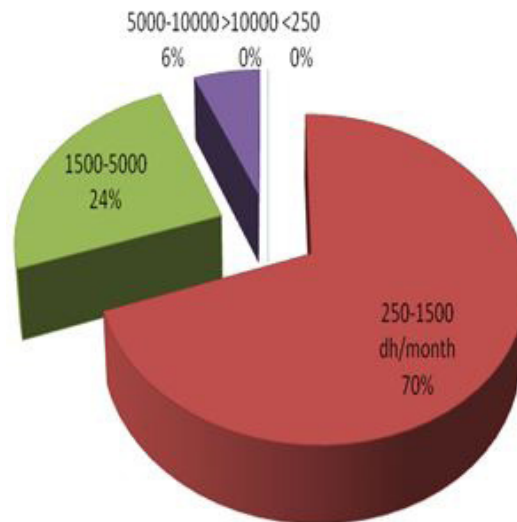


Figure 6: Distribution of use frequency of the species according to the income in the rural town of Timahdite

Ethnobotanic and Ethnopharmacologic Distribution of the Plant Studied

Used Parts: Various plant organs are used by the population for the satisfaction of their therapeutic needs. The results of the survey show that the leaves are the most used parts in the *Artemisia ifranensis* with a percentage of 61% (Figure 7), followed by stems and leaves (28%), and the whole plant (10%). The dominant use of the leaves of *Artemisia sp.* is concordant with the results reported in several studies [7,26,27,28,29,30,31].

This difference in proportions in the used parts of the plant is justified by the variability of concentration of the active substances in each organ of the plant or each species. The result can be explained view of leaves represent the place of the majority of photochemical reactions essentially the seat of photosynthesis and sometimes the storage of secondary metabolites responsible for the biological properties of the plant [17]. The leaves provide the majority of alkaloids, glycosides and essential oils. The importance of fruits is related at concentrations of their bitter, glucidic or aromatics substances associated with certain pigments which give them a characteristic colouring. The use of flowers is due to their richness in essential oils. It is the same for roots and seeds rich in sugars and vitamins [32].

Preparation Mode : The users are always seek the most simple method to prepare the phytodrug in the treatment of different symptoms. Thus, different therapeutic practices are used by the population, all the respondents use the plant leaves and flowers employing it in various preparations modes to facilitate the administration of active ingredient. Decoction preparation the most frequent mode for obtaining plant derivatives or preparing one phytomedicament containing wormwood (72%), it is employed probably due to the users who believe that the heat reduces the toxicity of plants [29] and they are also convinced that the decoction method makes it possible to collect more active ingredients and preserve their therapeutic virtues. It is followed by preparation by fumigation (15%), infusion (6%) and powder (5%) (Figure 8). Such a result seems to be found in other research studies [33,34,35].

Track of Administration: The mode of prepared remedies administration is in relation to the symptoms of the treated disease. The data processing illustrated by Figure 9, shows that 82% of plant species users benefit from their derivatives by oral administration.

Therapeutic Indication : Taking account of the respondents number submitted to the ethnobotany survey , we estimated that a use is mentioned with a frequency of at least three, might have a presumption to be considered as major use of the plant and deserves special attention. The ethnobotanical analysis of the collected information has identified a number of diseases treated by the medicinal specie studied. In fact, *Artemisia ifranensis* is consumed mainly against the digestive tract diseases (63%). It is also used against dermatological conditions (11%), and for relieving headaches or neuralgia (10%). The percentage of use of the plant for the treatment of diseases of genital device, urinary and respiratory tracts is about 8%, 6%, and 2% respectively (Figure 10). Similar results have been found in other research studies [36,37,38].

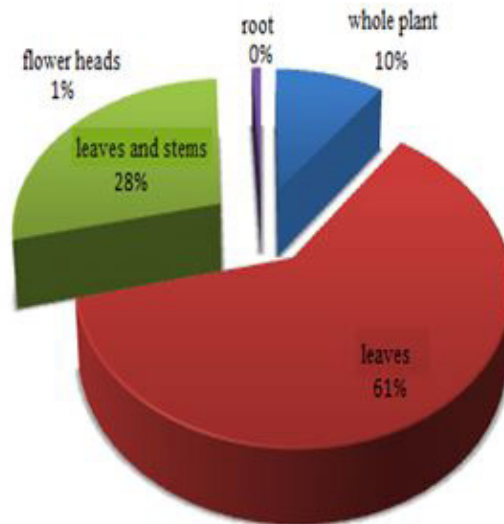


Figure 7: Distribution of the used part of the palnt specie in the rural town of Timahdite

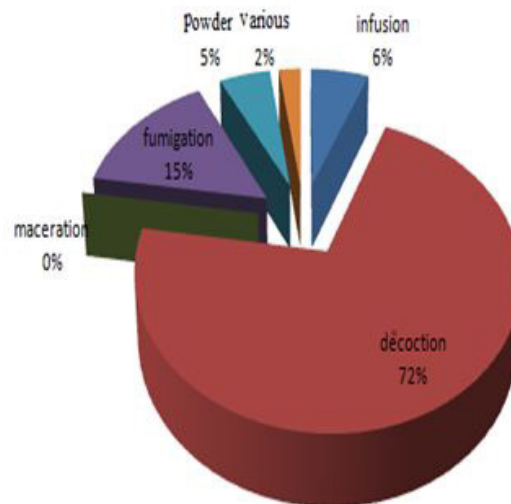


Figure 8: Distribution of the different preparation mode of the medicinal plant in the rural town of Timahdite

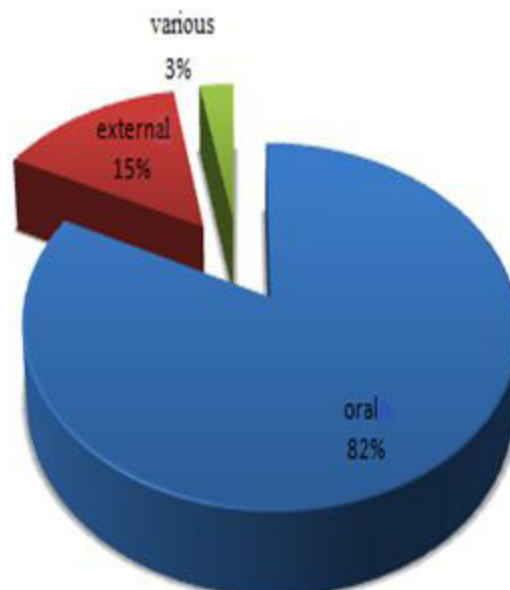


Figure 9: Distribution the track of administration of the plant species in the rural town of Timahdite

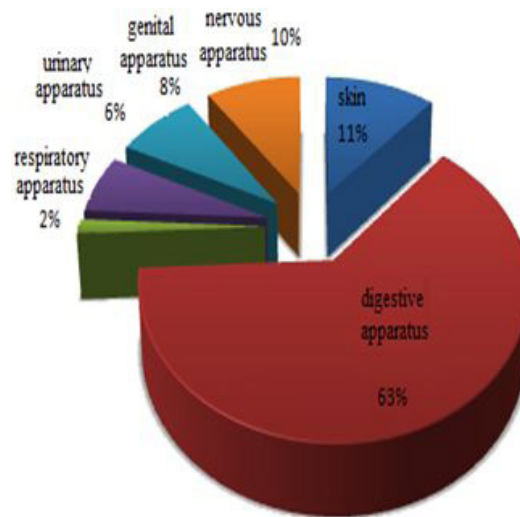


Figure 10: Distribution the different uses of the plant species in the rural town of Timahdite

Commercial Distribution of the Medicinal Plant

According to the Selling Price: The marketing of the specie plays an important role for the rural economy by improving the income of the population from the production and exploitation sites. According to our interviews, the survey shows that the producers sell the dried plant on the field at a price less than 30 dh/kg whereas in the fresh state, it costs 10DH per kg (Figure 11). The majority of the gatherers sell their harvest in wet form because of lack of means of treatment and conditioning of the plants (sampling, packing, transport, drying. These stages require spaces well-equipped, adequate equipment and one-week duration, according to the climatic conditions (sunning available).

According to the Circuit of Sales : Generally, all of the production in the aromatic and medicinal plants (AMP) field is intended for export. Indeed, the structure of trade and plant distribution networks remain traditional, archaic and informal. Thus, the survey revealed that the most frequently modes used for the plant marketing is the direct sale (on foot, edge of field, souk, or nearest market).

Sale circuits reflect a diversity of buyers types and market places. According to the case, the producers take the initiative to dry the plant and sell their products to an intermediary such the individual traders, domestic or foreign wholesalers, cooperatives, or to the final consumer. Indeed, sales of pyrethrum can stand in a local market (71%), national (26%) or international to a percentage of about 3% (Figure 12).

According to the survey we conducted in the Timahdite region, AMP sector suffers to predominance of informal sector, the lack of organization of production, distribution and marketing circuits which defend the sustainability and profitability of the sector.

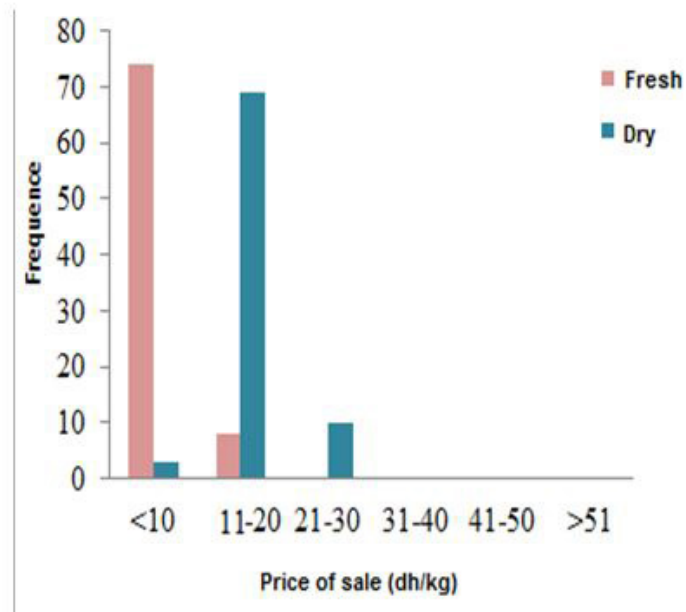


Figure 11: Distribution of the plant depending on its sale price

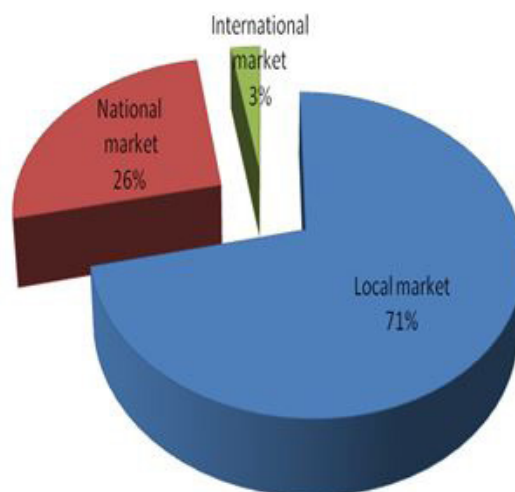


Figure 12: Distribution of the plant depending on market

Conclusion

The ethnobotany study of *Artemisia ifranensis* conducted in Timahdite region, has led to bring out the important place of traditional phytotherapy and confirmed the reduction of various species that were once abundant. Field visits by experts led to the same conclusion. The collection, synthesis and confrontation the collected data helped to contribute to the transformation of popular knowledge, from oral to written by establishing the monograph of plants and their use.

We can mention that the local population is the main factor of degradation of plant resources, since it is legitimate for it to take medicinal plants to provide for its needs, but it is certain that the mode of collection and the high use of certain species can contribute to the degradation of plant biodiversity. However, the new practices of commodification of natural plant resources are likely to cause great damage to this biodiversity, hence the interest of an intelligent policy of valorization and the promotion of this cultural heritage, which will ultimately make it possible to value biodiversity and contribute to the development and well-being of the people local.

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Declarations

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Conflict of Interest: The authors declare no conflict of interest.

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Survey Questionnaire

Moulay Ismail University Faculty of Science- Department of Chemistry Ethnobotany survey sheet of Artemisia ifranensis realized beside the population of the Timahdite region	Sheet N°..... Meknes
Area of study: _____ Zone or site: _____ Date of survey: _____	
<u>The demographic characteristics of the informant</u>	
1. Age: <input type="checkbox"/> A1 <20 <input type="checkbox"/> A2 [20-30] <input type="checkbox"/> A3 [30-40] <input type="checkbox"/> A4 [40-50] <input type="checkbox"/> A5 [50-60] <input type="checkbox"/> A6 >60	
2. Location of birth / current residence: <input style="width: 100px;" type="text"/> <input style="width: 100px;" type="text"/>	
3. Are you from the region? <input type="checkbox"/> Yes n <input type="checkbox"/> No	
4. Family status: <input type="checkbox"/> Married <input type="checkbox"/> Single <input type="checkbox"/> Widowed <input type="checkbox"/> Divorced	
5. Academic level: <input type="checkbox"/> Illiterate <input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> University	
6. Profession:	
7. Icome/month <input type="checkbox"/> Unemployed <input type="checkbox"/> 250-1500 <input type="checkbox"/> 1500-5000 <input type="checkbox"/> 5000-10000 <input type="checkbox"/> >10000	
8. Number of children:	
9. Know you plant? <input type="checkbox"/> Yes n <input type="checkbox"/> No	
10. How do you name it?	
11. Do you know other names for this plant?	
12. Do you use it? <input type="checkbox"/> Yes n <input type="checkbox"/> No	
13. It is used fresh or dry? Can we store it?	
14. Uses you plant with precise doses? <input type="checkbox"/> Yes n <input type="checkbox"/> No	
15. If yes, do you find it efficient? <input type="checkbox"/> Yes n <input type="checkbox"/> No	
<u>Ethnobotanical and ethnopharmacological plant characteristics</u>	
1. Type of plant? (Spontaneous, cultured, introduced)	
2. Which part of the plant does use it? (Leaf, flower, bud, fruit, twigs, bark, stem, root, whole plant, etc.)	
3. How do you prepare? (Infusion, decoction, maceration, Inhalation, Powder, Miscellaneous)	
4. Track of administration? (Oral, external application, other)	
5. What is therapeutic use? (circulatory, digestive, respiratory, urinary tract, genital tract, hearing, Visual system, nervous system, skeleton, skin)	
6. What can it serve else? (Culinary uses, domestic, symbolic, Decorative etc.)	
<u>Exploitation/Marketing</u>	
1. Part removed: <input type="checkbox"/> Leaf <input type="checkbox"/> Flower <input type="checkbox"/> Fruit <input type="checkbox"/> twigs <input type="checkbox"/> rod <input type="checkbox"/> root <input type="checkbox"/> whole plant	
2. Quantity removed (yield kg/day):	
3. Site of levy: <input type="checkbox"/> forest <input type="checkbox"/> collective lands <input type="checkbox"/> private lands	
4. Collection period: <input type="checkbox"/> Summer <input type="checkbox"/> Fall <input type="checkbox"/> winter <input type="checkbox"/> Spring <input type="checkbox"/> All the year	
5. Collection mode: <input type="checkbox"/> manual <input type="checkbox"/> tool <input type="checkbox"/> Other	
6. Which are the people who work in the collection? <input type="checkbox"/> nomad <input type="checkbox"/> Shepherd <input type="checkbox"/> farmer <input type="checkbox"/> herbalist <input type="checkbox"/> Other	
7. There are treatment and pretreatment of the plant before the sale?	
8. Which are the points of sale or place of marketing? <input type="checkbox"/> Local market <input type="checkbox"/> National <input type="checkbox"/> International <input type="checkbox"/> Other	
9. Price per the kilogram of plant in the field (Dh/Kg): Fresh <input type="checkbox"/> < 10 <input type="checkbox"/> [11-20] <input type="checkbox"/> [21-30] <input type="checkbox"/> [31-40] <input type="checkbox"/> [41-50] <input type="checkbox"/> P>51 Dry <input type="checkbox"/> < 10 <input type="checkbox"/> [11-20] <input type="checkbox"/> [21-30] <input type="checkbox"/> [31-40] <input type="checkbox"/> [41-50] <input type="checkbox"/> P>51	

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