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Ethnobotanical survey of toxic plants used in herbal medicine in the Rif, Morocco

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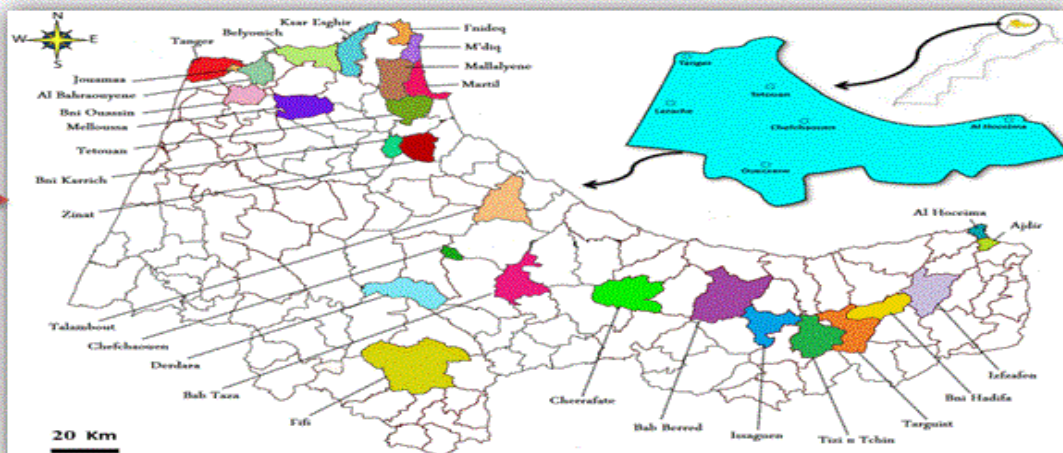
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Ethnobotanical survey of toxic plants used in herbal medicine in the Rif, Morocco

Study area



Methodology

Interviews: By conducting a stratified random sampling, samples are then formed in each of the 28 strata

Results

- Used part → leaf
- Plant Type → Spontaneous
- Use of the plant → Fresh
- Administration mode → Oral
- Method of preparation → Decoction
- Most cited plant → *Rosmarinus officinalis* L.
- The study identified → 84 Toxic plants, 30 botanical families



Abstract

Popular herbal medicine has served as a unique health provider for human beings for thousands of years. In the present study, we document the toxic plants used as medicines in the Rif, intending to assess the knowledge of indigenous people on the toxicity of the natural products used. Ethnobotanical survey was conducted in the Rif, northern Morocco between June 2016 and June 2018 using semi-structured questionnaires and focus groups. An investigation of the scientific literature was conducted to sustain or verify the claimed toxicological information. A total of 84 species of plants belonging to 67 genera and 30 families were reported as being used in the prevention and treatment of diseases. The families reported to be most representatives of these kinds of plants are Asteraceae and Fabaceae (7 species). However, the highly toxic plant prescribed was *Rosmarinus officinalis* L. Leaf was the most commonly used plant part, and the majority of herbal remedies were prepared from a decoction (40.6%). The results of this investigation showed that the local people in the Rif are still dependent on herbal medicine. These species used for remedial purposes are noted to have a potential toxic impact associated with their irrational consumption. Therefore, we recommend that attention should be observed when using them as medicinal sources.

Keywords: Herbal medicine, Human diseases, Medicinal plants, Survey, Toxicity



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Introduction

The history of herbal medicine, from ancient times to the present day, is rich in teachings. Since its appearance, only 3 million years ago, humans have used fine plants as food (1). Whether the plant is edible or toxic, it is used to kill the game and the enemy or to heal, humans have discovered through a series of failures and successes, the use of plants for his well-being (2). At present, herbal medicines can help us provide interesting solutions to the constraints associated with health, especially in developing countries. In the Moroccan Rif, phytotherapy is an ancient practice, which owes greatly to Arabo-Amazigh medicine, even if non-Muslims, Jews, and Christian particularly, have played an important part in this regard. Like all synthetic medicines, the use of medicinal plants causes deleterious effects on the human and animal body. The preponderance of medicinal plants contains dozens of complex composites, some of them with high complexity. Really, of about 400 000 plants studied, most of them comprise toxic substances (3). This said it resembles that medicinal plants should be used with precautions and toxicology investigations conducted to improve the knowledge of the plant or plant preparation given to communities (4). It has been shown that the toxicity of a given medicinal plant species depends on different factors (5; 6), including the dose used, the strength of secondary metabolites, the harvest season, the time of exposure, the climate and soil, the preparation mode (infusion, maceration, decoction, raw and cooked), the part used (root, fruit, leaf, stem, seed, and bark).



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Introduction

Cases of intoxications reported by the Center Antipoison and Pharmacovigilance of Morocco (CAPM) show that health problems due to irrational, anarchic, and uncontrolled practices of plants are far from negligible. In Morocco, plants were responsible for 5.1% of intoxications announced in the period between 1980 and 2008. The toxicity of plants usually produces morbidity and mortality. During the period registered, there were 4287 cases of poisoning, of which 357 cases were recorded as the maximum value in 2003. The high number of deaths was reported in 10 cases in 2001 (7).

Knowledge of the toxicity of the Moroccan plant species is only available to a low degree. Due to the absence of ethnopharmacological and toxicological studies in this area, we have little evidence that the risks of herbal medicine are clinically significant; this is explained by the lack of research in this field. It has recently reported that only 15% of randomized clinical studies of the evaluation of medicinal plants have taken into account the side and toxic effects of these plants (8). The main aim of this study is the valorization of poisonous medicinal plants and to provide an overview on the state of plant biodiversity of toxic medicinal plants, recommended by the actors of traditional medicine (herbalists, elder people, traditional healers, and druggists) in this region.



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Results and discussion

1- Demographic characteristics

The indigenous knowledge was obtained from 1000 local people in the study area. Based on socio-demography, the participants were categorized into various groups. Among the participants, 65.4% were men and the remaining were women 34.6%, with a sex ratio man/woman of 1.89. In terms of age, the age groups of 40–60 were very high compared to other groups (43.6%). Just 30% were more than 60 years old, 22.1% were 20–40 years old, and 4.3% of interviewees were under 20 years old. From the total respondents, 76.5% were married, 15.6% divorced, and 7.9% single. Recognizing the educational class, the preponderance of respondents (51.6%) was illiterate, while 34.1% and 13.6% of respondents attended primary and secondary school, respectively. Only 0.7% of respondents were tended to higher education. Concerning the source of information regarding the therapeutic use of medicinal species, the results showed that 78.5% of interviewed persons refer to the experiences of the other (parents and elderly relatives) for preparing recipes, which confirms the transmission of traditional practices from generation to another. While 20.3% of the population refers to herbalists and 1.2% of users prefer a pharmacist.



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Results and discussion

2- Most used families

A total of 84 toxic plants belonging to 67 genera and 30 floral families were documented from the study area as having rich healing uses. The Asteraceae and Fabaceae families were represented by the largest number of species with 9 poisonous species each (9-12), followed by Apiaceae and Solanaceae with 7 poisonous species each (13-17). These results are in general accordance with some ethnobotanical studies which indicated that the most prominent families were Asteraceae and Fabaceae (18-23).

The most important total of medicinal plants from these families may be due to their extensive distribution, richness, abundance, and a wide variety of phytochemical compounds in the species taxa belonging to this family in the Rif's area. Toxicological investigations on these plant families could contribute insights into their rich phytoconstituents and images of the pharmacological effects of their active composites (24).



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3- Relative frequency citation (RFC)

The relative frequency citation index authenticates the frequency of citation of a medicinal plant species used for different human diseases. Results of relative frequency citation (RFC) showed that the highest RFC value was reported for *Rosmarinus officinalis* L. (RFC = 18.9%), followed by *Dittrichia viscosa* (L.) Greuter. (RFC = 16.5%), *Nerium oleander* L. (RFC = 14.6%), *Salvia officinalis* L. (RFC = 11.9%), *Artemisia herba-alba* Asso. (RFC = 9.5%), and *Chenopodium ambrosioides* L. (RFC = 9.3%). The lowest RFC was reported for eleven toxic species (RFC = 0.1%).

The results reveal that more autochthonous people have a better understanding of medicinal plants as we find that the population is aware of the toxicity of certain parts of the plant which they avoid. Therefore, plant species that were not previously studied but have a high RFC should be further evaluated using toxicological and phytochemical techniques for drug discovery.



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4- Plant parts used in herbal medicine

Indigenous people in the study area collect diverse plant parts (root, leaf, flower, fruit, bulb, and seed) for the preparation of herbal remedies. Based on the plant part value PPV record, leaf (PPV = 0.476) was reported as the principal plant part for herbal medicine followed by seed (PPV = 0.180), root (PPV = 0.108), whole plant (PPV = 0.090), other combination (PPV = 0.055), and fruit (PPV = 0.047). While flower and bulb constitute PPV = 0.027 and PPV = 0.018, respectively.

Our finding on the proportions of different plant parts used in the Rif coincides with most of the other ethnobotanical investigations that have registered the predominance of leaves as being employed in the preparation of herbal drugs (25–32). The purpose of why leaves were frequently used could be that they are simply available and are active in photosynthesis and production of metabolites. Additionally, the collection of leaves has a less detrimental impact on plants compared to the harvesting of roots, fruit, and stem especially where there are no sustainable harvesting procedures in place (33).



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5- Diseases treated and their ICF values

The present study reported a total of 2663 reports of different diseases categorized into 6 categories. In the results, ICF varied from 0.9546 to 0.9786, where the dermatological diseases have elevated ICF value of 0.9786, with 469 use-reports for 11 toxic medicinal plants used followed by metabolic diseases (ICF = 0.9784), respiratory diseases (ICF = 0.9772), neurological diseases (ICF = 0.9754), and genitourinary diseases (ICF = 0.9555). The least ICF was associated with digestive system diseases (ICF = 0.9546).

The ICF indicates the consensus between plant species and informants concerning to the treatment of ailments. It signifies the best consensus between plant species and treated dermatological diseases because local people interviewed used precise plant species commonly for dermatological diseases. High ICF is correlated to species that could be efficient in treating a particular ailment (34). Consequently, species with high ICF are to be prioritized for further toxicological and pharmacological studies



Results and discussion

6- Preparation modes and routes of administration

In herbal medicine, there are several modes of preparing plants, depending on the use you want to make of them. The results showed that the majority of remedies were prepared from decoction (40.6%), followed by infusion (25.2%), cataplasm (15.4%), other modes (12.1%), and cooked (6.7%). These results are in general accord with previous ethnobotanical inventories which designated that the most important mode of preparation was decoction (35-41). Furthermore, these results explain that the indigenous people in the Rif region believe in decoction mode and found it suitable for heating the body and decontaminating the plants. Indeed the decoction allows collect the most for the active ingredient and attenuates or cancels the toxic effect of certain recipes (12-17; 42). The routes administration in this study changes with the type of ailment treated and the actual sites of the diseases. The result revealed the most route of application for herbal therapeutics was oral (84.8%). Also, the oral administration is a favored route all over the globe (22-30; 43-46). Nevertheless, the recommendation of medicinal plants, essentially based on oral administration represents a real health danger.



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Conclusions

In total, 84 poisonous medicinal plants belonging to 67 genera and 30 families were reported to be used by indigenous people from Northern Morocco. This study demonstrates that the practice of herbal medicine in the Rif region is increasing incredibly; our informants blindly trust this medicine without taking into account the danger of these plants on their health and this is due to the know-how acquired, the population (older) has learned relatively to recognize the dose and the part which brings the least toxicity (local culture to save). Medicinal plants, like medicines, must obey strict standard rules that only the herbal medicine professional can meet. Therefore, attention should be employed when using these plants, especially medicinal purposes. It is important to obtain information on these medicinal plant-based remedies prepared and prescribed by therapeutics, especially in terms of toxicity, composition, specific effectiveness of illness, and to encourage practitioners of this herbal medicine on the protection and safeguard of patients. This necessarily means regulating the profession in our country. We believe that any poisonous plant or ingredients taken from toxic plants should be tested before being used as a remedy. Hence, various advanced cell biological, biochemical, molecular biological and in vitro cell culture techniques should be applied with different medicinal herbs in order to test their safety before testing their efficacy.



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