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An ethnoveterinary investigation into medicinal and aromatic plants used to treat livestock diseases by the local communities of the Rif, north of Morocco.

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pharmaceuticals MDPI

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An ethnoveterinary investigation into medicinal and aromatic plants used to treat livestock diseases by the local communities of the Rif, north of Morocco.

Graphical Abstract

Field Survey (2016-2020)
Zemmour an Zayane tribes

- Species identification
- Data collection
- Data Analyses

Results

150 plant species
129 genera
56 families

11 species of animals were treated

11 health diseases categories

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Abstract:

Ethnopharmacological relevance: The extensive use of medicinal plants in the healthcare practices of indigenous peoples serves as a basis for the development of natural medications. The objective of the present research was to provide a comprehensive ethnoveterinary understanding of medicinal plants used for therapeutic purposes. **Methods:** The Zemmour and Zayane tribes were the focus of the field inquiry from January 2016 to December 2020. (Middle Atlas). Open-ended and semi-structured interviews were conducted with three hundred local informants. Various criteria were used to quantify the ethnoveterinary's benefits, scope, and relevance, including informant consensus factor, fidelity level, relative popularity level, rank-order priority, and Jaccard index. **Results:** In ethnoveterinary preparations, 150 plant species belonging to 129 genera and 56 families were used. *Allium sativum* L. was the ethnoveterinary plant species used most often in the research region (16.7%). Leaves are the most common plant portion used (46.5 %). The intestinal illnesses had the highest FIC score, at 0.90. The species *Artemisia herbacea* Asso and *Asparagus officinalis* L. Both demonstrate a 100% accuracy for diarrhea and rabies, respectively. The most recommended plant species for fever medicines was *Eucalyptus globulus* Labill. (ROP = 74). **Conclusions:** research reveals that indigenous people in the Middle Atlas consistently understand ethnoveterinary herbs. In this investigation, we encourage chemists and pharmacologists to do more phytochemical and pharmacological research on medicinal plants with high ROP, FL, and FIC relevance.

Keywords: Animal diseases, Ethnoveterinary, Medicinal plants, Herbal medicine.

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Introduction

Ethnoveterinary medicine refers to the collective knowledge of an indigenous community about relationships between people and nature. This relationship has continued since time immemorial [1]. For millennia, nature has given therapeutic herbs, and a significant proportion of contemporary medications have indeed been obtained from vegetable products [2]. Generally, native communities have embraced herbs to treat various human and livestock ailments. A long-standing socio-cultural relationship between tribal peoples and the environment resulted in the evolution of indigenous knowledge within societies, including plant-based remedies to treat human and animal health problems [3]. Ethnoveterinary medicine (EVM) is based on traditional folk skills, tactics, methods, techniques, approaches, knowledge, theories, concepts, beliefs, and practices for curing various ailments, healthy farming, and animal health management [4–6].

Introduction

This diverse knowledge and ethnoveterinary capacities can be learned thru experience and passed down from generation to generation [7]. Traditional wisdom has become extinct in some civilized countries [6]. This poses a risk to the development and long-term viability of conventional practices. The African adage aptly describes the significance of this corpus of information: “When a knowledgeable old person dies, a whole library disappears” [8]. On the other hand, EVM plays a significant role in livelihood management and adequate animal husbandry in many poor rural communities worldwide [9] and often provides the only general standards for agriculturalists to treat animal illnesses. The use of EVM to control livestock diseases has been cited by the World Health Organization [10], which estimated that 80 percent of the population in underdeveloped nations depends only on the traditional system of medicine for primary medical care.

Introduction

More than half the world's people still rely exclusively on plants for remedies, and plants supply the active components in most traditional medicinal goods. Farm animals strongly influence Morocco's socio-economic existence. With a substantial human population and around 36 million economically affluent prospective customers, household consumption for these food items is fast expanding; need often surpasses supply. The livestock population in Morocco is estimated to consist of 3.441 million cattle, 19.880 million sheep, 5.732 million goats, and 456 million poultry birds, according to the 2nd livestock census [11]. Although the heads of livestock in Morocco are numerous, the high mortality and health risks due to various diseases and parasitic infections have posed a grave danger to the development of livestock farming in Morocco. Each year, roughly 12% of cattle and 25% of poultry birds die due to numerous illnesses and inadequate health care.

Introduction

The number of veterinarians does not exceed 1500 nationally. We currently have one veterinarian for every 374000 animals covering 12 regions and a 710 850 km^2 area [12]. Throughout many emerging regions, herders and farmers cure their animals using a combination of local ethnoveterinary traditions and contemporary veterinary health care. Presently, the use of ethnoveterinary medicinal plants is in the guardianship of the elders of the tribes. Their documentation is necessary to transfer this knowledge to other community members in written form. In light of the above, the principal purpose of this investigation is to document ethnoveterinary knowledge of plants used by the indigenous communities of the Zemmour and Zayane tribes to control and treat various livestock ailments (Figure 1).

Introduction

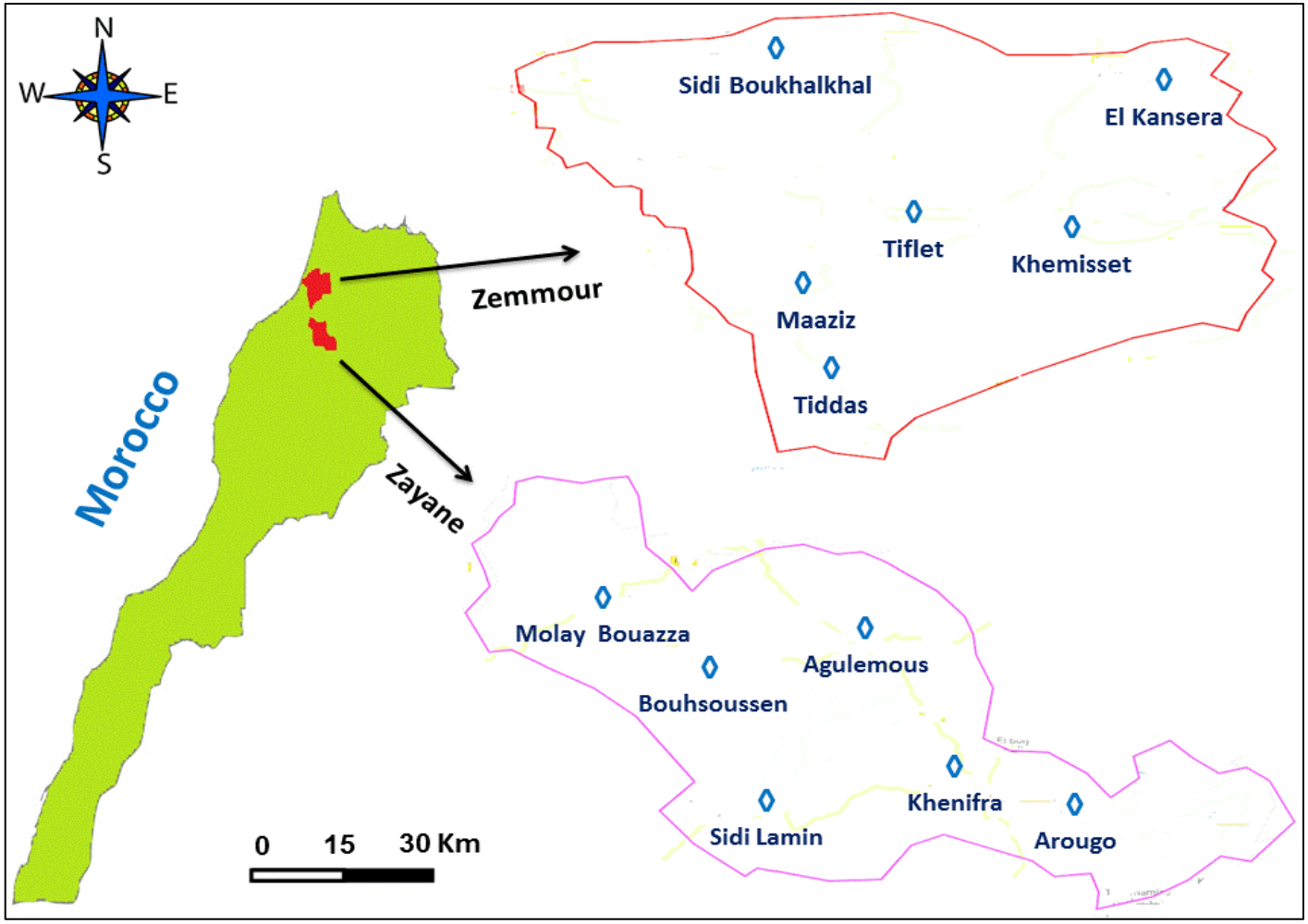

Figure 1. Map of Morocco showing the Zemmour and Zayane tribes.

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Results and discussion

Overall, this study revealed the veterinary use of 150 medicinal plant species, distributed among 129 genera and belonging to 56 families, to treat 11 categories of diseases, recorded by 300 participants ranging in age from 40 to 100 years, including cattle holders, shepherds, nomads, knowledgeable elders, local farmers, village leaders, and traditional practitioners. These results indicate that the study area has rich ethnoveterinary medicinal plants and indigenous knowledge associated with conventionally used species. Similar results have also been found in other regions of the Middle Atlas [13, 14–16]. This comparison shows that the study regions have a wide variety of ethnopharmacological herbs.

Results and discussion

The Lamiaceae family was primarily reported by informants, followed by Asteraceae and Fabaceae; this is probably due to their richness in the flora of the Middle Atlas and their traditional applications known in herbal medicine by the native tribes of Zemmour and Zayane. The current research corroborates results from other regions of Morocco and other parts of the globe [17, 8, 11, 13, 2, 8, 18–21]. In this study, the analysis revealed that nine kinds of plant parts are used for herbal tea as restorative materials. The most commonly gathered plant parts are the leaves and seeds, which are used to prepare a variety of livestock-specific therapeutic formulations.

Results and discussion

The therapists' preference for using leaves in the production of herbal remedies is likely owing to their year-round accessibility and their ease of collection, storage, processing, and handling. Leaves and seeds are generative, renewable components, and collecting them does not result in death. Leaves are expected to contain more readily extracted phytochemicals, crude medicines, and a variety of other combinations that might be useful in herbal remedies [22, 23]. Similarly, ethnobotanical investigations in Morocco and other regions worldwide [7, 9, 12, 20, 21, 24–28] have found that medicinal herbs' leaves have been frequently used to heal human and animal illnesses.

Results and discussion

The highest percentage is calculated for *Allium sativum* L., *Artemisia absinthium* L., and *Rosmarinus officinalis* L. *Allium sativum* L. is significantly cited in several ethnobotanical investigations done across the globe [28–32]. These plants are arranged according to the number of respondents who identified them. These herbs are indigenous to the Middle Atlas and have been known by indigenous societies for a long time. Moreover, since these plants are prevalent in the study regions, the Zemmour and Zayane tribes know them intimately. These findings are significant because they might serve as a foundation for future studies on plant-derived therapeutic chemicals, possibly leading to the discovery of new drugs [33].

Results and discussion

The findings indicated that the majority of herbal prescriptions were made using decoctions. The plant's principal solvent was water, although tea, milk, honey, oils, and butter were also commonly employed as components. These findings indicate that the local people believe in the decoction method and find it helpful in warming the body and sterilizing herb species [34]. On the other hand, the decoction delivers the maximum number of bioactive chemicals and ultimately reduces the harmful impact of toxic substances. Decoction and infusion are the most popular folk medicinal procedures employed by patients, who prepare plant components by combining them with water, soup, or tea [25, 27, 33, 35–39].

Results and discussion

The investigation discovered that medicinal plant medication doses were unclear, and their negative consequences were unknown. This is risky since it is easy to overdose on the cure without realizing it. One hundred fifty plant species have been identified to cure 11 different ailments (Table 1). Digestive system problems were among the most commonly treated conditions. During the research, it was discovered that locals in Zemmour and Zayane bought herbals primarily for digestive problems. Common digestive disorders may be caused by health ailments, deficiency of pure water, the stress in livestock, lack of pasture due to drought that sweeps the Middle Atlas from time to time, and toxic substances present in agriculture fields.

Results and discussion

Table 1. Categories of diseases with FIC value and number of use reports

Diseases category	Number of use reports	Number of taxa used	FIC Value
Digestive problems: Indigestion, Enteritis, Flatulence, Ulcer, Diarrhea, Constipation, Gastritis, Anthelminthic, Colic, Hemorrhoids	812	82	0.900
Poison bites: Snakebite, Insect bite, Scorpion bite	66	8	0.892
General health: Lameness, Swellings, General weakness, Anorexia, Sore eyes, Pediculosis	235	28	0.885
Microbial infection: Cholera, Ectoparasites, Endoparasites, Dysentery, Measles, Jaundice, Chickenpox, Rabies, Anthrax, Sheeppox, Goatpox, Foot-and-mouth disease, Listeriosis	243	34	0.864
Skin: Allergy, Albinism, Eczema, Ringworm, Urticaria, Cracked heels, Vitiligo, Skin edema, Scabies	166	24	0.861
Fever and cough: Fever, Cough	178	28	0.847
Urinary problems: Diuretic, Painful urination, Burning urination, Dysuria, Urinary incontinence	40	7	0.846
Respiratory problems: Bronchitis, Flu, Pneumonia, Asthma, Respiratory distress	187	30	0.844
Sexual and related disorders: Excessive bleeding, Dystocia, Leucorrhoea, Uterine disorders, Infertility, Abortion, Dysmenorrhea, Lactation problem, Mastitis	141	23	0.843
Pain and Wounds: Wound, Toothache, Naval pain, Earache, Headache, Knee pain, Gout	110	21	0.817
Bone problems: Bone fracture, Polyarthritis, Rickets, Hip dislocation, Paralysis, Rheumatism	53	12	0.788

Results and discussion

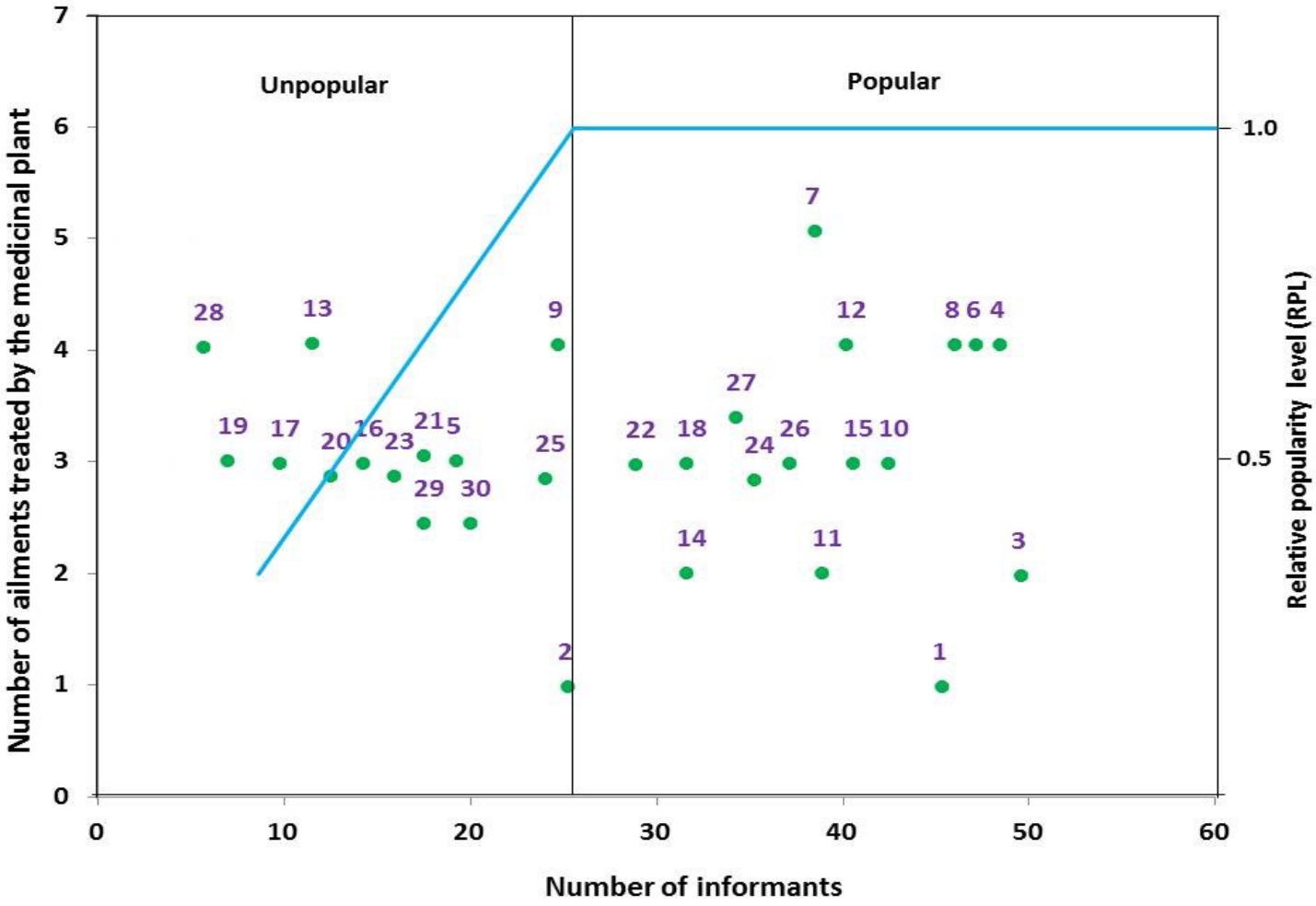
The preponderance of digestive system cures confirms previous ethnobotanical investigations undertaken in other areas [23, 40–43]. This is congruent with the assertion that conventional pharmaceutical medicines are often reserved for managing mild-to-moderately severe disorders [44]. Further, high FIC values may be utilized to identify promising species for active phytochemical discovery [45]. Conversely, the most inferior FIC was discovered for toothaches and fever, indicating little or no agreement on using plants to treat these ailments. The lowest FIC does not negate the significance of species in those classes. The low FIC value may be related to the research participants' inability to provide data.

Results and discussion

In our work, medicinal plant species with an elevated relative popularity level were: *Eucalyptus globulus* Labill., followed by *Artemisia absinthium* L., *Rosmarinus officinalis* L. The widespread popularity of these plant species may be related to their excellent effectiveness and the Zemmour and Zayane people's choice understanding of their usage as herbal remedies. Plant species are categorized into two at the base of the RPL index: unpopular and popular groups. In this study, 14 medicinal plants were classified as unpopular because they were reported by fewer than 50 interviewees, while 16 plant species were classified as popular because more than 50 respondents cited them (Figure 2).

Results and discussion

Figure 2. Correlation between the numbers of informants claimed use of 30 plant species for a particular disease.



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Results and discussion

Each species has a unique ability to heal, which is quantified by its FL level [46]. The fidelity level of the thirty most significant plant taxa varied between 65 and 100%. *Artemisia herba-alba* Asso and *Asparagus officinalis* L. show a 100% fidelity level for diarrhea and rabies, respectively. Phytochemical, pharmacological, and biological activity may reveal that these taxa are valuable medicinal plants [47]. Similarly, increased FL levels for a plant species demonstrate its unique ability to cure a particular ailment [48]. Conversely, species of plants with low FL indicate that they were least favored. Furthermore, it may also mean that medicinal herbs employed to control and cure a specific condition have a higher degree of fidelity than those used to treat other types of diseases [49].

Results and discussion

Rank Order Priority (ROP) is a weighted metric used to describe how species perceive the abundance of the supplies referenced in the examined use class [50]. The present study indicated that *Eucalyptus globulus* Labill. (ROP = 74), *Artemisia absinthium* L. (ROP = 55), *Rosmarinus officinalis* L. (ROP = 52), *Trigonella foenum-graecum* L. (ROP = 50) had the most elevated scores of ROP; this indicates that these species are the primary plant species used by native populations of the Middle Atlas in their ethnoveterinary traditions. Furthermore, this is likely attributable to the decline in the popularity of natural remedies among the study regions' indigenous tribes. At the same time, medicinal herbs such as *Artemisia herba-alba* Asso (ROP = 16) and *Asparagus officinalis* L. (ROP = 15) were given less priority by the indigenous inhabitants.

Results and discussion

The findings of this study are compared to those of twenty national and international studies done in places with climatic circumstances and cultural values comparable to the study regions. The results demonstrate that across 116 medicinal plants, the similarity percentage varies from 33.33 to 4.62, while the dissimilarity percentage varies from 33.96 to 3.47. The High Atlas Central research exhibited the highest similarity [51], followed by the High Atlas, Morocco [52], and Beni Mellal Region studies [53] with JI values of 15.74, 13.07, and 11.97, respectively.

Results and discussion

The lowest JI scores were for the investigations performed in the Gujar Tribe, Kashmir Himalaya [54], and Mutasa District, Zimbabwe [55]. These investigations were conducted at a greater distance from our research site, indicating a higher disparity in ethnoveterinary knowledge due to population size, species variety, and habitat structure variations. Moreover, there would be less opportunity for cultural information to be exchanged between these studies and our research regions since mountain ranges and cultural differences separate the areas [56]. Medicinal plants, owing to their bioactive constituents and medicinal and antioxidant properties, have been found to benefit human health and to be helpful for a variety of problems and disorders [57–62].

Conclusions

The present investigation revealed that the study regions have a great reservoir of ethnoveterinary medicinal plants. The indigenous peoples of Zemmour and Zayane have extensive and widespread knowledge about how to use these plant species to treat their livestock. Although contemporary healthcare institutions are accessible, the communities continue to depend on alternative therapies, demonstrating the importance of indigenous herbal plant remedies. Due to its simplicity of accessibility, easy preparations, and application to animals, phytotherapy is deemed adaptive and sustainable for rural agricultural communities.

Conclusions

This study, we feel, will promote further ethnoveterinary investigation into animal disease control strategies in the study regions. Medicinal plants with high FL and FIC scores should be subjected to pharmacological testing, chemical analysis to discover bioactive compounds, and probable formulation as common medication preparations for treating various animal ailments. Consequently, it is critical to develop a preservation strategy for the Middle Atlas vegetation, focusing on taxa as necessary as medicinal and aromatic plants.

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