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Inventory of gastrointestinal anthelmintic medicinal plants used by urban populations in Niger: case of the urban communes of Agadez, Niamey and Zinder

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Abstract:
Background*: Traditional medicine constitutes for Africa in general and for Niger in particular a cultural and economic heritage of undeniable importance. However, the development of this heritage poses a certain number of problems, one of the most important of which remains the distrust of healers in sharing their often-initiatory knowledge. Thus, it is important to conduct an ethnobotanical study to keep the medicinal secrets of plants in writing.*
Materials and Methods*: An ethnobotanical survey was carried out, using a pre-established questionnaire addressed to traditional practitioners according to their availability through direct and individual interviews. For this, the technique of semi-structured open interviews is used to collect information.*
Results*: The data collected made it possible to inventory twenty-five species divided into eighteen (18) families and twenty-two (22) genera. The best-represented families are the Fabaceae with five (6) species followed by the Combretaceae (Three (3) species), then come the Asteraceae and the Solanaceae with two (2) species each. The most used species in the gastrointestinal anthelmintic treatment are: Detariummicrocarpum (76%), Combretum glutinosum (72%), Carica papaya (66%), Momordica balsamina (64%), Prosopis africana (64%) Acanthospemumhispidum (60%), and Pterocarpus erinaceus (56%). The plants used are mainly herbs (60%) and trees (40%). The bark, leaves, and roots are the organs most used in the treatment of this disease. Decoction (65%) and maceration (29%) are the most common methods of preparation. Several harvesting methods are used for sampling, which is not without consequences for plant species.*
Conclusion:*This study highlighted the diversity and importance of phytodiversity in gastrointestinal anthelmintic treatment. The results also showed that the urban population uses medicinal plants to treat gastrointestinal worms.*
Key Word*: Medicinal plants, Niger, Traditional medicine, Antihelminthic, gastrointestinal.*

I. Introduction

According to the WHO (2002), 80% of the population uses traditional medicine based on medicinal plants in primary health care. Mounkaila (2018) identified 95.24% of people who use plants for care. This justifies that interest and research in the field of indigenous knowledge have increased in recent years, especially after the Rio de Janeiro Conference (Wezel, 2002). Despite the performance of modern medicine, African pharmacopoeia still occupies an important place in health care in Africa today (Cherry et al., 2015). Medicinal plants constitute a precious heritage for humanity and more particularly for the majority of poor communities in developing countries who depend on them to ensure their primary health care and their livelihoods (Salhis, 2010). Knowledge about medicinal plants is held by people who today have difficulty transmitting it because their offspring no longer want to follow in their footsteps Mounkaila (2018). According to Aké Assi (1983), in rural areas, each inhabitant knows and uses the virtues of one or more plants. Among the knowledge about medicinal plants, there is that relating to the treatment of worms.

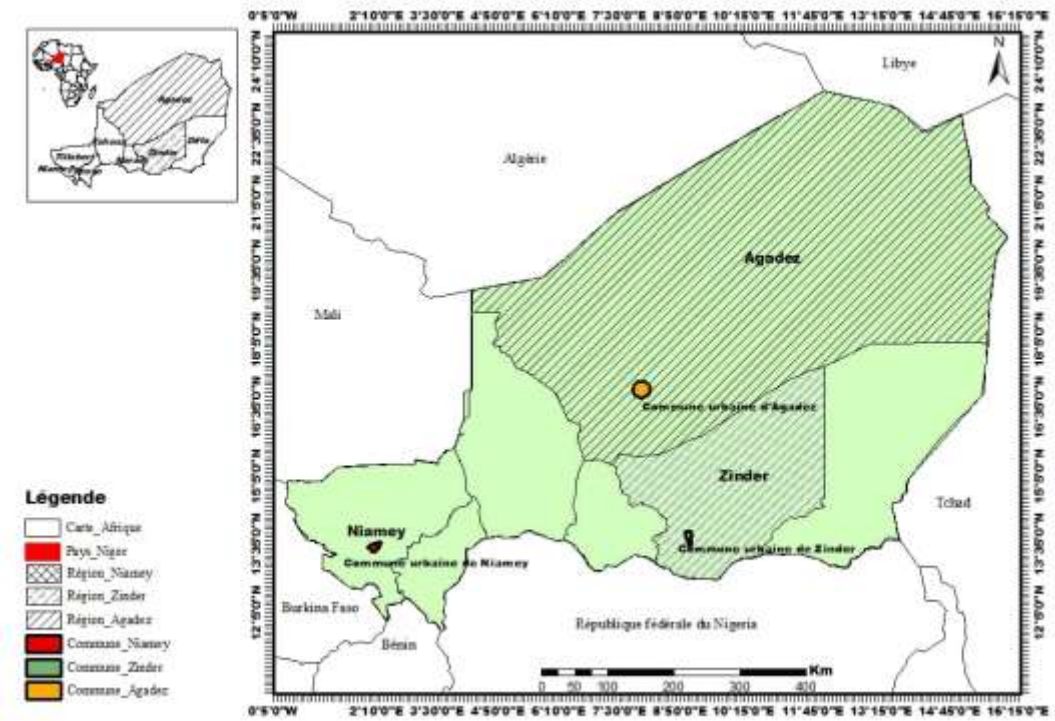
Helminths are parasitic, round, or flatworms. The term helminth is above all a synonym for parasitic worm without variable qualifying value, which is used in particular in parasitology to refer to long or soft worm-like animal species that infest the body of other species. The number of species of different helminths is vast, it

is estimated at around one million species. Nematodes are the most diverse of all helminths with the greatest number of species. Helminthiasis is one of the major health problems in the world. Around 1.5 billion, or 25% of the world's population, are affected by this photology, particularly in tropical countries, especially in the areas of sub-Saharan Africa, South America, China, and Eastern Asia (WHO, 2010). Ascariasis is the most common helminthiasis, it is a cosmopolitan parasitic disease affecting more than 1 billion of the world's population (Machouart, 2010). In South East Asia, it reaches 237 million of the population, 84 million in America, and in Africa including Madagascar, it reaches 173 million of the population (WHO, 2003).

Man's concern has been the satisfaction of his food needs, he has thus developed an intimate relationship with the environment that surrounds him. To heal himself, he learned, to his advantage, to discern the plant and animal resources necessary for his survival. For this, he was inspired by the habits of animals, his experience, and sometimes his imagination. This is why the uses of plants have often turned out to be tragic (Pousset, 1989). People in Africa, Asia, and Latin America use traditional medicine to meet their primary healthcare needs. In addition to being accessible and affordable, traditional medicine often belongs to a larger belief system and is considered an integral part of everyday life and well-being. (WHO, 2002). The risk of seeing certain healers disappear without having revealed their secrets, leads to redoubled efforts to keep information on medicinal plants in writing but also to promote them. It is for this reason that this study was conducted in three urban communities in Niger. The general objective of the present study is to contribute to the knowledge of medicinal plants used against gastrointestinal worms in three cities (Niamey, Agadez, and Zinder) with a view to their rational and sustainable use in Niger.

II. Material And Methods

2.1. Study area



The study area is located in two bioclimatic zones, namely Niamey and Zinder for the Sahelian zone and Agadez for the Sahelo-Saharan and Saharan zones. All these areas have two seasons (dry and rainy)
The vegetation of Niamey is made up of thickets (the lateritic plateaus) and steppes (the sandy terraces, in the dry valleys and on the dunes. For Zinder, we note natural vegetation with scattered trees, shrubs, and grasses. The terroir is generally flat in this savannah zone whose dominant trees are thorny species and non-thorny species.

Although desert, Agadez conceals important assets in the forest areas with natural reserves, forest formations of floodable tree steppe whose dominant species are Hyphaene thebaïca, Acacia ehrembergiana, Acacia raddiana, Acacia nilotica, Balanites aegyptiaca, Calotopisprocera, Ziziphus mauritiana etc....

2.2. Methods

The ethnobotanical surveys on medicinal plants were carried out using questionnaires; these surveys made it possible to draw up a list of medicinal plants used by the populations of Zinder and Agadez in traditional herbal medicine.Structured and semi-structured interview techniques were used to collect information in the field. Thus, a survey based on direct interviews is carried out on the uses of medicinal plants used in traditional pharmacopeia and the impact of sampling techniques on these plants. This involves precise information on the one hand on the informant, the identity of the plant used, the part used, the method of preparation and medicinal uses, and on the other hand on the impact of the sampling methods on these resources. The questions are direct and based on dialogue in the local language, sometimes accompanied by the purchase of the medicinal plants sold or the presentation of the species if it is available.People aged 31 and over, regardless of gender, are assumed to be holders of ancestral knowledge and better suited to witnessing ecological changes and providing uses of plant species (Barmo 2008).

The evaluation of the levels of knowledge and relative consumption of species were calculated according to the formula used by several authors (N'Dri et al., 2008, Vanié-Bi et al., 2021) which is written as follows:

$Cr=n/N\times100$

with Cr = level of knowledge of the species; n = number of people who recognized the species and N is the total number of people interviewed.

The classification following the evaluation of the knowledge levels of the species was made using the Dajoz method (Dajoz, 1982). Thus, for a Cr between 50 and 100%, the species is considered better known; for a Cr between 25 to 50%, the species is considered moderately known and for a Cr less than 25%, the species is considered little known by the people interviewed.

It should be noted that a multiple correspondence analysis (factorial map of the categories of variables) was carried out in order to highlight the variables best correlated with the main axes and also the degree of dependence between the modalities of the variables.

III. Results and Discussion

3.1. Results

3.1.1. Floristic analysis

This study made it possible to identify 26 plant species divided into eighteen (18) families and twenty-two (22) genera. The most represented families are Fabaceae (5), Combretaceae (3), Asteraceae, and Solanaceae 2 species each.

Scientific names	Families	Parts used	Preparationmethods	Levels of knowledge
Acanthospemumhispidum	*Asteraceae*	Leaves	Decoction,	60
Albizia chevalieri	Mimosaceae	Leaves, roots	Decoction, Decoction	54
Allium sativum	*Amaryllidacées*	Fruits	Infusion	52
Anogeissusleiocarpa	*Combretaceae*	Bark	Maceration	48
Artemisia campastri	*Asteraceae*	Leaves	Decoction	26
Azadirachta indicaA.Juss	Méliacées	Leaves	Decoction, maceration	32
Capsicum annuum	*Solanaceae*	Leaves	Decoction	30
Capsicum frutescens	Solanacées	Leaves	Decoction	26
Caricapapaya	*Caricaceae*	Graines	Infusion	66
Cassia italica	*Fabaceae*	Leaves	Decoction	34
Cassia occidentalis	*Fabaceae*	Rhizome	Decoction	28
Celosiatrigyna	Amaranthacées	Leaves	Decoction, maceration	28
Chasmantheradependens	*Menispermaceae*	Leaves	Decoction	24
Combretumaculeatum	*Combretaceae*	Leaves, bark	Decoction, maceration	24
Combretumglutinosum	*Combretaceae*	Bark, Rootss	Decoction	72
Commelinaforskalae	*Commelinaceae*	Leaves	Decoction	24
Diospyrosmespiliformis	Ebenaceae	Leaves, roots	Decoction, maceration	36
Euphorbia aegyptiaca	*Euphorbiaceae*	Whole plant	Decoction, Decoction	26
Hibiscus sabdariffa	*Malvaceae*	Leaves	Decoction	26

Lanneaacida	Anacardiaceae	Leaves, roots	Decoction	46
Lonchocarpussericeus	Fabaceae	Leaves	Decoction	30
Momordicabalsamina	*cucurbitaceae*	Whole plant	Decoction	64
Nelsoniacanescens	Acanthaceae	Whole plant	Decoction, maceration	44
Detariummicrocarpum	*Fabaceae*	Bark, rootss	Decoction	76
Pterocarpus erinaceus	Fabaceae	Bark, rootss	Decoction	56
Prosopis africana	Mimosaceae	Leaves, bark	Decoction	64

The level of knowledge of anthelmintic plants (Table 1) shows that several species of medicinal plants are well known to the respondents, these are Detariummicrocarpum, Pterocarpus erinaceus, Prosopis africana, Momordica balsamina, Combretum glutinosum, Carica papaya, Acanthospemumhispidum and Albizia knighti. The species Chasmantheradependens, Combretum aculeatum, and Commelinaforskalae are little-known species and the others are moderately known species by those interviewed.

3.1.2. Plants parts used

The parts of the plants used are the leaves with 47%, then the bark and the roots with 17% each. Then comes the whole plant with 10%. The nalysis of the figure2 shows that leaves are the most used and according to Bitsindou (1986), this high frequency of use of leaves is due to the ease and speed of harvesting. For Bigendako-Polygenis and Lejoly (1990), leaves are the site of photosynthesis and sometimes the storage of secondary metabolites which can be the active ingredients responsible for biological properties.

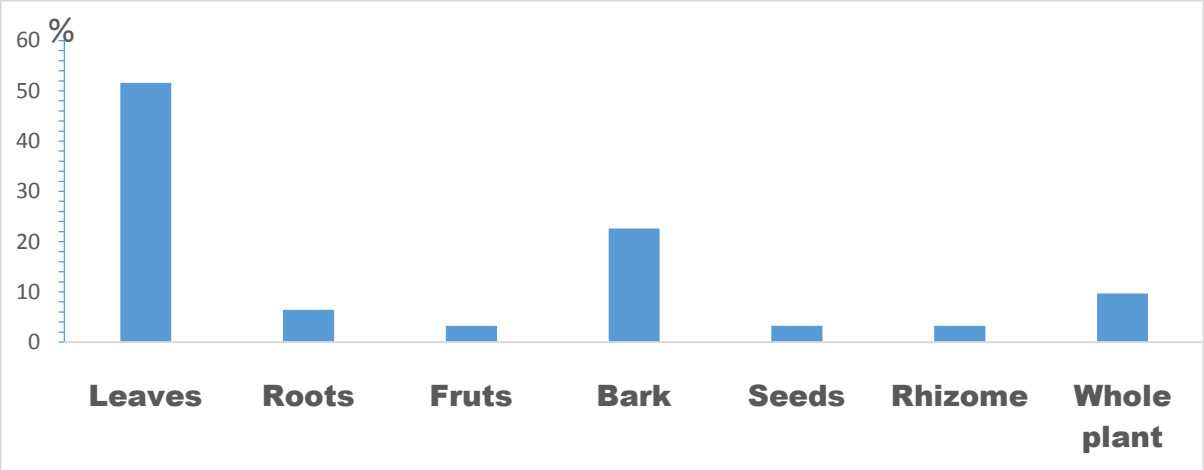


Figure 2: Proportion of different plant parts used

3.1.3. Method of preparation

For the administration of the drug, three methods of preparation are used to cure helminthiasis (Figure 3). Decoction is the most used method of preparation with 65% and according to Salhi et al., (2010), it allows the most active ingredients to be collected and attenuates or cancels the toxic effect of certain recipes. So this is why most traditional drugs are prepared by decoction. The two other methods of preparation are maceration and infusion with 29% and 6% respectively.

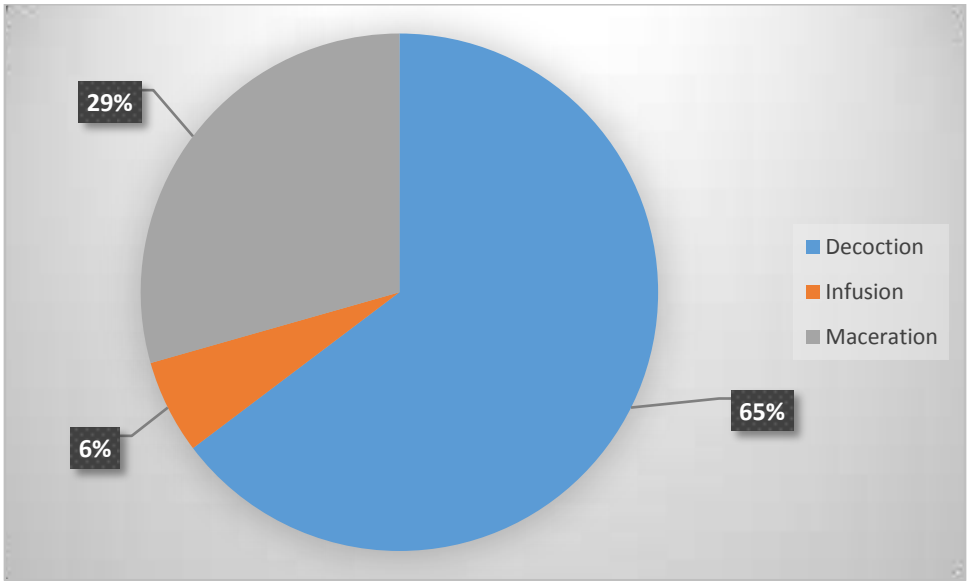


Figure 3: preparation methods

3.1.4. **Otherdiseases treated by gastrointestinal anthelmintic plants**

In addition to being used against gastrointestinal worms, these plants cure several other illnesses such as hemorrhoids, malaria, snake bites, and stomach aches (Figure 4).

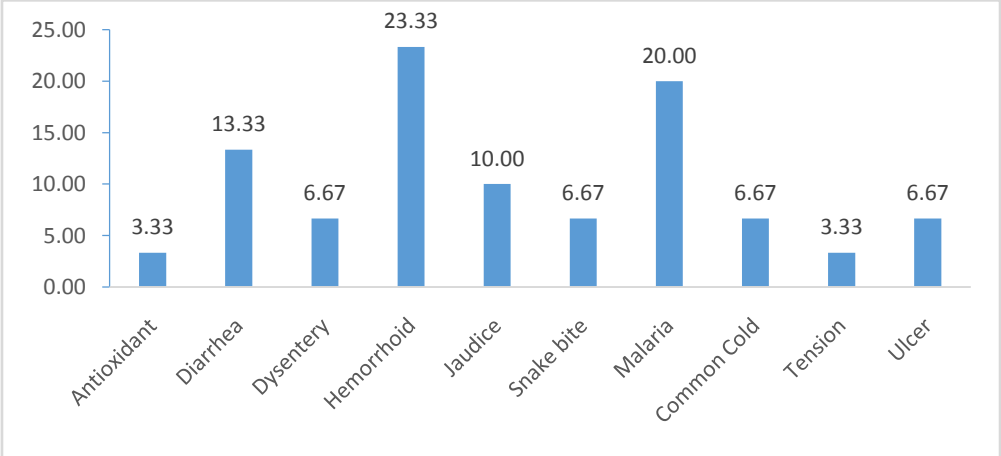


Figure 4: Other diseases treated by gastrointestinal anthelmintic plants

The results obtained show that hemorrhoids (23.33%), malaria (20%), diarrhea (13.33%), and jaundice (10%), (Figure 4) are the diseases that these plants treat more. The number of species recorded for the treatment of hemorrhoids is the largest because this disease is very common in Niger.

3.1.5. **Variable categories and the contribution of the categories (contrib)**

Figure 5 highlights the dependencies between certain modalities according to their degree of contribution (contrib) in the definition of the different axes. This mainly concerns, according to axis 1, use. Following axis 2, the seeds of *Carica papaya* and the bulbs of *Allium sativum* are used in infusion.

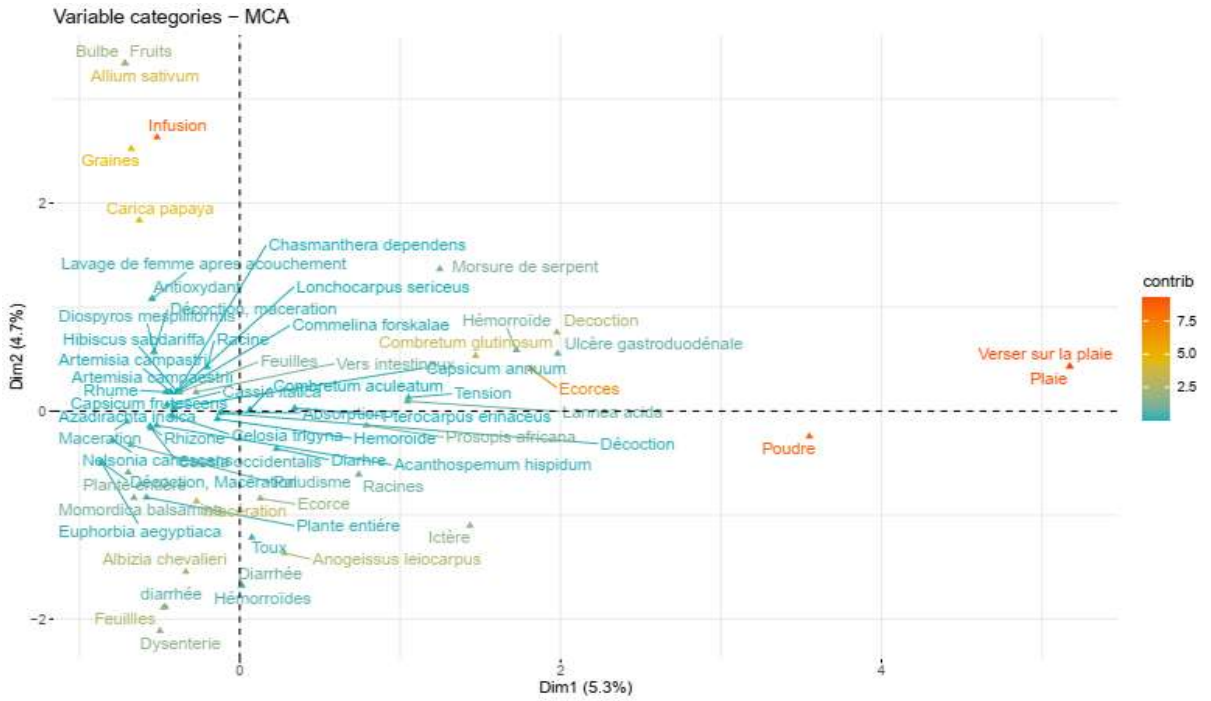


Figure 5: Factor map of variable categories and the contribution of the categories (contrib)

3.2. Discussion

The majority of respondents were men. This profile is typical of most surveys carried out among traditional therapists. This indicates that the practice of traditional medicine is much more reserved for men. The majority of people surveyed were over 30 years old. Indeed, older people are expected to provide more reliable information, due to the fact that they hold a large part of the ancestral knowledge which is transmitted orally (Lakouéténé et al. 2009); Gnagne et al. 2017, Diatta al., 2013. This knowledge of plants could be lost if the new generation does not take over. It is therefore important to record traditional medicines and promote them in order to give more credence to this knowledge (Danton et al, 2019).

This survey carried out in made it possible to know 26 species of medicinal plants used in the traditional treatment of intestinal worms. These inventoried species belong to eleven (11) families. The best-represented families are Fabaceae (3 species), Combretaceae, and Asteraceae with 2 species each. These results are similar to those of Mounkaila et al (2017) who identified 27 medicinal plants used against malaria in the traditional Nigerien pharmacopeia in four communes of Niger. They are also similar to those of Iro (2006) who recorded 28 species in Boumba terroirs. These results are lower than those of Ikhiri et al. (1984) and Saadou (1993) respectively recorded 186 species in the Niamey markets and 245 medicinal species across the Nigerien territory. This difference between the results of the present study and those of Ikhri et al., (1984), is explained by the difference in study scales. The difference with Saadou's results can be explained by the scope covered by his study.

The leaves are the organs most used for gastrointestinal anthelmintic treatment. This greater use of leaves compared to other organs confirms the results of Salhi et al., (2010), Tahri et al., 2012, Diatta et al., (2013) Mosaddegh et al., (2016) and Mounkaila (2018). According to Bitsindou (1986), this high frequency of use of leaves is due to the ease and speed of harvesting. But also for Bigendako-Polygenis and Lejoly (1990), the leaves are the site of photosynthesis and sometimes the storage of secondary metabolites which can be the active ingredients responsible for biological properties.

Several methods of preparation are used: decoction, infusion, and maceration. Among these methods, decoction is the most used method. According to Salhi et al., (2010), the decoction makes it possible to collect the most active ingredients and attenuates or cancels the toxic effect of certain recipes. With the decoction as the first method of preparation, our results corroborate those of several authors: Zerbo et al., (2011); Benkhnigue et al., (2011); Mehdioui et al., (2007), Mounkaila et al (2017)

IV. Conclusion

The results obtained during this study made it possible to gather several pieces of information on the medicinal species used by the population in various treatments of diseases. Various organs (leaves, flowers, fruits, roots, bark), coming from 26 plant species are used by populations for the treatment of diseases. Among these organs, the leaves are the most used. Note that three methods of traditional preparation of medicines (decoction, maceration, powder) have been recorded.

This work represents a source of information that will contribute to the knowledge of gastrointestinal anthelmintic medicinal plants and also safeguard this local know-how. It can be a database for the valorization of this anthelmintic medicinal flora with a view to discovering new active ingredients. And also relieve populations of these diseases.

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