

Analysis of ethnobotanical formulas used for the treatment of dromedary (*Camelus dromedarius*) diseases

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Abstract

Plants are important sources of food; at the same time, they present medicinal virtues for the man and the animal. Thus, the present ethnobotanical study was aimed to identify ethnobotanical formulas for the treatment of diseases affecting dromedaries. The study was carried out through individual interviews with 41 breeders using pre-established ethno-veterinary survey sheets. A total of 188 formulas, 130 of which are of plant origin, have been designated for the treatment of 28 camel diseases and symptoms identified in the study area. The results of this study showed that: *Stereospermum kunthianum*, Water + *Camellia sinensis*, Water + *Lepidium sativum*, Water + *Acacia nilotica* and Water + *Salvadora persica* are the most reputable formulas. *Stereospermum kunthianum* and *Camellia sinensis* are the most requested species in the constitution of these formulas. General tiredness and Diarrhea are the most common diseases with a citation rate of 18.09% and 16.49%, respectively. The leaves are the parts of the plant most used in the formulation of ethnobotanical recipes with a rate of use of 54,1%. On the other hand, pounding and maceration are the most frequent methods of preparing recipes with respective rates of 52,7% and 26,4%. And the oral route is the best choice for the administration of products to camels. This study revealed important endogenous information on the ethnomedicine held by the cameleer and which can be valued by modern medicine for the management of camel health.

Keywords: Ethno-veterinarian; Dromedary; Diseases; Niger; Medicinal plants

1. Introduction

According to the annual report of the HCME [1], the Zinder region represents the country's leading pastoral region with an estimated workforce in 2012 of 3,169,032 TLUs; i.e. 25.58% of the national herd. With specific regard to the camel species, Niger had a total of 1,670,471 TLUs in 2008, of which the Zinder region alone recorded 228,199 TLUs, i.e. 13.66% of the national population [2].

The dromedary (*Camelus dromedarius*) is known to be one of the most adapted domestic species to arid and semi-arid environments. It has physiological, biological and metabolic particularities that give it a legendary reputation for surviving, reproducing and producing in extreme conditions considered restrictive for other ruminants. However, it has long been marginalized by animal production development programs in Niger.

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In 1989, [3] reported that the greatest indicator of the importance of camels in sub-desert and north-Sahelian zones has been the cycle of droughts over the past fifteen years. This animal has indeed exceptional capacities in particular those allowing him to be satisfied with meager food resources available. Thus, it allows man to survive in these inclement regions by giving him milk and meat, providing him with work and allowing him to earn a significant income.

However, this animal is also exposed to the diseases that attack sahelian livestock. The breeder as the conductor of the breeding system is willing to seek remedies, either through traditional veterinary medicine or modern medicine. Indeed, the low vaccination coverage combined with the inaccessibility of veterinary products naturally predispose breeders, in order to deal with animal diseases, to look for herbal remedies associated or not, to products of animal or mineral [4]. Thus, interest in medicinal plants for veterinary use has recently increased [5]. Because, the use of medicinal plants in the treatment of pathologies of domestic animals has several advantages due in particular to their availability, their affordable cost and their proven effectiveness.

Indeed, in Niger, scientific work aimed at promoting traditional medicine was initiated by Ag Arya [4] to seek better therapeutic responses of the veterinary ethno pharmacopoeia to parasitic diseases in the pastoral zone of Tahoua. This was followed by the inventory of medicinal plants in the urban municipality of Zinder [6]. In the rest of the sub-region, other works have emerged, in particular that of Dassou [7] aimed at characterizing the medicinal flora used in the treatment of animal diseases and symptoms in Benin. This work was preceded by that of Bâ [8] on veterinary art and traditional pharmacopoeia in Sahelian Africa and that of Tamboura [9] on veterinary ethnomedicine and traditional pharmacopoeia in the central plateau of Burkina Faso.

With the aim of bringing complements to these various publications made in Niger and abroad, the present study aims to highlight the importance of traditional remedies in the treatment of diseases in camels.

Thus, the global objective of this research is to identify the formulas based on medicinal plants used by breeders in the Zinder region for the treatment of camel diseases. Specifically, it aims to (1) know the diseases that affect camels, (2) identify the logical and ordered combinations of plant organs to treat the targeted diseases and (3) determine the methods of preparation and administration of these organs.

2. Material and method

The study was carried out in the Zinder region (Eastern of Niger), from September 21 to October 01, 2019, in two rural communes, namely Kellé (Gouré), Tenhiya (Tanout) and in the department of Tesker. It consisted in administering to camel herders a sheet in order to find the following information: the herder's data, the size of the herd, the types of diseases and recipes for treating sick camels. The form was designed for individual interviews following well-defined criteria: possession of at least one camel herd, experience in camel husbandry, good knowledge of animal diseases and availability to answer the questionnaire.

The data collected was entered into an Excel sheet to determine the frequency of the variables analyzed, namely: the type of disease or symptom, the treatment formula, the part of the plant used, the mode of preparation and the route of administration of the recipe. Also, another parameter, namely the contribution of each plant in the constitution of the recipes (Cpr) was determined. It makes it possible to know the frequency of involvement of a plant in the recipes and is given by the formula:

$$Cpr = \frac{Nr}{Nt} [10]$$

where Nr is the number of recipes involving the plant and Nt the total number of recipes.

3. Results

3.1. Listed formulas

The survey identified one hundred and eighty-eight (188) formulas distributed as follows: municipality of Tenhiya (51%), department of Tesker (44%) and municipality of Kellé (5%).

And according to their origin, these formulas are grouped as follows: formulas of vegetable origin (69.15%), of animal origin (10.11%), of mineral origin (10.11%), and others treatment techniques which represent (10.64%).

3.1.1. Plant-based formulas

A total of one hundred and thirty (130) formulas of plant origin, i.e. 69.15%, were inventoried. They can be mono-specific (organ of a single plant species) or associated with other species of plant, animal and/or mineral origin to produce medicinal products.

3.1.2. Medicinal plants

These plant formulas have been formulated on the basis of a total of thirty (30) plant species, the most frequent of which are: *Stereospermum kunthianum*, *Camellia sinensis*, *Pennisetum typhoides* with a respective citation rate and frequency of involvement (Cpr) of 20, 55% and 0.24; 10.27% and 0.12 and 7.53% and 0.09 (Figure 1).

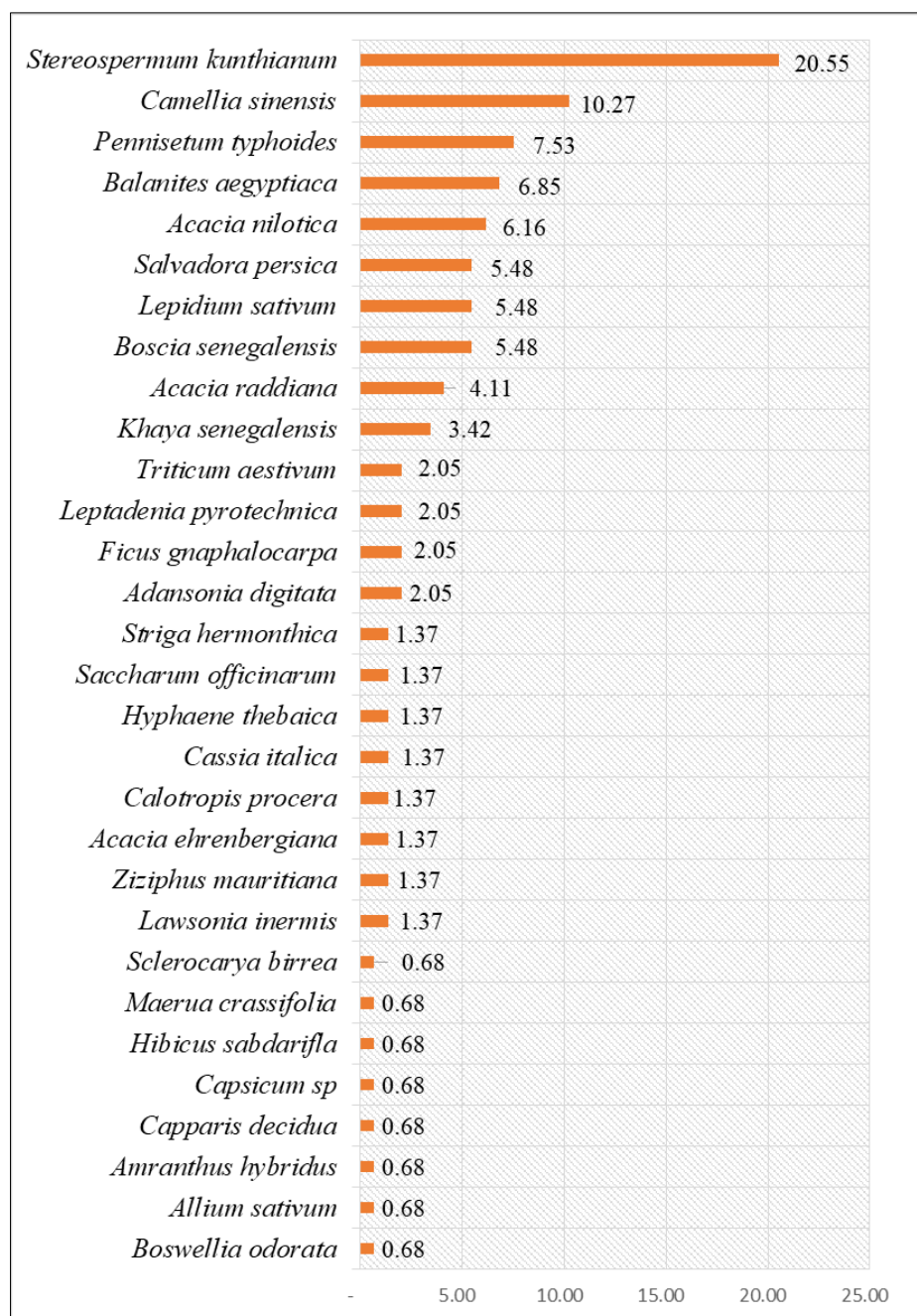


Figure 1 Frequencies of plants cited by breeders for the treatment of their animals

3.1.3. Organs used

All plant organs are important for the formulation of recipes used to treat camel diseases and symptoms. But the leaves are the most used organ with a citation percentage of 54.1%. They are followed by bark (14.2%), seeds (12.2%) and fruits (9.5%) (Figure 2).

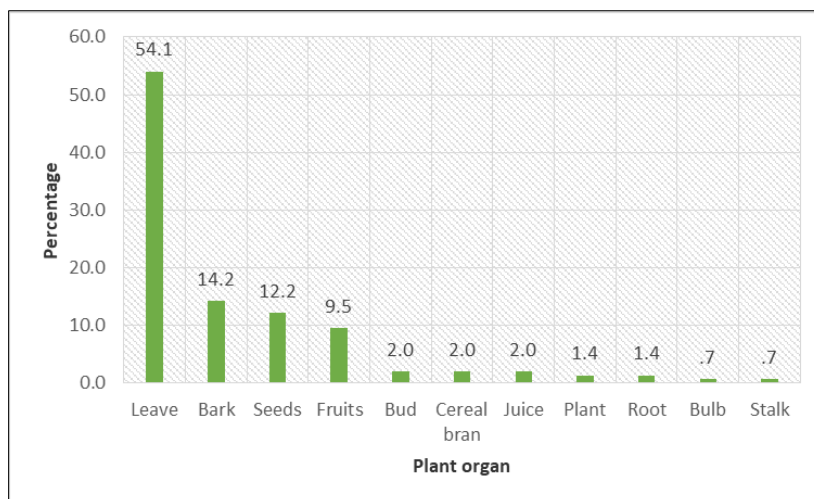


Figure 2 Frequency of different plant organs used in medicinal formulations

3.2. Methods of preparation and routes of administration of plant-based formulas

Considering the preparation of plant products, four (4) modes have been identified: pounding, maceration, decoction and plastering with pounding being the most used mode at 52.7%, followed by maceration (26.4%), decoction (20.2%) and plastering (0.78%).

The different products prepared are administered to the animal orally (73.1%), cutaneous (12.3%), nasal (10.8%), ocular (3.1%) and by different places (0.80%).

3.2.1. Animal Formulas

These are recipes made from milk, butter, eggs or bones to treat diseases such as respiratory problems, constipation, diarrhea, dermatitis, external parasitosis and retained placenta. These animal products are either used alone in the recipe, or in combination with salt or natron.

3.2.2. Formulas of mineral origin

These formulas essentially contain ordinary kitchen salt, natron or stones administered alone to animals or in combination with some animal products or diluted in water. These recipes are typically used to combat the same illnesses that can be treated with animal-derived formulas.

3.2.3. Formulas of other origins

There are twenty (20) listed formulas based on the use of used motor oil to generally treat dermatitis, which is applied to the lesions. Also, these formulas are applied by surgical form to treat a disease known as "Djini", called heat stress or heat stroke, which consists of making the animal bleed with the help of a needled object at the level of the jugular vein.

3.3. Diseases of dromedaries identified

A total of twenty-eight (28) diseases and symptoms were identified (Figure 3). General tiredness, diarrhea, dermatitis and constipation are the diseases most cited by breeders with a respective percentage of 18.09%, 16.49%, 8.51% and 7.45%.

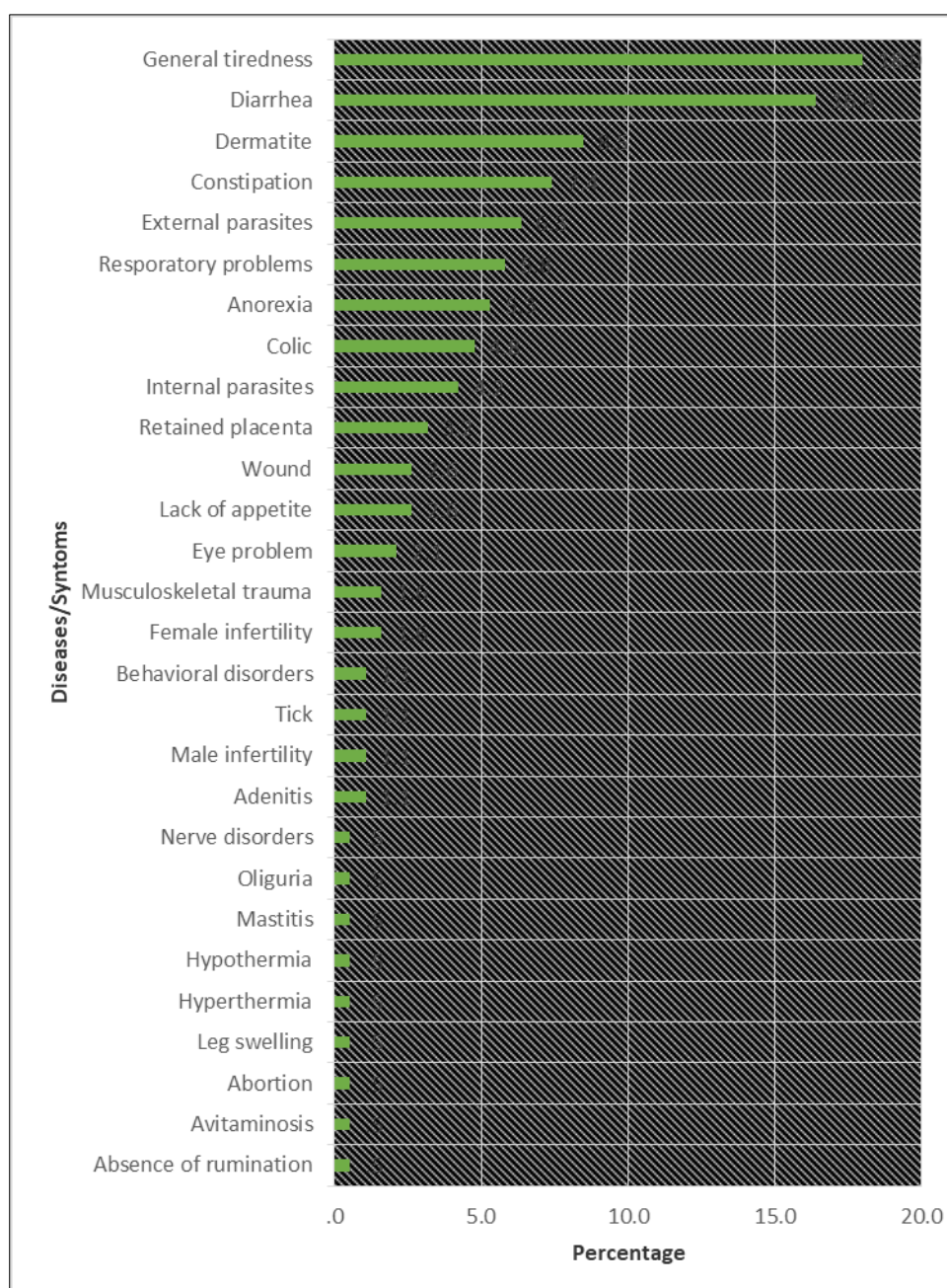


Figure 3 Frequencies of diseases and symptoms reported by respondents in camel herds

3.4. Relationship between diseases and curative recipes

The frequency of the different medicinal formulas to treat all the diseases listed by breeders varies from 1 to 15 with the formula based on *Stereospermum kunthianum* (mono-specific formula) the most cited (15 times) i.e. a rate of 11.53 %. It is followed by those based on: Water + *Acacia nilotica*, Water + *Balanites aegyptiaca* and Water + *Salvadora persica* with a citation rate each of 5.43%.

The set of recipes cited by breeders can be categorized into three major groups; group 1 in which several recipes are proposed to treat the same disease, group 2 that in which the same recipe is used to treat more than one disease and group 3 in which the same recipe is advanced by more than one person for treat the same disease.

3.4.1. Group 1. Panoply of medicinal formulas against a single disease

The diseases for which the breeders offer several recipes are Diarrhea and General tiredness with respectively 17 and 16 different recipes. These are followed by Anorexia and Colic with 9 medicinal formulas each one, then Constipation

and Internal parasitosis with 7 recipes each one, then Respiratory problems with 6 recipes and Dermatitis and External parasitosis with 5 recipes each one. And for Lack of appetite and Placental retention, each presents 4 recipes, then come Eye problems with 3 recipes and finally Musculoskeletal trauma and Adenitis with 2 recipes each one.

3.4.2. Group 2. Formula for multiple diseases

Several recipes are cited by breeders to treat several diseases at the same time. It is mainly the monogamous *Stereospermum kunthianum* recipe cited by camel breeders to cure eight (8) diseases (Anorexia, Abortion, Colic, Diarrhea, General fatigue, Hypothermia, Internal parasitosis and Nervous disorders). This is followed by the recipes: Water + *Acacia nilotica* and Water + *Balanites aegyptiaca* which each treats six (6) diseases. Next comes the Water + *Salvadora persica* recipe with four (4) diseases that can be treated by that formula. Finally, the Water + *Lepidium sativum* and Water + *Camellia sinensis* recipes which are used by breeders to treat respectively three (3) and two (2) diseases in camels.

3.4.3. Group 3. Repeated formulas against the same disease

This group is essentially made up of the monogamous *Stereospermum kunthianum* formula proposed 6 times and 3 times by the breeders to treat General tiredness and Anorexia respectively, the Water + *Lepidium sativum* formula repeated 4 times by respondents to treat General tiredness and Water + *Camellia sinensis* formula cited 3 times to fight Constipation. Other formulas including Water + *Khaya senegalensis*, Water + *Stereospermum kunthianum* + natron, Water + *Acacia nilotica*, Water + *Triticum aestivum*, Water + *Camellia sinensis* + Water + *Salvadora persica*, Water + *Salvadora persica*, Water + *Boscia senegalensis*, *Pennisetum typhoides* + Natron and Water + *Leptadenia pyrotechnica* are used by breeders to treat the following diseases respectively: Colic, Diarrhea, General tiredness, Ticks, Lack of appetite, Internal parasitosis and Retained placenta.

4. Discussion

The results of this survey showed that respondents are one hundred percent (100%) male and aged on average fifty years. This profile of traditional healers is the one observed in most studies of its kind [11]. This is explained by the fact that in the Zinder region (a pastoral area), camel breeding is purely practiced by men who also have experience in the field.

In addition, between the three study sites, a greater quantity of formulas was identified in the municipality of Tenhiya, i.e. a rate of 51%. This is due to the better collaboration that the breeders of this area gave to this study but probably also because of their great experience in the use of traditional medicine in the care of their animals.

Also, it is noted that traditional medicines based on medicinal plants represent 69.15% of the traditional recipes encountered in the field. This result corroborates that of Ouahiba and Nassira [12] who found 68% of herbal recipes and other sources including salt, clay, crushed glass, yeast, bleach, vinegar, soft drink, used car oil, fuel oil, and honey, represent only 32%.

Furthermore, this survey revealed the predominance of three (3) diseases: General tiredness, Diarrhea and Dermatitis and the biophysical characteristics of the area could be the cause. Indeed, Tiredness and Dermatitis can be favored not only by the high intensity of solar radiation during the day, the dispersion of trees and/or their absence in certain environments, but also by the lack of water points, used as source of watering. And for Diarrhea, it is mostly seen in young camels. Thus, most of the respondents confirmed that it is due to the lack of leguminous fodder. According to Jean-Pierre [13], a deficiency in cobalt (Co), a growth factor for rumen bacteria, causes diarrhea and anemia.

Also, *Stereospermum kunthianum* and *Camellia sinensis*, are the most cited species among the thirty (30) listed with a respective frequency of 20.5 and 10.3. These results are contrary to those presented by [4]. Indeed, these authors have, during their study, shown that it is rather *Allium cepa* and *Stereospermum kanthianum* plants which were the most represented.

In addition, the results of the present study showed that leaves and barks are the most used organs. This observation is in line with that of Tamboura [9] who explains that breeders know perfectly well that it is at the level of these organs that the active substances are concentrated. All these organs are prepared mainly by pounding to undoubtedly better reduce their size in order to facilitate their transit and the absorption of their active ingredients in the animal's body. Compared to the route of administration, it is observed that the oral route is the most cited with 73.1%. This remark is consistent with that of Merazi [5] where the oral route occupies a rate of 70%.

Moreover, the Cpr, which determines the contribution of each plant in the constitution of the recipes, revealed the frequent involvement of *Stereospermum kanthianum* (0.24) and *Camellia sinensis* (0.12) in the constitution of the recipes. This observation can be justified by a better accessibility of these plants for the camel breeders who master the curative effect of such plants well. Indeed, it was reported by Beitlakhdar [14] that green tea (*Camellia sinensis*) is considered everywhere by populations as diuretic, tonic, anti-diarrheal. Because the mountain people sometimes take a concentrated and cooled infusion of green tea, strongly sweetened, as a restorative, after a long walk. Also, he adds that in external use, the tea powder is used as a healer of open wounds, and its decoction for rinsing the eyes, and also for eye ailments. Regarding *Stereospermum kanthianum* (tobacco), it was shown by Compaoré [15] that this species contains poly-phenolic compounds, which have antioxidant and diuretic properties.

5. Conclusion

The results of this survey conducted among 41 breeders across the municipalities of Kellé and Tenhiya and the department of Tesker, confirm the use of traditional medicine by camel breeders to treat diseases in their dromedaries. And this because of the ease they find in acquiring such type of treatment.

The therapeutic formulas used consist of products of vegetable, animal or mineral origin, or by their combination. The most famous recipes are: *Stereospermum kunthianum*, Water + *Camellia sinensis*, Water + *Lepidium sativum*, Water + *Acacia nilotica* and Water + *Salvadora persica*. These recipes are used by breeders to particularly treat Tiredness in camels, the most common symptom among the twenty-eight (28) diseases and symptoms identified. These recipes consist mainly of pounded and macerated leaves belonging to one or more plant species and which are generally administered orally to camels. All of these recipes can be used to treat one or more ailments and vice versa.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

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