



Some Investigations on the Traditional Pharmacopoeia about Venomous Bites and Stings from Scorpions, Snakes and Spiders; in the Hina Subdivision, Far-North, Cameroon

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: This study aimed to find out (a) which plants and animals are used in popular phyto- and zootherapy for the treatment of spiders, scorpions and snake venoms in the Hina subdivision, of the Far-North Region of Cameroon, and (b) the reasons for these usage.

Methods: The morbidity data on venomous bites and stings was obtained from the Hina-Marback (main town of subdivision) hospital. Information on the treatment was gathered through interviews with traditional healers and conversation with people who had spent their entire lives in the region.

Results: Of the 31 patients recorded at Hina-Marback hospital, 22.58% are 3 to 10 years and 35.5% are 11 to 20 years old. Among victims, 41.9% were pupils of whom 64.5% were males. Necrotize bites and stings are most frequent constituting 67.7% of the total. Of 82 patients studied, bites from *Echis ocellatus* (49.9%) and *Cobra nigricollis* (23.2%) are most frequent. Twenty-two plant species belonging to 20 genera were collected, from which 22 therapeutic preparations are used for treatment. While some preparations such as from *Annona senegalensis* are used to treat

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necrotizing bites, those of *Securidada longipedonculata* are used for neuro-toxic bites. Chemistry and pharmacology confirm the virtues of these plants, which act by competing for the venom active binding sites. Also 6 animal species belonging to 5 genera were collected from which 8 therapeutic preparations are useful.

Conclusion: Traditional healers of Hina are able to overcome non-complicated bites and sting-related disorders. Chemotherapy with plant preparations and animal products are most frequently employed. Therapies used in combination show some efficiency. Ingestion of the flesh of venomous snake for treatment needs further investigation.

Keywords: *Venomous bites; antidotes; hina subdivision; Cameroon.*

1. INTRODUCTION

Venom is a poisonous liquid secreted in some animals by a special organ through a sting or bite [1]. It acts in two ways. Either it destroys the tissues and the blood vessels (the venom is said to be necrotizing); or it alters the nervous system's functioning (the venom is said to be a neurotoxin). Illnesses due to snake, scorpion and spider bites and stings are well known by traditional therapists under the name of "Memtere" (in Fulfulde language). They constitute a public health preoccupation in the Hina Subdivision of the Mayo-Tsanaga Division of the Far-North Region. An average of 213 cases of bites and stings are recorded every year [2]. Health-wise, there is an important threat to the inhabitants of the Subdivision, due to the scarcity of anti-venom and the remoteness of the hospitable centers. The level of illiteracy is high with up to 73% of the inhabitants not knowing how to read or write. Financially, poverty amongst the inhabitants is high with up to 71% of the informants unable to pay medical fees. These reasons justify the choice of this survey. Several investigations have been carried out on venomous bites by scientists [3,4,5,6,2,7,8,9]; but none on the improvement of health conditions in Hina. The venomous animals are an obstacle to development and pose a threat to public health.

Their bites and stings inoculate their victims with poisonous substances which can either be neurotoxins or haemorrhagins.

- the neurotoxins of *Elapidae*, some scorpions and some spiders alter nervous transmissions and may lead in extreme cases to the paralysis of the diaphragm and stoppage of breathing;

the hemorrhagins, of *Echis ocellatus* - a Sahelian viper abundant in the Far - North region of Cameroon causes various haemorrhages, intravascular coagulations and haemolysis

leading to the destruction of red blood cells, necrosis, including cardiac, renal and neurological troubles. This case of venomous bite poses the most threat. This species bites very quickly and is responsible for more than 85% of the venomous bites in the region [9].

In the Hina Subdivision, public health interventions on venomous bites are mediocre, with numerous complications from which death can occur. To remedy this situation, traditional healers prepare animal and plant antidotes, with the main goal of reducing unrests observed in patients during the bites and also to heal them. Some preparations have systemic actions, by intervening on the disrupted functioning of an organ caused by venom acting by competition or pharmacological antagonism and at the same time protecting or normalizing the physiological function disrupted by the venom. Others are more specific, directly antagonizing the venom by inhibiting its poisonous component at the molecular level. The question is: considering the variability and complexity of the types of venomous bites as well as the urgency of treatment, do the traditional healers of the Hina Subdivision succeed to circumscribe and prevent the effects of these bites efficiently?

The aim of this study was to document animals and plants used in the treatment of snake, scorpion and spider venomous bites and stings respectively, as well as to gather the information on the therapeutic preparations used by the traditional healers of the Hina Subdivision of Far-North Region of Cameroon and to appreciate the efficiency of traditional treatment through conversations.

2. STUDY AREA

Hina-Marback is the head quarter of the Hina Subdivision in the Mayo-Tsanaga Division. The study area situated between (10°19'-10°40' North latitude and 14°13'-14°35' East longitude) is on

an elevation of 450 m above sea level. The population of the area is 39,854, representing 1.6% of the population of whole Far-North region and 0.20% of the total population of Cameroon [10]. The language of the area is Fulfuldé. The population is organized into a community (Lamidat) controlled by a Lamido-Moslem. The primary means of livelihood are cattle-rearing and subsistence agriculture. In this area artisanal activities involving the production of fabrics from cotton are well developed since it is a cotton-growing region. The climate is tropical, of the Soudan-Sahelian type, with an average rainfall and temperature of 904.1 mm and 24.9°C respectively [11]. Vegetation is a spiny steppe of the sahelian type Fig. 1; among the woody plants, *Acacia hockii* is extensively dominant [12].

3. METHODOLOGY

This study was conducted from 2009-2011. The morbidity data on venomous bites and stings was obtained from the registers of the Hina-Marback hospital. Information on the treatment of venomous bites and stings was gathered through conversation with traditional healers (many of whom are illiterates) who had spent their entire life in the region, and for whom the medicinal use of antidotes is an integral part of the overlying social dynamics. Communication and the necessary co-operation between the research team and the informants were facilitated by the second co-author who is a native of Hina. We were introduced to former and new victims of venomous bites and stings. Data

from the interviews were subsequently transcribed onto a form prepared for that purpose to facilitate analysis. Persons involved in the survey were debriefed on objectives of the research as well as on the type of information to focus on in the interviews. For the informants, questions focused on the symptoms of snake, scorpion and spiders bites and stings; the type of treatment used, and recovery duration, all carried out in retrospection. The healers had to answer questions on the treatments administered to victims, the type of venom and the corresponding recipes, in prospection. The traditional healers who cooperated showed the plants used to treat venomous bites and stings and indicated the various recipes. A digital camera enabled us to take pictures of the plants whose parts had been harvested as voucher specimens. The animals listed as treating venous bites and stings were identified using an identification key of the “wildlife institute” of Ngaoundéré and others publications [13,14,15].

Plant classification and nomenclature followed the work of many researchers [16,17,18,19]. The chemical and biochemical data of plants were searched in scientific literature. The goal was to determine the effectiveness of their extracts on the treatment of venomous bites and stings. The results were treated and analyzed in a computer using MS Word and Excel programs. The plants listed as treating venomous bites and stings were collected, pressed, dried, and identified by the Author or by comparison with specimens of the Cameroon National Herbarium (HNC) (YA),



Hina's subdivision landscape (steppe). First plan: *Boswellia dalzielii* (Burseraceae).

Maroua landscape (savanna). First plan: *Hyphaene thebaica* (Arecaceae), branched stems palm.

Tokombéré landscape (steppe). First plan: 3 individuals of *Acacia albida* (Mimosaceae).

Fig. 1. The Cameroon Far-North vegetation types: Wooded savanna and steppe

Ministry of Scientific and Technical Research. Data collected were compared with those from Cameroon ethnobotany as well as from other African countries, and analyzed against scientific literature [20]. Voucher herbarium Specimens were deposited at the Plant Biology Laboratory of the Higher Teachers' Training College of the University of Yaoundé I, Cameroon. Also a full record of the completed questionnaire is kept on file.

4. RESULTS AND DISCUSSION

4.1 Venomous Bite and Sting Morbidity at the Hina-Marback Hospital (2009 and 2010)

The venomous bite and sting morbidity at the Hina-Marback hospital was obtained from the registers. The 31 patients concerned are listed by age group Table 1. The 11-20 year bracket is the most affected (35.5%). It includes the teenagers (even pupils) who are the breeders or the shepherds of cows and goats, exposed by this activity to snake bites and stings from scorpions and spiders. On the other hand the age group between 61 and 70 is less affected (3.23%). This consists of the old people who no longer have active roaming activities or have acquired a certain experience of the primary healthcares or certain immunity due to previous bites and stings.

Table 1. Distribution of patients according to their age group

Age group	Number	Percent (%) of total
0-10	7	22.58
11-20	11	35.50
21-30	5	16.12
31-40	3	9.67
41-50	2	6.45
51-60	2	6.45
61-70	1	3.23
Total	31	100

Snake bites and scorpion and spider stings are higher amongst pupils (41.9%) than in shepherds and breeders (12.9%), occurring along the long paths to school, during grazing and roaming activities. In housewives (25.8%) it takes place at the time of collection of fire-wood in bushes Table 2. Males are affected more (64.52%) than females (35.48%), because they are more mobile than the latter.

Table 2. Distribution of patients according to their specific activities

Specific activities	Number	Percent of the patients (%)
Pupils	13	41.92
Housewives	8	25.81
Farmers	6	16.13
Shepherds and breeders	4	12.9
Total	31	100

4.2 Snake Bites, Scorpion and Spider Stings Treatment in the Hina Subdivision

The research gave interesting results concerning the ethno medical approach of the treatment of snakebites, scorpion and spider stings by using ingredients of medicinal plants and animal origin respectively.

4.2.1 Preview on the animals causing venomous bites and stings

The health service personnel and the traditional healers mentioned three venomous animal groups: the snakes, the scorpions and the spiders. About 10 species belonging to 7 families are concerned [21,22,23].

The venoms can be regrouped into neurotropic toxins and necrosis (with hemorrhagic symptoms) as shown in Table 3. Some venomous animals are presented in Fig. 2.

4.2.2 Therapeutic course

The fieldwork survey in the Hina population shows that the epidemiology of venomous bites and stings is closely related to the rainfall pattern Table 5 and the specific activities bound to the sex and age of the victims such as roaming (nomad), hunting, fishing and domestic chores Table 4. Lethality before all intervention is high, but the respondents refused to talk of it. The Viperidae family (especially the genus *Echis*) is responsible for up to 68.2% of recorded cases (56/82) followed in decreasing order, by the Elapidae (especially *Naja nigricollis*) - 15.8% (13/82) and the Scorpionidae - 9.7% (8/82) families. The spiders, probably the genus *Latrodectus* have been positively declared responsible for 7.3% (6/82). Houses made of temporal construction material, poorly disposed old clothing and shoes constitute a refuge for scorpions leading to the principal household causes of scorpion stings in Fig. 3.



Echis ocellatus (Viperidae)



Naja nigricollis (Elapidae)



Androctonus sp. (Scorpionidae)



Buthacus leptochelys (Scorpionidae)



Latrodectus mactans (Theridiidae)



Loxosceles sp. (Sicariidae)

Fig. 2. Some venomous animals in Vina (Hina) Subdivision. (source: Google documents). Examples: *Echis ocellatus* (http://www.futura-sciences.com/uploads/tx_oxcsfutura/Echis_ocellatus.jpg). *Naja nigricollis* (<http://www.sareptiles.co.za/gallery/albums/userpics/10272/woodi.jpg>)



Fig. 3. Habitat made of temporary material, with openings for tiny creatures.

Features of the symptoms provide information about the possible source of the venomous bite or sting as well as choice of the type of treatment to administer Table 5. Venomous bite by *Echis ocellatus* is highest. *Echis ocellatus* is a sahelian viper very abundant in the Hina Subdivision and responsible for more than 85% of the cases registered in the Far- North of Cameroon [24].

4.2.3 Treatment of venomous bites and stings in traditherapy

The traditional healers administer two types of treatment:

- symptomatic, composed of anti-inflammatory and antalgic agents, which are either haemostatic, cardiotoxic, antibiotic or anticonvulsive in action. The treatment is made from medicinal plants preparations;
- etiologic or specific, using black stone and especially with the antidotal antibodies of the cow milk or the blood of lambs according to availability at the moment. Treatment is achieved with preparations from animal ingredients.

4.2.3.1 Treatment using preparations from animal ingredients

Table 6 gives a qualitative and quantitative data on animal antidotes. The wide knowledge of animal antidotes is illustrated by the high average listing: 2.25 quotations by informant. It is noteworthy that more than one animal ingredient is used in a preparation (1.25 animal ingredient per preparation), and that the average medicinal preparation per animal is high (1.33). These results show a substantial application of antidotal substances of animal origins. Within an anthropological framework, the research on antidotes is an integral part of the overlying social dynamics. Nevertheless, the cultural roots of the local shepherd, farmer and artisanal population run remarkably deep, reflecting their strong ethnic consciousness. The Hina inhabitants know that after a bite, the snake becomes helpless since it does not have any more venom and so they confidently and fearlessly catch it for use in antidote preparations.

Table 3. Animal species responsible for venomous bites and stings in the Hina Subdivision

Species	Families	Venom characteristics	Local and common names (language)
Snakes			Mohsourom (Mada, Zougou, Mouyam)
<i>Naja nigricollis</i> , (black neck cobra, savannas spitter cobra)	Elapidae	cardiotoxic venom, neurotropic toxins	modovdogore savannas spitter cobra
<i>Naja haje</i>	Elapidae	neurotropic toxins	Egyptian Cobra
<i>Echis ocellatus</i>	Viperidae	Necrosis, haemorrhagic syndromes	mikewed
<i>Bitis arietans</i>	Viperidae	Necrosis, haemorrhagic syndromes	African Puff Adder
<i>Atractaspis</i> sp. (fossorial viper)	Atractaspididae	Necrosis, haemorrhagic syndromes	fossorial viper
Scorpions			Aratte (Mada, Zougou)
<i>Androctonus</i> sp., (<i>Androctonus mauretanicus</i>)	Scorpionidae	neurotropic toxins	Aratte tika
<i>Buthacus leptochelys</i>	Scorpionidae	neurotropic toxins	Aratte ngo
<i>Buthus</i> sp.	Buthidae	neurotropic toxins, poor with enzymes	Aratte kla
Spiders			Akan
<i>Latrodectus</i> sp. or widowed black (<i>Latrodectus mactans</i>)	Theridiidae	latrodectism of neurotoxic type	widowed black
<i>Loxosceles</i> sp. (recluse brownish)	Sicariidae	loxoscelism of necrosing type, rarely haemolytic	recluse brownish

Table 4. Distribution of animal venomous bites and stings according to victim activities

	Roaming works		Pastoral activity		(Domestic chores)		Passage on the tracks		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%
Bites of <i>Echis ocellatus</i> (Viperidae)	20	0.64	19	0.78	8	0.57	9	0.69	56	68.29
Bites of <i>Naja nigricollis</i> (Elapidae)	7	0.22	3	0.12	0	0	3	0.23	13	15.85
Scorpionism (Scorpionidae)	3	0.09	1	0.04	3	0.21	1	0.07	8	9.75
Araneism (Theridiidae or Sicariidae)	1	0.03	1	0.04	3	0.21	0	0	5	6.09
Total	31	0.94	24	0.98	14	0.99	13	0.99	82	100

Table 5. Venomous bites and stings symptoms and the suspected animals responsible for them

Clinic signs and diagnostic	Suspected animals responsible for the bite or sting
oedema, hemorrhage, necrosis, pain respiratory trouble, paralysis Trouble assault pain, nausea, sweat, general uneasiness	<i>Echis ocellatus</i> , Viperidae <i>Naja nigricollis</i> , Elapidae Scorpion
fever, inflammation, oedema	Spider

4.2.3.2 Plants with antivenin properties

Twenty-two plant antidotes belonging to 18 families were listed in Table 7 in order of their family names, with local or common names, and the number(s) of quotations. One family,

Fabaceae, is represented by 3 species, namely *Crotalaria* sp., *Crotalaria retusa* and *Erythrina senegalensis*. Euphorbiaceae and Mimosaceae are represented each, by 2 species. Three medicinal plant groups: were obtained:

- a group destined for treating venomous bites by Viperidae with, mainly, *Annona senegalensis* (Annonaceae); *Azadirachta indica*. (Meliaceae) ;
- a group destined for treating venomous bites by Elapidae with, among other, *Securidada longipedunculata* (Polygalaceae) and the *Ximenia americana* (Olacaceae);
- a group with mixed use.

4.2.3.3 Antivenin preparations

Twenty one plants species gave 21 recipes listed with the plant parts used. Various methods of preparation and modes of administration are shown in Table 8. The properties of some preparations are also given.

Anti-inflammatory and diuretic properties for rapid toxin elimination used against *Naja* bites.

Table 6. Venomous animal part used and mode of use in traditherapy

Recipe number/Families	Animal species and animal part used	Method of preparation of antidote and mode of use
Total informants = 16 Total animal species = 6	Total medicinal ingredients in all medicinal preparations = 10 Total animal ingredients / medicinal preparation = 1.25 (10/8)	Total medicinal preparations = 8 Average medicinal preparation/animal = 1.33 (8/6) Total quotations of medicinal preparations = 96 Total quotations of medicinal preparations /informant = 6
1. Ovinae	<i>Ovies aries</i> (Lamb (she): fresh blood	1/2 glassful of cool blood, obtained by wounding the animal is immediately given to the victim of <i>Echis ocellatus</i> bite to drink. After about 10 min the victim vomits and feels better. This beverage facilitates the liquefaction of the coagulated blood of the patient [2].
2. Ophidinae	Snake: flesh of the snake	Whatever is the family of the snake which bites, it is killed and the flesh without fats is carefully stripped from its dorsal side. The victim is given to eat raw. 15min after the ingestion, the victim vomits venom directly and gets relieved [2].
3. Bovidae	<i>Bos taurus</i> (cow) : milk straight from the cow	1.5L of cow milk is drunk by the victim. The toxin is eliminated via urine during the day and gradually, the patient recovers his health. This beverage, which is rich in antibodies against snakebites, accelerates diuresis [13].
	<i>Bos taurus</i> (cow) : charred bone or black stone	A piece of cow bone is charred in an aluminum paper packing and applied on the bite (widened by a scarification); it adsorbs the toxins of the venom by capillarity, and falls itself off the body when the capillaries are filled up. It is then soaked in acidic milk to remove the adsorbed venom, and then wiped with a clean cloth and preserved for future use [13].
4. Equidae	- <i>Equus caballus</i> (horse) : hairs	On ash in a crust formed by burnt hairs, add human urine and apply the mixture

	- urine of the victim	on the poisoned part: 3 times per day during 5 days [21].
	<i>Equus africanus asinus</i> (donkey): bile	Some drops of the bile are put on the bitten or stung part 2 times a day for 4 days. The bile is preserved dried in the gall bladder. If necessary, it is warmed on glowing coal to weaken it before application [24].
5. Hominidae	<i>Homo sapiens</i> (human): urine of the victim	½ a glassful of urine is drunk by the victim [23].
	<i>Homo sapiens</i> (human): - vaginal secretions - urine of victim	Vaginal secretions are immediately rubbed on the affected area and the victim drinks ½ a glass of his/her urine [28].

Table 7. List of plants with antivenin properties

Families	Scientific names	Local name (Fulfulde)	Number and % related to 93 quotations
Antidotes of necrotizing venom			
1	Annonaceae <i>Annona senegalensis</i> Pers.	Doukkouhi laddé	12 (12.9%)
2	Meliaceae <i>Azadirachta indica</i> A. Juss.	Nim	5 (5.3%)
3	Caricaceae <i>Carica papaya</i> L.	Doukkouhi	2 (2.1%)
4	Combretaceae <i>Combretum molle</i> . R. Br. Ex G. Don	nanakawi	2 (2.1%)
5	Mimosaceae <i>Entadra africana</i> Guill. & Perr.	Fado waadou	6 (6.4%)
6	Loganiaceae <i>Strychnos spinosa</i> Lam.	Narbatanahi	8 (8.6%)
7	Olacaceae <i>Ximenia americana</i> L.	Djabboulli	9 (9.6%)
Antidotes of neurotic venom			
8	Fabaceae <i>Erythrina senegalensis</i> DC.	wolombo	2 (2.1%)
9	Polygalaceae <i>Securidada longepedunculata</i> Fresen.	Alalli	10 (10.7%)
10	Rhamnaceae <i>Ziziphus spina-christi</i> (L.) Desf.	Tépodarola	9 (9.6%)
Antidotes with mixed uses			
11	Caesalpiniaceae <i>Bauhinia rufescens</i> Lam.	Dambaréti	2 (2.1%)
12	Asteraceae <i>Bidens pilosa</i> L.	Carata	5 (5.3%)
13	Burseraceae <i>Boswellia dalzielii</i> . Hutch.	Andakehi	5 (5.3%)
14	Asclepiadaceae <i>Calotropis procera</i> (Ait.) Ait.	Babambi	2 (2.1%)
15	Fabaceae <i>Crotalaria retusa</i> L.	Nemnemelhi	2 (2.1%)
16	Cucurbitaceae <i>Cucurbita maxima</i> .L.	waigooré	2 (2.1%)
17	Iridaceae <i>Gladiolus gregarius</i> Welw. ex Bak.	Gladiolus	2 (2.1%)
18	Malvaceae <i>Hibiscus sabdariffa</i> L.	Gabeidji kenaf	2 (2.1%)
19	Euphorbiaceae <i>Jatropha curcas</i> L.	tabanano	2 (2.1%)
20	Euphorbiaceae <i>Ricinus communis</i> L.	Kolkowadjé	2 (2.1%)
21	Mimosaceae <i>Tamarindus indica</i> L.	Djabbi	2 (2.1%)

4.3 Discussion

Venomous bites and stings affect people of all age groups between 1 to 60 years. The percentage of bites and stings is higher in the males. This contradicts the findings in which 55.7% of victims are females compared to 44.2% males [25]. Within the study area men's activities

(grazing, agriculture and hunting), increase their chances of coming in contact with the venomous animals. *Echis ocellatus* is the species mainly responsible for viperine snakebites dominated by a necrotic and the hemorrhagic symptom in the savanna/sahelian zones of Far -North of Cameroon [21]. Hina Subdivision is a part of that area. This snake causes 68.29% of the

venomous bites in the study area. This correlates well with the works which have demonstrated a 65.75% prevalence in snake bites caused by the *Echis ocellatus* [24]. Neurotoxic venomous bites and stings are recorded especially from *Cobra niqricollis* (15.8%) and scorpions (9.7%). In contrast to the other families, the venoms of the scorpions *Buthidae* are poor in enzymes, which explain the reduction or total absence of local reactions to the sting. The desert or semi-desert species of Vina (Hina) are less dangerous. However, scorpion stings, in children and young teenagers can be serious. This age bracket of the population can only briefly resist low toxin levels and most often on the average for three days [26]. It is often considered that after the first twenty-four hours, the vital prognosis is no longer a problem.

Poison injection into a victim by a spider is called spider venomous sting, and the specific sting from one genus - *Latrodectus*, is called *Latrodectus* venomous sting. The alpha-latrotoxine contained in the venom of this genus has a more dangerous neurotoxic action [27]. Fortunately, the quantity injected in case of a bite

is a lot weaker. Generalized loxoscelism, of the necrotic type, caused by *Loxosceles* is rare.

Delays in consultation after such stings are long and rang from 4 to 48 hours. Primary healthcares are provided by the traditional healers in 50 to 90% of the cases. Most of the time, there is more fear than pain and injury caused by the stings. The "white or dry sting" without inoculation of venom seems well established [28]. It constitutes the rank 0 and corresponds to a dry bite. The hold in charge of a patient of rank 1 can be merely symptomatic. A venomous bite or sting classified in rank 2 or 3 is a formal indication for the use of immunotherapy and a patient of the rank 3 must be admitted in hospital for resuscitation.

Classically, viperine poisonous bites are treated with *Annona senegalensis*, *Ximenia americana* Fig. 4 as opposed to Cobra poisonous bites treated with *Securidaca longepedunculata*, *Ziziphus spina christi* [3,29,5,25] Fig. 5. *Annona senegalensis* possesses some antivenin properties which are opposite to those of the venom of the Viperidae, *Bitis arietans* [30].

Table 8. Different antivenin preparations, the ingredients used the method of preparation and administration

Recipe number	Plant species and plant part used	Method of preparation of antidote and mode of use Quotation of preparation [between brackets]	Properties (active principles)
	Total informants = 18 Total plant species = 21 Total medicinal species in all medicinal preparations = 23	Total plant species/medicinal preparation = 1.09 (23/21) Total quotations of medicinal preparations = 225 Total quotations of medicinal preparations /informant = 12.5 Total medicinal preparations = 21 Average medicinal preparation/plant = 1 (21/21) Monospecific recipes = 19	
1	<i>Annona Senegalensis</i> : root powder	1 tablespoon of the powder is infused in one glassful of hot water and the solution drunk: 2 times per day for 7 days [4].	Antiseptic, anti-sedative of respiratory tract infections, diuretic, febrifuge.
2	<i>Azadirachta indica</i> : 1 handful of leaves	The leafy stems, chopped up, are boiled in 1.5L of water for 15 min and the mixture infused during 2 hours. The solution is drunk: 1 glassful 3 times a day, for 5 days [31].	Anti-inflammatory and diuretic properties for rapid elimination of the toxins. Used against <i>Naja</i> bites.
3	<i>Bidens pilosa</i> : 1handful of leafy stems	The leaves are boiled in 1L of water during 15 min and the decoction is cooled and drunk: 250 ml 2 times a day	The treatment must begin in the first hour that follows the bite or

		for 3 to 5 days [31].	sting
4	<i>Boswellia dalzielii</i> : stem bark powdered	-3 soup spoonfuls of the powder are added to one glassful of cooled pap and the mixture drunk: morning and evening during 15 days. - A person bitten by the snake and lying on the leaves of <i>Boswellia</i> feels relieved because venom is attenuated by emissions from the leaves [31].	Against snakebites, scorpion and spider stings.
5	<i>Calotropis procera</i> : stem latex (white)	2 to 3 drops of latex are applied on the bite [29].	Antiseptic and sedative. (contain calotropine and calotoxin)
6	<i>Carica papaya</i> : latex of stem or immature fruit	Some drops of the latex are applied on the part bitten: morning and evening during 3 days [29].	Antivenin, diuretic, haemostatic, against viper bites
7	<i>Crotalaria retusa</i> : 10 g of whole plants	The paste of the ingredients is infused in one cupful of hot water and the decoction drunk, only once per victim. [29]	Against scorpion stings (contain an alkaloid of pyrrolizidine group)
8	<i>Crotalaria</i> sp. 4 to 5 leaves in paste	The paste is applied on the affected part [29].	Against scorpion stings
9	<i>Cucurbita maxima</i> : leaf juice	The juice is applied on the affected part: morning and evening during seven days [29].	
10	<i>Entada africana</i> : -powdered roots -juice of pounded stem bark	--1 soup spoonful of the roots powder is mixed with 1 glassful of milk straight from the cow and the mixture drunk: morning, noon and evening for at least 3 days. - Juice of the stem bark is applied on bite [6].	Antiseptic, haemostatic and healing. The haemostatic action of the stem bark assures the protection of vascular tubes, prevents hemorrhagic action that destroys the vascular endothelium. Used against Viperidae bites
11	<i>Erythrina senegalensis</i> : powdered stem bark	1 teaspoonful of powder is infused in 1 glassful of hot water and the mixture drunk: morning and evening during 3 days [29].	
12	<i>Gladiolus gregarius</i> : whole plant (leaves and roots)	The paste of the whole plant (leaf and bulb) is applied on the affected zone and on all joints of the limb stung [29].	Against scorpion stings
13	<i>Hibiscus sabdariffa</i> : fresh fibrous stem bark	1 handful of stem bark is macerated in 2 L of water for 30 min and the solution drunk: morning, noon and evening for 1 day [29].	Against snakebites
14	<i>Jatropha curcas</i> : 2g of fruits	The fruits are macerated in 1 L of water for 10 hours and the solution drunk: 1 glassful 2 times a day for 7 days [29].	Diuretic and purgative
15	<i>Securidaca longipedunculata</i> : 1 handful of dried roots and 1 handful of dried leaves	The ingredients are pounded and boiled in 6L of water for 15 min. The preparation is infused for 12 hours and the decoction drunk: 1 glassful three times a day for 8 days. [22]	The extract sets close to the cholinergic receptor of the postsynaptic membrane and prevent the poison from fixing, while distorting the site or partially concealing it.

			The <i>Naja</i> neurotoxin is prevented from attaching itself and this prevents paralysis by neuromuscular block (Koné 1980 [3]). Against neurotoxic venomous bites
16	<i>Strychnos spinosa</i> : 1 handful of leaves 1 handful of stem bark 1 handful of roots	The dried ingredients are powdered. A tablespoon of the powder is introduced in one cup of cooled pap, and the mixture drunk: morning and evening for five days [21].	Antiseptic and diuretic, eliminates Viperidae toxin by diuresis (contains strychnine and the brucin)
17	<i>Tamarindus indica</i> : 1 handful of leaves	The leaves are macerated in 2L of cold water, and then boiled for 20 min and the cooled solution drunk: 250mL morning and evening during one week. The preparation is also used for the massage of the infected part [29].	Diuretic and purgative, used against snakebite,
18	<i>Ximenia americana</i> : powdered roots	-1 tablespoonful of powder is brewed in 1 glassful of hot water or in 1 cup of hot mush and the mixture drunk: morning, noon and evening during one week. - The powder can be snuff to make the victim sneeze [7].	Anti-edematous, against the necrotize venomous bites of Elapidae; the plant possesses healing properties
19	<i>Ziziphus spina christi</i> : - roots and stem bark powdered	5 tablespoonfuls of powder are macerated in 1 L of cold water for 11 hours and the mixture drunk: 1 glassful morning and evening during 1 week. - 1 tablespoon of the powder can be added to one cupful of cooled mush and the mixture drunk: 2 times per day during 1 week [2]. - The powder of thorns burnt black is used as poultice [29].	
20	- <i>Bauhinia rufescens</i> : 1 handful of dried fruits - <i>Ricinus communis</i> : 1 handful of dried fruits	The powdered ingredients are infused in 10 L of hot water and the mixture drunk: 1 glassful morning and evening for 7 days [29].	Anti-diarrheic, anti dysenteric and anti cholera used against spider stings
21	- <i>Boswellia dalzielii</i> : 1 handful of stem bark - <i>Combretum molle</i> : 1 handful of stem bark	The dried ingredients are mixed and pulverized. The powder is infused in 5 L of hot water and the decoction drunk: 1.5 L morning and evening for 10 days. The treatment is continued with the preparation of <i>Azadirachta indica</i> on the 12 th day, for the next 5 days [16].	Anti-edematous, anti cholera. Used against necrotize venomous bites and stings



Annona senegalensis:
branched shrub **Annona senegalensis:**
ellipsoids fruits of 3 cm long **Ximenia africana:** ellipsoid
fruits of 3 cm long

Fig. 4. Two main plants with antivenin properties, opposite to necrotic and hemorrhagic symptoms of the venom of the Viperidae



Securidaca longepedunculata:
erected shrubs of 3-4 m **Securidaca longepedunculata:**
samarum of 4-5cm long,
with a membranous wing **Ziziphus spina christi:**
spindly ramifications,
mixed

Fig. 5. Two main plants with antivenin properties, opposite to neurotoxic bites symptoms of the venom of the Elapidae

Securidaca longepedunculata possesses an anti-inflammatory effect which neutralizes the action of the venom of the Cobra. The neurotoxin of this last fixes on the cholinergic receptor situated on the postsynaptic membrane of the acetylcholine, blocks the propagation of the nervous impulse and muscular contraction, leading to paralysis. The root extract of *Securidaca longepedunculata*, would prevent the neurotoxin of Cobra, while partially concealing the receptor, to attach itself on it, and to prevent paralysis by neuromuscular blockage [2,9]. *Ziziphus spina christi* has some traditional antivenin healing effects, whereas *Azadirachta indica* is a diuretic and an anti-inflammatory plant. This is why the ingestion of the leaf decoction of *Azadirachta indica* would bring about the elimination of the toxins via urine. *Calotropis procera* is used in cases of spider

stings and *Boswellia dalzielii* is polyvalent in the treatment. These results are confirmed by the Chippaux works [2]. Some of these plants are used in the same way in some regions of Burkina Faso [31]. Other plants possess poisonous latexes and are considered poisonous for internal use. On the other hand they can be used externally and they possess some antiseptic and sedative properties such as *Ricinus communis*, *Calotropis procera* and *Jatropha curcas* [20,8].

A study carried out on venom antidotes, leads to the conclusion that animal parts are also used as antivenins by Ffulbes, residing in the Hina Subdivision of the Far-North region of Cameroon. Human breast milk, ear wax, urine and vagina secretions have been found to be used in various ways [8]. However the use of donkey bile, horse

hairs, viper or cobra flesh was found to be new in the Cameroonian ethnopharmacology literature [8]. In Hina, immunotherapy is also used as specific treatment for all venomous bites and stings by administering antibodies produced by the cow body following different snake bites during transhumance. These antibodies are present in the cow milk or in the blood of the ewe that suckles this milk, the choice of one or the other being guided by the availability of the ingredients for serotherapy. The black stone is always in the pocket for venom adsorption, whenever the case arises.

5. CONCLUSION

His survey demonstrates medicinal plant contribution to the possibilities of treatment of venomous bites and stings, notably in those caused by *Viperidae* and *Elapidae*. Plant extract can either be antagonistic to venom or potentiate antivenin serum. Besides, the observations are sustained by other types of local tradi-therapeutic approaches (use of ingredients of animal origin, a type of emanotherapy). Traditional healthcare system is a first line care, which uses the tried out therapeutic preparations, capable of delaying the action of venom, enabling the subsequent evacuation of the victim to a conventional healthcare centre where serotherapy, if available, could be administered. Energizing and popularizing the traditional antivenin pharmacopoeia contributes to a reduction or to total elimination of deaths due to snakebites, scorpion and spider stings.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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