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Ethnobotanical survey of medicinal plants against ophidian envenomations in the Bonginda/Bikoro Group in DR Congo

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Abstract

Snakebite envenomation is a neglected tropical disease causing enormous suffering, disability and premature death on all continents. This study aims to inventory the plants involved in the management of snakebite cases in rural areas.

A survey was conducted in the Bonginda groupement, Bonginda Territory, Equateur Province in DR Congo during the period from January 2019 to December 2020. Data was collected by the standardized interview method with a focus on individual interview technique. To this end, a questionnaire was administered to traditional healers reputed in the treatment of snakebites.

It shows that 17 species grouped into 14 families are used to treat cases of ophidian envenomation in Bonginda. The Fabaceae and Rubiaceae families each have 3 species. The others are monospecific. Among the organs used, leaves predominate with a score of 44.4%. They are followed by the roots (18.5%). Regarding the mode of preparation, the decoction prevails with 27.3%. It is followed by grinding (13.6%). As for the route of administration, local application (28.6%) is ahead of the oral route (23.8%) and purgation (14.3%).

Constituents based on medicinal plants are recognized as local heritage.

Keywords: Medicinal Plants; Ophidian Envenomation; Traditional Healer; Rural Environment; DR Congo

1. Introduction

Snake envenomation is a worldwide health problem and a reason for morbidity and mortality. According to WHO [1] around 5.5 million snakebites occur each year, resulting in up to 2 million envenomations, at least 100,000 deaths and around 300,000 amputations and other irreversible disabilities [1]. More than 500,000 victims of snakebite envenomation have been reported in Africa [2-5].

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In Africa, ancestors hold endogenous knowledge that they pass on to their descendants to treat tropical diseases [6]. Qualified as empirical, this endogenous knowledge is not based on any theory, but it is often used in the composition of drugs [7].

In rural Africa, the role of traditional medicine and medicinal plants in the management of snakebites is well established [8]. The majority of people bitten by snakes claim to have used traditional treatment rather than to the antivenom of modern medicine [9, 10]. Successful snakebite treatment in rural areas requires the involvement of traditional health practitioners [11].

With a view to palliating deaths due to snakebites, various authors have taken an interest in the medicinal plants used in traditional medicine against ophidian envenomations [2, 11, 12]. The use of plants against the effects of snakebite has long been recognized. Currently, various authors are giving it more scientific attention in their studies [13-16].

This study aims to inventory the plants involved in the management of snakebite cases in the Bonginda group, Bikoro Territory, Equateur Province in DR Congo.

2. Material and methods

2.1. Study framework

Reporting to the Lac Ntomba Sector, the Bonginda group constitutes the large liquid part of the territory. Administratively, the chief town of the territory is included in this grouping. Referring to the map below, the Bonginda groupement is designated by the edge. The chief town of the sector is in Moheli on the axis Mpenda - Momboyo Catholic Mission [17].

Figure 1 Map of the territory of Bikoro Source St Moulin 2005

2.2. Ethnobotanical surveys

Data collection concerns the period from January 2019 to December 2020. A questionnaire was administered to traditional healers known to treat snakebites.

The data was collected by the standardized interview method, favoring the individual interview technique. A four-section questionnaire was therefore developed:

- An Introductory Note Section;
- A Section Of The Socio-Demographic Characteristics Of The Respondent;
- A Section Of The Survey Itself;
- A Section Of Ethical Considerations

3. Results

Table 1 shows the floristic list, the vernacular names, the organs used, the methods of preparation and administration

Table 1 Floristic list, vernacular names, organs used, methods of preparation and administration

Family	Species	Vernacular name (Dialect)	Organ used	Method of preparation	Routes of administration
Annonaceae	*Anonidium mannii*(Oliv.) Engl. & Diels	Mondenge ya nzambe (lingala) Mobei (Lokonda, Lontomba)	Sterm bark	Splay	Scarification Local application
Caricaceae	*Carica papaya* L.	Paipai (lingala)	Leaf Root	Decoction	Bath
Cecropiaceae	*Cecropia pachystachya* Trécul	Sabu, Bomambo (Lomongo) Bombambo (Lonkundo) Kombokombo (Lingala) Bokombo (Lokonda , Lontomba)	Root Leaf Bud	Maceration Calcination	Oral route Massage
Commelinaceae	*Palisota schweinfurthii* C.B.Clarke	Zazu, Kpato, Zâzo (Ngwaka) Itele (Lontomba)	Whole plant	Splay	Scarification Local application
Euphorbiaceae	*Manniophyton fulvum* Müll.Arg	Mokosa (Lingala) Sambia (Lontomba)	Stem sap	Extraction	Local application
Fabaceae	*Scorodophloeus zenkeri* Harms	Bofili (Lomongo) Bopili (Lokonda) Mbopili (Mpama)	Root bark Leaf	Calcination	Purgation
Fabaceae	*Senna occidentalis* (L.) Link	Limingolanta (Lomongo) Bonungolata (Lonkundo) Bolebebonse (Lontomba) Betshobeawane(Elinga)	Leaf Pod Root	Drying Incineration of roots Cutting of leafs and pod	Incisions Local application
Fabaceae	*Pentaclethra macrophylla* Benth.	Ebala (Kitembo) Buadja (Lomongo) Owala (Kitetela) Boala (Lonkundo) Obala (Mpama, Kinunu) Ehili (Lokonda)	Pod	Decoction	Bath
Clusiaceae	*Harungana madagascariensis* Lam. ex Poir.	Botonongolo, Montone (Lonkundo) Bohili (Lontomba)	Leaf	Grinding	Local application
Meliaceae	*Entandrophragma palustre* Staner	Bosala (Kinunu, Mongo) Bobala (Lokonda, Lotomba)	Stem bark	Decoction	Purgation Inhalation

Phyllanthaceae	*Hymenocardiaulmoides*Oliv.	Ikengeleke (Lokonda) Ikengelek (Lonkundo) Eyanze (Lontomba)	Leaf	Decoction	Oral route
Rubiaceae	*Feretia apodanthera* Del.	Ilongia (Ekonda , Lontomba)	Leaf	Pounding Maceration	Oral route
Rubiaceae	*Morinda morindoides* (Baker) Milne-Redh	Kongobololo (Lingala, Lokonda) Kong'ololo (Lonkundo) Ngongabololo (Mpama)	Leaf	Decoction	Oral route
Rubiaceae	*Ophiorrhiza mungos* Linn..	Nsambiilokay (Lontomba)	Leaf	Chewing	Oral route
Salicaceae	*Oncoba welwitschii* Oliv	Ehake (Lotomba, Lokonda)	Leaf Root	Decoction Filtration	Purgation
Sapotaceae	*Synsepalum dulcificum* Schum.) Baill.	Bomonga, Mpunga (Lontomba) Bompunga (Lokonda) Munga (Ngwaka) Mofunga (Elinga)	Stem Leaf Root	Grinding	Local application
Solanaceae	*Nicotiana tabacum* L.	Ikaya li tumbaco (Kisengele) Mongolo (Lontomba) Likaya (Mpama) Tumbaco (Lingala)	Leaf	Grinding	Local application

The analysis of Table 1 reveals that in Bonginda, the anti-venom floristic list includes 17 species grouped into 14 families. The Fabaceae and Rubiaceae families each have 3 species. The others are monospecific.

Figure 2 presents the analysis of the organs used, the methods of preparation and the routes of administration

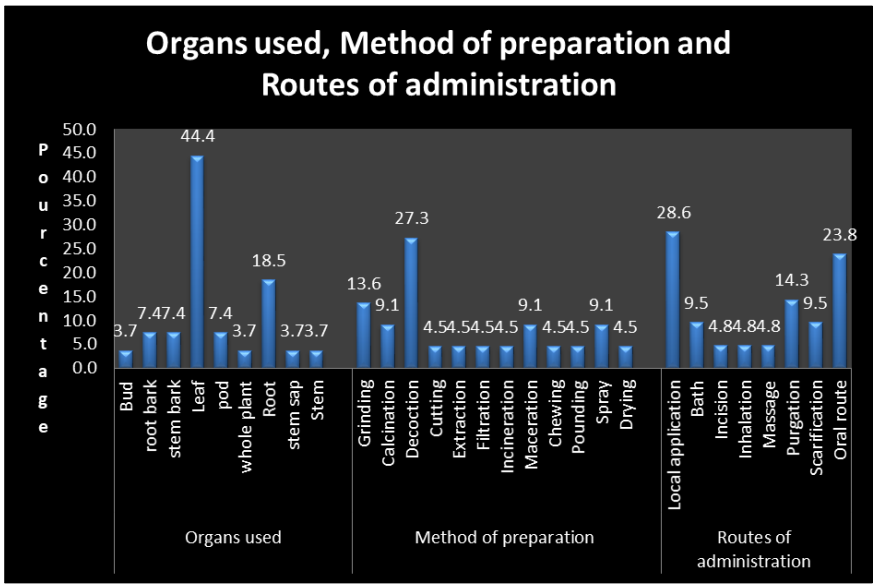

Figure 2 Organs used, Method of preparation and Routes of administration

3.1. Organs used

The leaves predominate with the score of 44.4%. They are followed by the roots (18.5%). Root bark, stem bark and pod each account for 7.4%. They precede the buds, the whole plant, the stem sap and the stem which each represents 3.7%.

3.2. Method of preparation

The decoction takes precedence with 27.3% followed by grinding (13.6%). Calcination, maceration and pulverization each intervene with 9.1%.

3.3. Route of administration

Local application (28.6) is ahead of the oral route (23.8%) and purgation (14.3%). The local bath (9.5%) and the scarification (9.5%) predominate over the incision, the inhalation, and the massage which intervene each with 4.8%.

4. Discussion

The treatment of snakebites by plants is of interest to several researchers around the world. In Bonginda, most cases of ophidian envenomation call on medicinal plants through traditional healers. A list of 17 species grouped into 14 families has just been drawn up. The Fabaceae and Rubiaceae families each have 3 species.

- Fabaceae: *Scorodophloeus zenkeri* Harms; *Senna occidentalis* (L.) Link; *Pentaclethra macrophylla* Benth.
- Rubiaceae: *Feretia apodanthera* Del. ; *Morinda morindoides* (Baker) Milne-Redh; *Ophiorrhiza mungos* Linn.

Ngbolua *et al.*[9] note that 17 medicinal plants belonging to 16 botanical families are used against snakebites in forest areas of DR Congo. The families Leguminosae and Araceae each have 2 species.

- Leguminoseae: *Senna occidentalis* (L.) Link, *Piptadeniastrum africanum* (Hook.f.) Brenan
- Araceae: *Anchomanes giganteus* Engl. ; *Cercestis congoensis* Engl.

In Uganda, a literature review carried out in multidisciplinary databases revealed that 77 plant species belonging to 65 genera and 42 families are used for the treatment of snakebites in Uganda [12]). The majority of these species belong to the Fabaceae (31%), Euphorbiaceae (14%), Asteraceae (12%), Amaryllidaceae (10%) and Solanaceae (10%) families.

In Kenya, Omara[2] identified 54 species grouped into 27 families. The predominant families consisted of Fabaceae and Malvaceae, each with 5 species.

In Senegal, Sow [18] carried out a survey at three sites in three regions: Dakar, Kaolack and Kédougou. In total, he recorded two families of plants both among healers, traditional healers and herbalists:

- Annonaceae: *Annona chrysophylla* Boj., *A. senegalensis* var. *chrysophylla* (Boj.) R. Sillans, *A. senegalensis* var *latifolia* Oliv., *A. arenaria* Thonn;
- Polygalaceae: *Securidaca longipedunculata* Fresen.

In Mali, Bah *et al.*[11] identified 13 species grouped into 11 families. The Rubiaceae and Fabaceae families are predominant:

- Fabaceae: *Acacia albida* Delile Balazan; P*iliostigma reticulatum* (DC.) Hochst; *Tamarindus indica* L.
- Rubiaceae: *Crossopteryx febrifuga* (Afzel) Benth. *Gardenia ternifolia* Schumach. &Thonn

Recognition of the anti-venom properties of certain species goes beyond the limits of the DR Congo. Indeed, *Senna siamea* is also included in the inventory carried out in Kenya [2]. The same is true for *Nicotiana tabacum, Senna occidentalis, Carica papaya* in Uganda [12] and *Ophiorrhiza mungos* Linn. in India [19].

Molander *et al.*[20], tested 226 extracts of 94 species used to treat snakebites from three countries: Mali, D.R. Congo and South Africa. The Anacardiaceae and Malvaceae families had the highest number of active species. Of the 226 plant extracts tested, 41 plant species showed more than 90% inhibition in one or more tests. Inhibition is attributed mainly to polyphenols such as tannins in most extracts. Inhibition of digestive enzymes by tannins may be beneficial in the treatment of local tissue damage caused by snake venom and inhibition of the "spreading factor" The enzyme hyaluronidase may delay the onset of systemic effects, thereby improving the rate of survival.

Among the 41 plant species, five plant extracts were active in the hyaluronidase enzyme assay and one extract was active in the protease assay after removal of tannins suggesting that they may contain a more specific inhibitor. The five plants are widely distributed alongside *Bitis arietans* and *Naja nigricollis* is a potential inhibitor accessible to everyone in sub-Saharan Africa [20].

Many Indian herbal medicines are recommended for the treatment of snakebites. Several laboratory studies have demonstrated the anti-venom effects of plant extracts. Let us mention in particular the cases of:

- Methanolic root extracts of *Vitex negundo* Linn. and *Emblica officinalis* Gaertn. [13]
- Seed extract of *Strychnos nuxvomica* Linn [21];
- Leaf extracts of *Asystasia gangetica* (L) and *Newbouldia leavis* (P. Beauv) [22]
- Plant extracts of *Andrographis paniculata* and *Aristolochia indica* [23]
- Extract of *Eclipta prostrata* [24]
- Extract root of *Tabernaemontana alternifolia* [25].

5. Conclusion

Given the prevalence of snakebite cases in the equatorial forest and the resulting consequences, the present study aimed to enhance endogenous knowledge on the treatment of ophidian envenomation in Bonginda, Territory of Bikoro Province of Ecuador in DR Congo.

The field survey revealed that the anti-venom floristic list includes 17 species grouped into 14 families. The Fabaceae and Rubiaceae families each have 3 species.

- Fabaceae: *Scorodophloeus zenkeri* Harms; *Senna occidentalis* (L.) Link; *Pentaclethra macrophylla* Benth.
- Rubiaceae: *Feretia apodanthera* Del. ; *Morinda morindoides* (Baker) Milne-Redh; *Ophiorrhiza mungos* Linn

The reputation of the anti-venom properties of certain species goes beyond the African continent. Such is the case of *Ophiorrhiza mungos* Linn. prescribed in India against the same pathology

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

There is no conflict of interest be the authors of this manuscript.

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