



Ethnobotanical Survey and Sociocultural Uses of Two Plant Species of the Genus *Alstonia* (Apocynaceae) in the Kungu Territory (South Ubangi) in the Democratic Republic of the Congo

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Abstract: *The aim of the present study is to provide actors interested in herbal medicine with endogenous knowledge on the medicinal and traditional uses of *Alstonia boonei* and *A. congensis* in the Kungu territory. The survey revealed that both are widely used either alone or in combination with other species and contribute to the treatment of many diseases. Endogenous knowledge of these two species and their medicinal-traditional uses reveal that 23 kinds of diseases are treated, of which snakebite the only disease is commonly treated by the three sociocultural groups targeted in this study, namely Bomboma, Ngbandi, and Ngombe. Of the different plant parts used in the preparation of therapeutic recipes, bark dominates with 58.8%, followed respectively by sap (22.4%), leaves (12.9%), and roots (5.9%). Finally, as forests are increasingly threatened, it would be imperative to preserve these two medicinal species by developing, for example, their cultivation and thus guarantee a sustainable and regular supply of organs used as raw materials in the preparation of medicinal recipes.*

Keywords: *Ubangi ecoregion; traditional medicine; alstonia; sustainable development goals; Democratic Republic of Congo*

I. Introduction

The Democratic Republic of Congo (DRC), with 52% of the Congo Basin's dense forests and 46% of Africa's forests, has a relative abundance of forest resources capable of contributing to sustainable economic development (Bosanza, 2013). The species *Alstonia boonei* is found in land firm areas while *Alstonia congensis* is usually found in swampy localities (it is found at the edge of waterholes in valley forests) up to 500 m altitude, but is also sometimes found on dry rocky ground (Lemmens, 2005).

In Africa, more than 80% of the population rely on traditional medicine using medicinal plants to solve the primary health problem (World Health Organization 2002; Neuwinger, 2000; Ngbolua et al., 2014; Toirambe, 2002; Mongeke et al., 2018). Indeed, the existence of traditional medicine is largely dependent on both the knowledge held by traditional practitioners on the medicinal use of plants, and the specific diversity of the flora used. The use of medicinal plants for various health problems is said to be supported by choice, but also because of the growing poverty of populations who do not have access to modern medicines because of their very high cost (Kambale et al., 2008; Mpiana et al., 2013).

Moreover, the organization of the health care system in the DRC, as elsewhere in Africa, is generally characterized by a certain plurality of health care provision in the sense that there is a coexistence of a modern health care system and a traditional system. Thus, in this context, in which interest is growing among researchers, the scarcity of data on ancestral knowledge and flora is still a handicap for the definition of an efficient policy on traditional medicine in the DRC (Nzuki, 2016).

In a study conducted in the Province of Sud-Ubangi (DRC), out of 39 plant species identified in the Bayenga forest reserve (Dongo sector), 41% are medicinal plants used for the treatment of common diseases in the area (Bosanza et al., 2021).

Alstonia boonei De Wild is one such species. Furthermore, it should be noted that *Alstonia boonei* is a species that has long been confused with *Alstonia congensis*. These two botanically very similar species could probably have the same chemical composition, which could result in identical biological activities.

In this context, what kind of knowledge do traditional practitioners have about the medicinal use of these two species in Kungu territory.

The present study aims to address some of the concerns about the medicinal and traditional uses of these two species by the different ethnic groups in the study area, with particular attention to the diseases treated, the plant organs used and the method of preparation of the therapeutic recipes.

Following the results of previous studies on herbal medicine (Mongeke et al., 2018; Bosanza et al., 2021), the bark would be the part most used in the form of decoctions to treat various illnesses, the nature of which varies from one socio-cultural group to another.

The aim of this work is to provide actors interested in phytotherapy with endogenous knowledge on the medicotraditional uses of *A. boonei* and *A. congensis* in the Kungu territory.

II. Research Methods

2.1 Study Area

This study was carried out in the Kungu Territory (Figure 1), located in the South Ubangi Province of the DRC. GPS coordinates indicate that the area lies between 2°20' and 3°15' North latitude and 18°40' East longitude.

According to the Ministry of Planning (2005), the climate is generally tropical of the AW type of Koppen's classification; specifically, a climatic zone of the Aw3 type, characterized by a dry season lasting 70 to 80 days. The annual rainfall is 1800 mm. The temperature is 20.7°C minimum and 30.7°C maximum, with a daily average of 25.7°C. The relative humidity is 87%. The annual average daily maximum temperatures are around 30°C. The soils are of the Ferrasol type on undefined rocks covering the northern half of the Ubangi and Mongala provinces. These soils are silty-clay sands and sandy silts.



Figure 1. Map of Kungu territory (Source: CAID, 2017)

2.2 Methods

To carry out this work, the methodological approach will consist of documentary and survey techniques.

The documentary research was an opportunity to consult as many books as possible on traditional medicine, paying particular attention to writings that emphasize the value of traditional medicine.

The aim of this documentary phase was to provide a reliable theoretical basis for this study, by taking into account the state of the scientific debate on our research subject.

The data collection tool was an interview guide for semi-structured interviews with our respondents, which included several variables, namely

- (1) Demographic characteristics (profile) of practitioners, such as socio-cultural group, age, gender, level of education, occupation, family situation, etc.
- (2) Ethnomedical, ethnobotanical and ethnoecological knowledge of traditional practitioners, such as the status of the medicinal plant (wild, cultivated), the category of use (medicinal, food, energy, timber, fodder), the diseases treated, the method of preparation (decoction, infusion, etc.) and the dosage (oral, anal, etc.)

The questions focused on endogenous knowledge about the plant and its medicinal and traditional uses by different ethnic groups. Particular attention was paid to recording the profile of the respondents, the diseases treated, the parts used, and the mode of preparation of therapeutic recipes.

Data collection for this study was carried out through semi-structured interviews with 42 'traditional healers' from three ethnic groups (Boba or Bomboma, Ngbandi, and Ngombe) living in three Sectors of the Territory during the period from December 2020 to March 2021 (Figure 1: map of Kungu territory). The sectors considered are Bomboma, Dongo, and Songo.

The sampling was snowball sampling as it was necessary to work on small, scarce populations where it is difficult to locate or approach people. Thus, meeting the first people led to meeting others until the desired sample size was reached (Kinkela, 2013).

The parameters considered were the profile of the respondents, the different diseases treated in the study area, the plant organs used to treat these diseases, and the modes of preparation of therapeutic recipes.

III. Discussion

3.1 Profile of the Surveys

Information on the profile of the respondents, i.e., gender, age, marital status, and level of education, is presented in Table 1.

Table 1. Profile of 'Traditional Healer' Respondents in Kungu Territory

Variable	Modalité	Frequency	Percentage (%)
Gender	Female	12	28.6
	Male	30	71.4
Age group	18 - 35 years	06	14.3
	36 – 50 years	17	40.5
	> 50 years	19	45.2
Marital status	Single	02	4.8
	Married	40	95.2
Educational level	Illiterate	02	4.8
	Primary	16	38.1
	Secondary	21	50.0

	University	03	7.1
Main Activity	Small farming	27	64.3
	Civil service	13	30.9
	Others	02	4.8

The results in Table 3 show that the majority of respondents are men (71.4%) and women represent only 28.6%. As for their age, 45% are old people over 50 years of age, followed by adults aged between 36 and 50 years (40.5%). This shows the lack of interest of young people in this activity. Of these, 95.2% are married. Regarding the level of education, it is clear that half of the respondents have a primary level of education. Finally, more than half of the respondents (64.3%) are small farmers.

3.2 Diseases Treated in the Study Area

The list of different diseases traditionally treated with *Alstonia* is given in Table 2.

Table 2. Different diseases were treated in the Study Area

N°	Diseases treated	Socio-cultural group		
		Bomboma	Ngbandi	Ngombe
01	Bronchitis	+	-	-
02	Fire burns	-	-	+
03	Bubon	-	+	-
04	Dental Carrie	-	+	+
05	Colic (bellyache)	+	-	+
06	Conjunctivitis	-	+	+
07	Diarrhoea	-	+	+
08	Abdominal pain	+	-	-
09	Postpartum pain	-	+	+
10	Poisoning	-	-	+
11	Yellow fever	-	-	+
12	Filariasis	+	-	-
13	Sexual weakness	+	-	-
14	Hemorrhoids	+	-	+
15	Hernia	-	+	+
16	Hypotension	-	+	+
17	Luxation	+	-	-
18	Headaches	-	+	+
19	Snakebite	+	+	+
20	Malaria	-	+	+
21	Rates	+	+	-
22	Measles	-	+	-
23	Intestinal verminous	-	+	+
Total diseases cited/group		09	13	15

Legend: +: *The disease is cited by the socio-cultural group*; -: *the disease is not cited by the socio-cultural group*

Endogenous knowledge of these two species of *Alstonia* and their medicinal-traditional uses reveal that 23 kinds of diseases are treated in the area. In relation to the number and nature of diseases particularly treated by each ethnic group targeted in this study, three categories can be established:

- a) Only one disease (i.e., 4.4% of diseases cited) is commonly treated by these three socio-cultural groups: snakebite, which accounts for 100% of this first category.
- b) Twelve diseases (i.e., 52.2% of diseases cited) are commonly treated by two of the three socio-cultural groups and are distributed as follows:
 - Nine diseases are commonly treated by the Ngbandi and Ngombe, namely: tooth decay, conjunctivitis, diarrhoea, pain after childbirth, hernia, hypotension, headaches, malaria, and intestinal verminous; they represent 39.2% of all diseases cited by the three socio-cultural groups and 75.0% of this 2nd category;
 - Two diseases (hemorrhoids and ventral colic) are commonly treated by two ethnic groups Bomboma and Ngombe i.e., 8.7% of all diseases cited and 16.7% of this 2nd category;
 - One disease (spleen disease) is commonly treated by two ethnic groups Bomboma and Ngbandi, i.e., 4.4% of all diseases cited and 8.3% of this category.
- c) Ten diseases (i.e., 43.5% of diseases cited) are specifically treated by each of the three socio-cultural groups, of which:
 - 5 diseases, i.e., 21.7% of all diseases cited and 50.0% of this 3rd category are specifically treated by the Bomboma ethnic group namely: bronchitis, abdominal pain, filariasis, sexual weakness, and dislocation;
 - 2 diseases (Bubon and measles), i.e., 8.7% of all diseases cited and 20.0% of this 3rd category are specifically treated by the Ngbandi ethnic group;
 - 3 diseases hereafter: fire burns, poisoning, and yellow fever, i.e., 8.7% of all the diseases cited and 20.0% of this 3rd category are specifically treated by the Ngombe ethnic group.

Previous studies conducted on the same species have mentioned some of the diseases mentioned in this study namely diarrhoea, hemorrhoid, hernia, malaria, and respiratory tract problems (Latham and Konda, 2006). Lusakibanza, (2012) also mentions malaria, hernia and verminosis. In Gabon, it is antimalarial and anthelmintic (Bourobou et al., 1996).

3.3 Plant Organs Used in the Preparation of Recipes

Information on the preference for the use of plant parts in the preparation of different recipes according to ethnic groups is shown in Table 3.

Table 3. Frequency of use of Plant Parts in the Preparation of Recipes

Preparation methods	Bomboma		Ngbandi		Ngombe	
	Citation	Percentage	Citation	Percentage	Citation	Percentage
Leaves	0	0.0	4	16.7	7	21.2
Root	1	3.6	0	0.0	4	12.1
Stem bark	22	78.6	16	66.7	12	36.4
Sap	5	17.9	4	16.7	10	30.3
Total	28	100.0	24	100.0	33	100.0

Concerning the particularity of the parts used in the preparation of recipes for the diseases treated by each socio-cultural group targeted by this study, it is interesting to note that, according to Table 5.

The Bomboma do not use the leaf, but rather the bark (78.6%), followed by the sap (17.9%) and less of the root (3.6%);

Among the Ngbandi, it is rather the root that is not used, while the bark still dominates with 66.7%, followed ex aequo by leaf and sap (16.7%);

The Ngombe consume all parts but in different proportions with more importance respectively on bark (36.4%), sap (30.3%), leaves (21.2%), and root (12.1%). The following figure summarizes this information for the whole study.

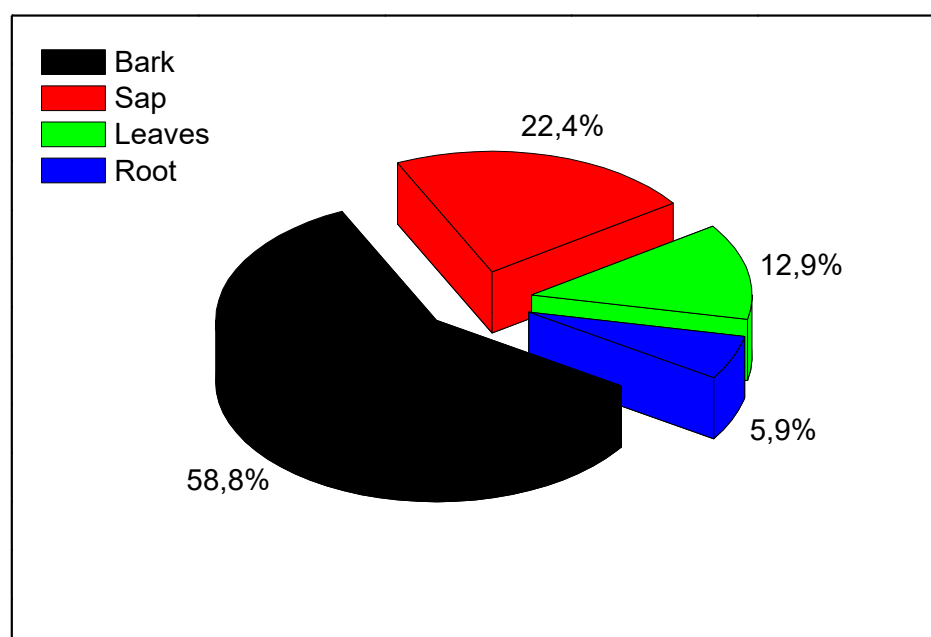


Figure 2. Citation Frequencies of Plant Parts Used In Recipe Preparation

Figure 2 clearly illustrates that among the plant parts used in the preparation of different recipes to treat the above-mentioned diseases, bark dominates with 58.8% followed respectively by sap (22.4%), leaves (12.9%), and root (5.9%) (Figure 2).

The predominance of bark was also previously reported in the same study area by Mongeke et al. (2019) with a ratio of 43% and by Bosanza et al. (2021) with a proportion of 68.2% compared to the other parts mentioned.

3.4 Preparation of Therapeutic Recipes

The preparation of recipes based on the different parts of these two species is done in several ways and varies from one disease to another and sometimes from one socio-cultural group to another as presented in Table 4.

Table 4. Indicators of Different Parts and Modes of Preparation of Recipes by Disease Cited and by Socio-Cultural Group

N°	Diseases treated	Socio-cultural group		
		Bomboma	Ngbandi	Ngombe
01	Bronchitis	B(2) /B(5)/B(5)	–	–
02	Fire burns	–	–	S(3)/S(5)
03	Bubon	–	S(6)	–
04	Dental carrie	–	B(2)/B(2)	R(3)
05	Colic (bellyache)	B(2)/B(2) /R(2)/S(5)	–	B(2)/R(1)/L(1)/L(1)
06	Conjunctivitis (Eye Diseases)	–	B(5)/L(1)/S(5)	L(1)/S(5)/S(5)
07	Diarrhoea	–	B(2)/B(2)/S(5)	B(2)/L(1)/B(2)
08	Abdominal pain	B(2)/B(2)/S(5) S(5)	–	–
09	Postpartum pain	–	B(2)/L(2)	S(5)/L(2)/R(2)

)R(2)
10	Poisoning	–	–	L(1)
11	Yellow fever	–	–	S(2)/S(2)
12	Filariasis	B(2)/B(2)/B(2)	–	–
13	Sexual weakness	B(2)/B(2)/B(2)	–	–
14	Hemorrhoids	B(2)/B(2)/B(2)/B(2)/ B(2)/B(2)/B(2)/S(5)	–	S(5)/B(5)
15	Hernia	–	S(5)	S(5)
16	Hypotension	–	B(2)	B(2)/B(2)
17	Luxation	B(6)	–	–
18	Headaches	–	B(1)	B(1)
19	Snakebite	S(5)	B(2)	B(5)/B(3)/S(5)/ L(4)/ B(3)/S(5)
20	Malaria	–	B(2)/L(1)	
21	Rates	B(3)	B(2) ; B(3)/B(3)	–
22	Measles	–	B(2)	–
23	Intestinal verminous	–	B(2)/L(2)/B(2)	B(2)

Legend:

- ◆ *Plant parts used: -B: Bark; L: Leaf; R: Root; S: Sap*
- ◆ *Mode of preparation : (1) Infusion (2) Decoction (3) Maceration ; (4) Mastication (5) Expression (6) Cataplastm*

The proportions of citations for different ways of preparing therapeutic recipes, by each socio-cultural group, are recorded in Table 5.

Table 5. Indicators of Different Modes of Preparation of Therapeutic Recipes

Code	Preparation methods	Bomboma		Ngbandi		Ngombe	
		Citation	%	Citation	%	Citation	%
(1)	Infusion	0	0.0	3	12.5	7	21.2
(2)	Decoction	19	67.9	13	54.2	11	33.3
(3)	Maceration	1	3.6	3	12.5	4	12.1
(4)	Chewing	0	0.0	0	0.0	00	0.0
(5)	Expression	7	25.0	4	16.7	10	30.3
(6)	Cataplastm	1	3.6	1	4.2	1	3.0
Total		14	100	24	100	33	100

Table 5 shows that decoction is the most commonly used method of preparation among all the socio-cultural groups targeted, with 67.9% of the Bomboma, 54.2% of the Ngbandi, and 33.3% of the Ngombe.

Previous studies indicate that medicinal plants are used whole or in part (leaf, stem, root, bark, fruit, etc.) in remedies made from plant substances, and not from pure mineral or chemical substances (Pousset, 1989; Fortin et al., 1990; Potel, 2002).

These preparations are of several kinds, including poultices, decoctions, capsules and powders, infusions, inhalations, macerations, syrups, and tinctures (Pousset, 1989; Fortin et al., 1990; Potel, 2002).

IV. Conclusion

The aim of this research was to provide actors interested in herbal medicine with endogenous knowledge on the medicotraditional uses of *A. boonei* and *A. congensis* in the Kungu territory.

To carry out this work, the methodological approach consisted of a documentary technique focused on the review of literature that emphasizes the value of traditional medicine and a survey of traditional practitioners. The data collection tool was an interview guide for semi-structured interviews with the respondents, including several variables, namely: the profile of the respondents, the different diseases treated in the study area, the plant organs used to treat these diseases, and the methods of preparation of medicotraditional recipes.

The study revealed that these two species, *A. boonei*, and *A. congensis*, are particularly well known to the populations interviewed and are widely used either alone or in association with other species and contribute to the treatment of many diseases. Endogenous knowledge of these two species and their medicotraditional uses reveal that 23 types of illnesses are treated, of which snakebite the only illness is commonly treated by the three socio-cultural groups targeted in this study, namely Bomboma, Ngbandi, and Ngombe.

Among the different plant parts used for the preparation of therapeutic recipes, bark dominates with 58.8% followed respectively by sap (22.4%), leaves (12.9%), and roots (5.9%).

In addition, six modes of preparation of therapeutic recipes were used, namely decoction, expression, infusion, maceration, mastication, and cataplasm. Among these methods, the decoction is the most widely used among all the sociocultural groups targeted: 67.9% among the Bomboma, 54.2% among the Ngbandi, and 33.3% among the Ngombe.

Thus, it is important to carry out in-depth studies on the principles with medical effects present in the plant organs used for the preparation of recipes (natural remedies), the active principles conferring medical virtues on the species targeted by this study, and the dosage of use of each recipe obtained in order to prove the scientific evidence of the therapy.

Finally, as forests are increasingly threatened, it would be imperative to preserve these two medicinal species by developing, for example, their cultivation and thus guarantee a sustainable and regular supply of organs used as raw materials in the preparation of medicinal recipes

It is therefore desirable that phytochemical and pharmacological studies be carried out on both plants in order to validate their ethnomedical use and identify their active ingredients.

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