

## Medicinal plant recipes used in the management of peptic ulcers in Burkina Faso: Ethnobotanical study

Armandine LEMA<sup>1, 2, \*</sup>, Mindiériba Jean BANGOU<sup>1, 2</sup>, Mamadou SAWADOGO<sup>1, 2</sup>, Hyacinthe Mindiempo THIOMBIANO<sup>1, 2</sup> and Hermann Yempabou OUOBA<sup>1, 3</sup>

<sup>1</sup> Department of Biochemistry and Microbiology, University of Nazi BONI, 01 BP 1091 Bobo-Dioulasso 01, Burkina Faso.

<sup>2</sup> Laboratory for Research and Education in Animal Health and Biotechnology, University of Nazi BONI, 01 BP 1091 Bobo-Dioulasso 01, Burkina Faso.

<sup>3</sup> University Joseph Ki-Zerbo, Life and Earth Sciences Training and Research Unit, Laboratory of Plant Biology and Ecology, University of Nazi BONI, 03 BP 7021 Ouagadougou 03, Burkina Faso.

International Journal of Science and Research Archive, 2022, 06(01), 263–278

Publication history: Received on 03 May 2022; revised on 09 June 2022; accepted on 11 June 2022

Article DOI: <https://doi.org/10.30574/ijrsra.2022.6.1.0133>

### Abstract

**Introduction:** Peptic ulcer is a real public health problem in both developed and developing countries.

**Objective:** The present study is part of the establishment of a catalog of medicinal plant recipes with antiulcer activity in four cities of Burkina Faso.

**Methodology:** The method of approach was an ethnobotanical survey carried out among traditional health practitioners. It consisted in the preliminary drafting of questionnaires allowing the collection of socio-demographic and ethno-pharmacological data. This was a semi-structured interview with each traditional practitioner. The snowball technique was also used. The collection of our data was carried out in a single pass.

**Results:** At the end of the study, 290 traditional health practitioners were surveyed, with a predominance of men (69.66%) over women (30%). Likewise, 279 recipes of medicinal plants used in the treatment of peptic ulcers were identified. These recipes are made up of 113 species belonging to 48 botanical families. The most represented families were Caesalpiniaceae (9 species) and Combretaceae (8 species). Bark (31%), roots (25%) and leaves (24%) were the most used organs. The decoction (70%) was the predominant mode of preparation and was mainly administered orally (47%).

**Conclusion:** This study constitutes a very valuable source of information for further research in the field of phytochemistry and pharmacology in order to develop improved traditional anti-ulcer drugs.

**Keywords:** Peptic ulcer; Ethnobotanical survey; Medicinal plant recipes; Traditional health practitioners.

### 1. Introduction

Peptic ulcer disease is a condition resulting from an imbalance between the body's defense factors and aggressors [1]. Studies have shown that 98% of cases are due to a bacterium called *Helicobacter pylori* [2]. Other mechanisms such as: stress, alcohol consumption, smoking and non-steroidal anti-inflammatory drugs... also trigger ulcers [1, 3, 4]. According to some investigations, about 80% of subjects are infected from childhood and remain so throughout life [1, 5]. Every

\* Corresponding author: Armandine LEMA

Department of Biochemistry and Microbiology, University of Nazi BONI, 01 BP 1091 Bobo-Dioulasso 01, Burkina Faso.

year in France, there is an increase in the number of ulcer cases. According to the work of Oueldelhachemi [6], this increase has been estimated between 60 and 80,000 new cases per year which would correspond to about 4 million adults potentially carrying a duodenal ulcer disease. Appropriate anti-ulcer treatment consists of pain relief, accelerating mucosal healing and combating disease-causing germs to prevent recurrence [2]. There are many treatments for example antibiotics, antisecretory drugs, antacids and surgery offered by modern medicine [6]. But these treatments are at exorbitant costs and are not accessible to the majority of rural populations who use traditional medicine as an alternative [7]. Indeed, medicinal plants are a valuable source of many medicines. It is estimated that at least 25% of all modern medicines are derived, directly or indirectly, from medicinal plants, mainly through the application of modern technologies to traditional knowledge [8]. Authors have shown that nearly 80% of the African population use local plants for their primary health care [8-10]. Indeed, according to Béné *et al.* [11], the effectiveness of herbal medicine has been demonstrated and its benefits undeniable. Since, these medicinal plants contain an immense source of biomolecules capable of mitigating the effects induced by oxidative stress. In Africa, the knowledge concerning medicinal plants is mostly held by the elderly and they rarely transmit their knowledge. Their disappearance corresponds to an important loss of profitable information. It is therefore important to conduct studies aimed at documenting and safeguarding traditional pharmacopoeia knowledge [12]. It is with this in mind that we set ourselves the general objective of identifying the recipes of medicinal plants used in the treatment of peptic ulcers among traditional health practitioners.

## 2. Methodology

### 2.1. Presentation of the study areas

The ethnobotanical study was conducted in four (04) cities of Burkina Faso, namely: Bobo-Dioulasso, Boromo, Dédougou and Fada N'Gourma (Figure 1). It focused mainly on medicinal plant recipes used in the treatment of peptic ulcers. The parameters that justified our choice of these localities were: accessibility to information, ease of communication, proximity to cities and the number of traditional health practitioners.

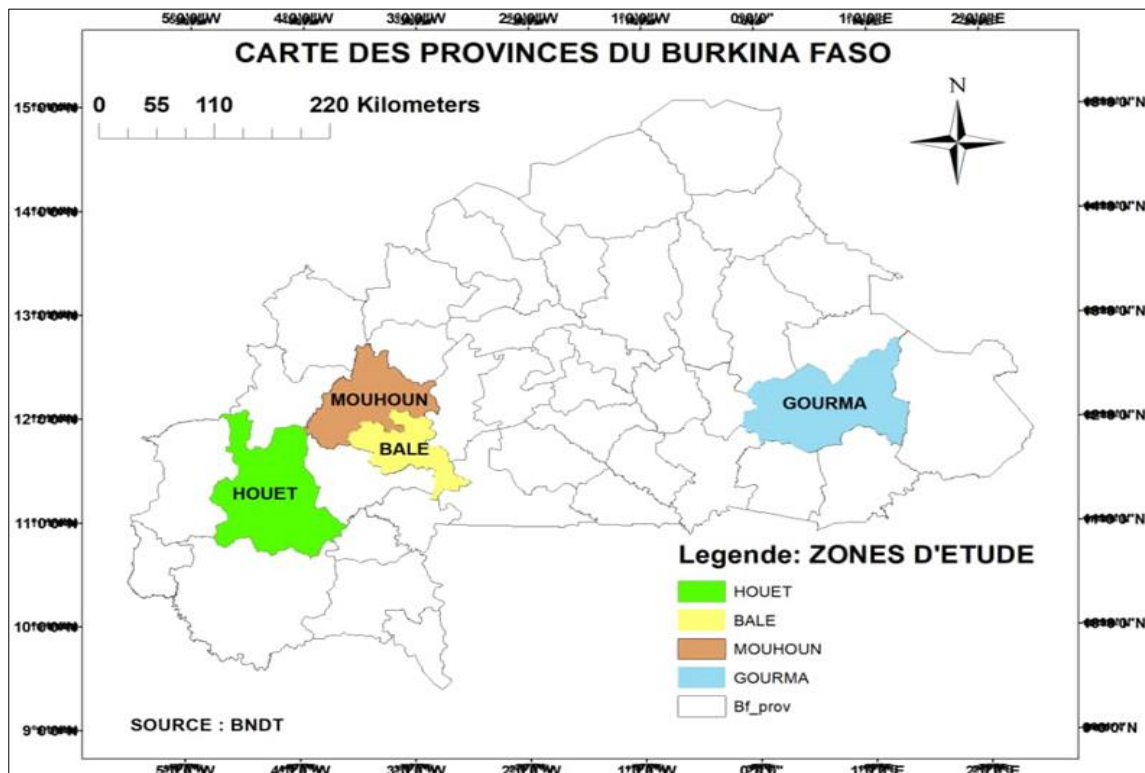


Figure 1 Mapping of study cities

## 2.2. Methodological approach

This was a series of ethnobotanical surveys, a prospective cross-sectional study, with a descriptive aim from 15 May to 20 September 2021. Data collection was carried out according to the method described by Jazy *et al.* [12], with slight modification. Survey sheets were used to collect sociodemographic and ethnobotanical data. The survey was conducted among traditional practitioners who agreed to participate in the study, describing their various plant-based recipes. This was a semi-structured interview with each traditional practitioner and the "snowball" technique was equally used. The data was collected in a single pass either at the home level or at the level of their service. The approach of the traditional healers was based on dialogue in local or French languages.

## 2.3. Data processing

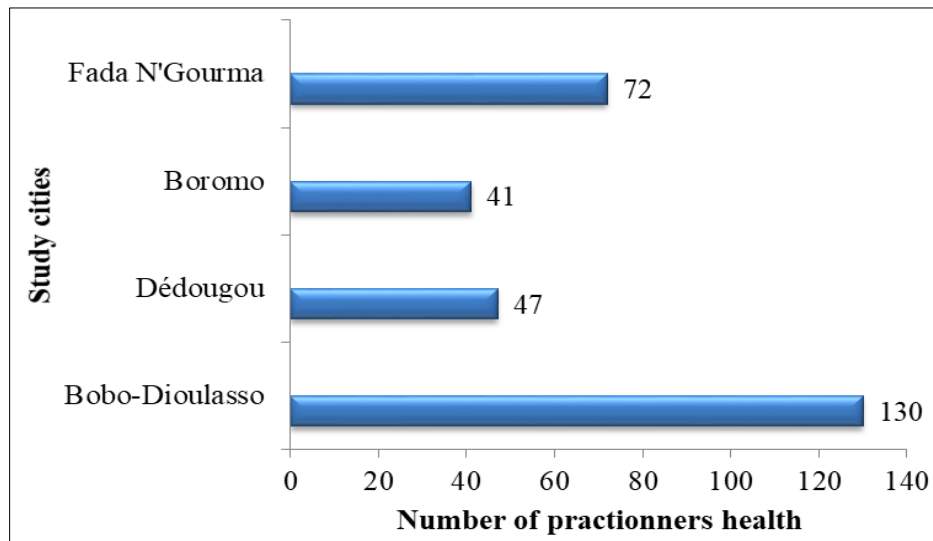
The data collected on the survey forms were of two types, socio-demographic and ethnobotanical. At the end of the study, all of these data were entered into Microsoft Excel 2016. The following parameters were studied: age, sex, number of years of experience, level of education, botanical family, part of the plant used, method of preparation and administration.

## 3. Results and discussion

### 3.1. Socio-demographic data

#### 3.1.1. Distribution of respondents by study area

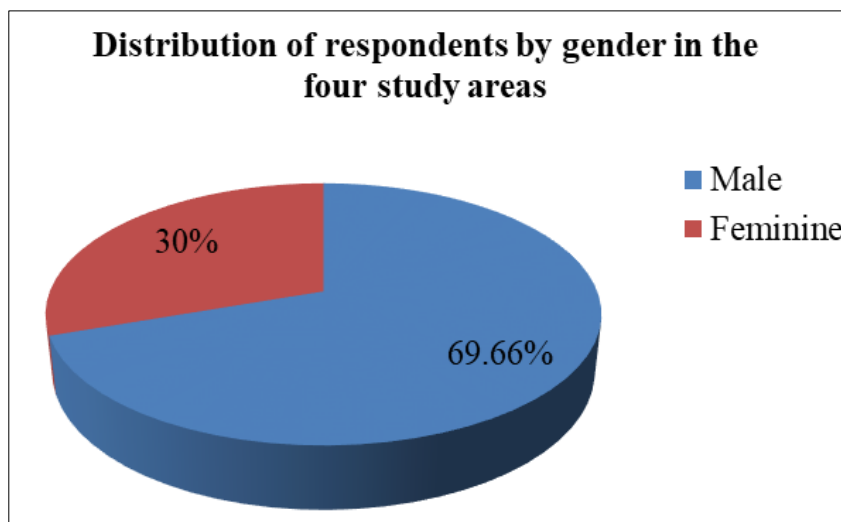
A total of 290 traditional practitioners were interviewed (Figure 2). The results show a predominance of traditional practitioners in the cities of Bobo-Dioulasso and Fada N'Gourma. This unequal distribution could be explained by the non-availability of traditional practitioners in the cities of Boromo and Dédougou. In fact, we conducted our surveys during the winter season and most of the respondents were farmers.



**Figure 2** Distribution of respondents by study cities

#### 3.1.2. Distribution of respondents by gender

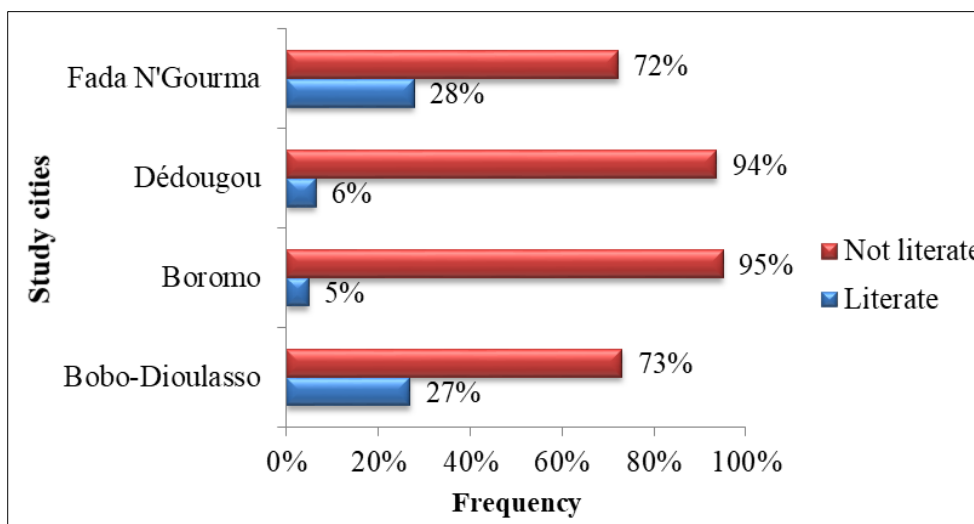
Medicinal plants are used by both men and women. The male gender predominates, i.e. 69.66% of men against 30% of women (Figure 3). The same observation is made by Gnagné *et al.* [13] who in their work in Ivory Coast also noted a strong predominance of the male gender (65%). This superiority could be due to the social and cultural barriers that men have erected against women. However, a good knowledge of the pharmacopoeia by women will save many lives, especially those of children in households.



**Figure 3** Distribution of respondents by gender

3.1.3. *Distribution of respondents by level of education*

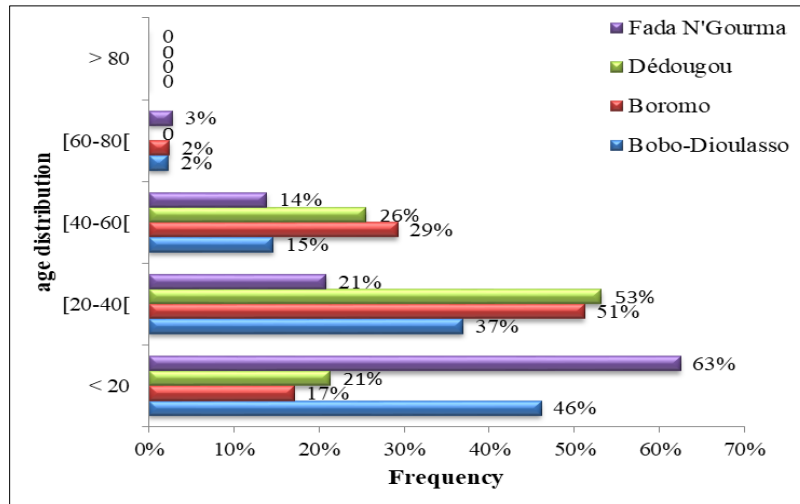
We collected information from both literate and non-literate traditional healers (Figure 4). However, we note that the majority of respondents are illiterate. The same observation was made by Guinnin *et al.* [14], who in their work in Benin on medicinal plants used in the traditional treatment of viral hepatitis B and C, showed that nearly 90% of the traditional practitioners surveyed were illiterate. According to the same authors, this finding could be explained by the fact that the use of medicinal plants remains the prerogative of poor people [13, 14].



**Figure 4** Distribution of respondents by level of education

3.1.4. *Age distribution of the subjects surveyed*

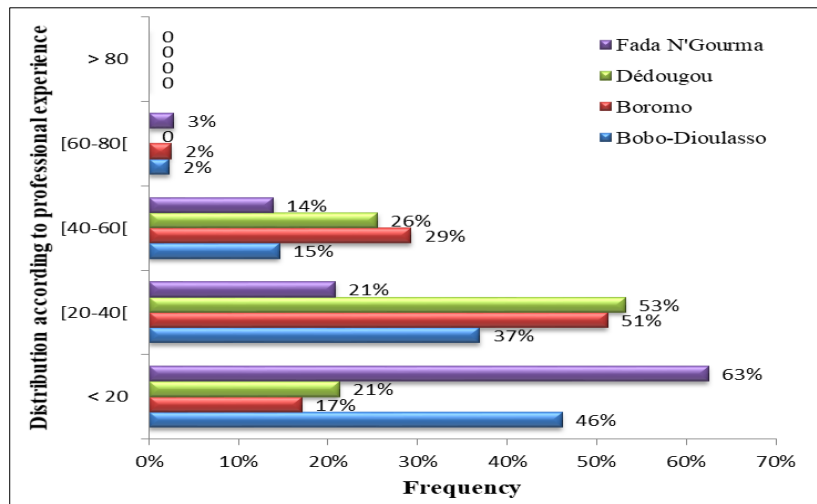
In the Boromo city, people aged 60 to 79 years have a high frequency of use of medicinal plants, i.e. 60.98%. The age distribution also shows that traditional practitioners in the 40-59 and 60-79 age groups in the Dédougou and Bobo-Dioulasso cities have an average frequency of use of medicinal plants, i.e., 44.68% and 43.08% respectively (Figure 5). The majority of the subjects surveyed were of middle age. The same finding was made by other authors such as Gnagné *et al.*; Olou *et al.* [13, 15]. This result could be explained by the conservation of endogenous knowledge by the elderly [16].



**Figure 5** Distribution of the subjects surveyed according to age

### 3.1.5. Distribution of surveyed subjects by professional experience

All of the traditional practitioners surveyed have at least three years of experience and the majority has more than 20 years of experience (Figure 6). In addition, these respondents claim to have inherited knowledge of medicinal plants from their parents. Studies have shown that experience accumulated with age is the main source of information at the local level. Most importantly, it has been recognized that in Africa, it is the elders, i.e., the oldest people, who hold the traditional knowledge of treating diseases [17, 18].

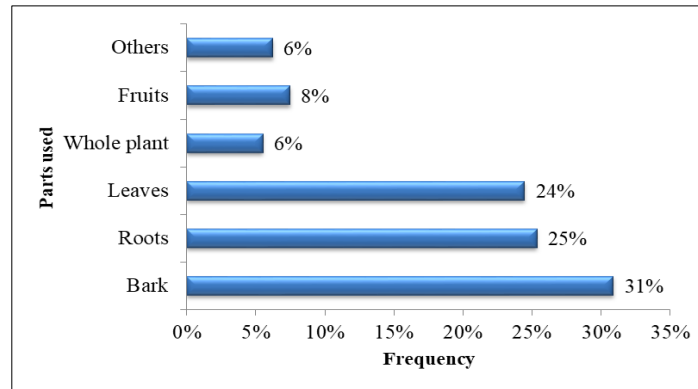


**Figure 6** Distribution respondents according to professional experience

## 3.2. Ethnobotanical data

### 3.2.1. Distribution of medicinal plants by parts used

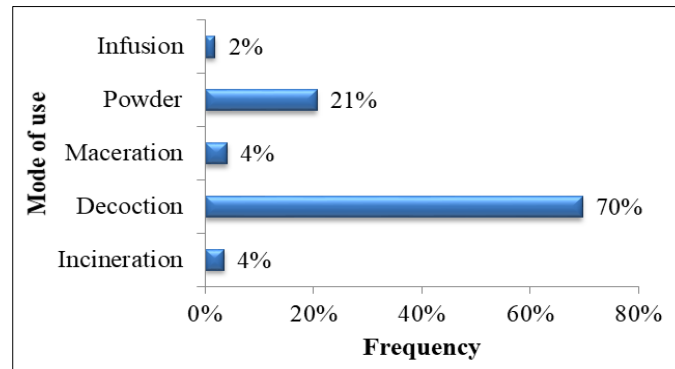
The parts most used by the surveyed traditional health practitioners in the preparation of recipes were barks (31%), roots (25%) and leaves (24%) (Figure 7). The high use of bark could be due to the richness of this organ in chemical substances since the bark is the communication pathway between the roots and the leaves Dongock *et al.* [16]. According to the same author, the roots are used because their underground positions would favor the conservation of highly light-labile active substances. Also the great solicitation of the leaves in traditional medicine, finds its reason in their richness in active substances. Tahri *et al.* [19] also reports that the leaves are the parts of the plant most used by traditional practitioners. This can be explained by the fact that photosynthesis or the manufacture of all active substances takes place in the leaves [20, 21] and also by the ease and speed of harvesting [19, 21].



**Figure 7** Distribution of medicinal plants according to the parts used

*3.2.2. Distribution of medicinal plants according to the mode of use*

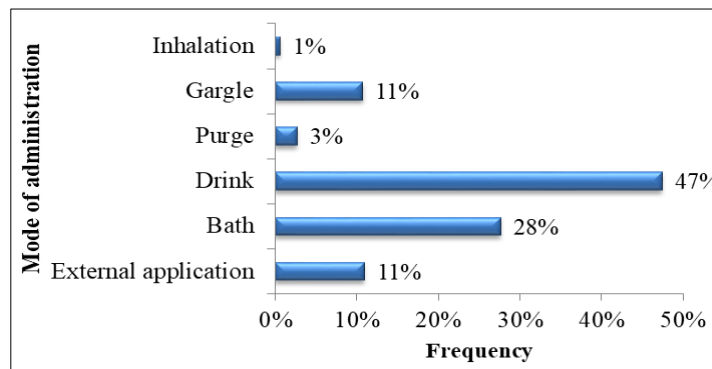
In traditional medicine, there are several modes of preparation of the recipes. The decoction (70%) and the powder (21%) were the most used modes. Indeed, decoction allows collecting the most active principles and attenuates or cancels the toxic effect of some recipes [19, 22]. The preparation of recipes is mono specific or in combination of several species.



**Figure 8** Distribution of medicinal plants according to the mode of preparation

*3.2.3. Distribution of medicinal plants by mode of administration*

Different modes of administration are used. The administration by drink (47%) and bath (28%) were the most used modes (Figure 9). Administration by drink could be due to the simplicity of this mode [22] and also by the fact that the drugs being in crude form, the oral route could prove to be the least dangerous [10].



**Figure 9** Distribution of medicinal plants by mode of administration

## 3.2.4. Distribution of species, families, and recipes in the different study cities

Several remedies based on medicinal plants are proposed by traditional practitioners to treat ulcers. These plants are used in combination or alone. In Bobo-Dioulasso, the surveys enabled the inventory of 279 recipes and 89 species belonging to 46 botanical families. In Boromo, 38 recipes and 22 species belonging to 17 families were identified. Also in Dédougou, we have identified 108 recipes, 33 species all belonging to 20 families. Finally, in the Fada N'Gourma city, we collected 137 recipes, 53 species also belonging to 27 botanical families. The most represented families were the Caesalpiniaceae (9 species) and the Combretaceae (8 species). A high proportion of medicinal species was observed in the different study cities, which could be explained by the richness and diversity of the flora of these localities [16].

**Table 1** Distribution of species involved in the different recipes

Families	Species	The parts used	Other pathologies treated	References
Anacardiaceae	<i>Lannea acida</i> A. Rich.	Bark	Stomach-aches, hypertension, diarrhea, gonorrhoea, rheumatism, malaria, anemia, hemorrhoids	[23-25]
	<i>Lannea microcarpa</i> Engl. & K. Krause	Bark	Malaria, diarrhea,, hypertension	[24]
	<i>Lannea velutina</i> A. Rich	Bark	Hypertension	[24]
	<i>Mangifera indica</i> L.	Bark	Diarrhea, hemoroid disease, candidiasis, anemia, rhino-bronchitis	[25-27]
	<i>Sclerocarya birrea</i> (A.Rich.) Hochst.	Bark	Cough, malaria, stomach-aches, dermatosis, diabetes, treatment of cardiovascular diseases	[16, 28]
Annonaceae	<i>Annona senegalensis</i> Pers	Roots	Diarrhea, colic, stoppage of the fontanel, painful rule, sexually transmitted infection	[26, 29-31]
	<i>Annona squamosa</i> L.	Leaves	Stomach-aches, diabetes, diarrhea, dysentery, malaria	[32]
	<i>Xylopia aethiopica</i> (Duna)	Fruits	Diarrhea, infection treatment, candidiasis, colic, rhino-bronchitis, eruptive fever	[26]
Apocynaceae	<i>Saba senegalensis</i> (A. DC.) Pichon	Fruits	Colic, stoppage of the fontanel	[26]
Arecaceae	<i>Borassus akeassii</i> Bayton, Ouédr & Guinko	Leaves	Malaria, fever, teething, anal sores, muscle weakness	[33]
Asclepiadaceae	<i>Calotropis procera</i> (Aiton) R.Br.	Roots, leaves, fruits	Cough, general pain, dermatosis, painful rule, sexually transmitted infection	[30, 34]
	<i>Leptadenia hastata</i> (Pers.) Decne	Whole plant	Mental illness treatment	[35]

Continuation (01) of table 1

Asteraceae	<i>Acanthospermum hispidum</i> DC	Bark	Malaria, stomach-aches, pregnancy, jaundice, white loss, pregnancy	[36, 37]
	<i>Chysanthellum americanum</i> (L.) Vatke	Whole plant	Kidney disease, ulcer	[37, 38]

	<i>Chrysanthellum indicum</i> subsp Afro	Whole plant	Malaria	[36]
	<i>Eclipta alba</i> (L.) Hassk.	Whole plant	Malaria, diabetes, childhood diseases	[37]
	<i>Vernonia colorata</i> (Wild.) Drake	leaves	Malaria, fever, high blood pressure, diarrhea, jaundice	[37]
Balanitaceae	<i>Balanites aegyptiaca</i> (L.) Del	Bark, roots	Constipation, malaria, hypertension	[24]
Balanophoraceae	<i>Bobgunnia madagascariensis</i> (Desv.) J.H.Kirkbr. & Wiersema	Leaves	Malaria	[23]
Bignoniaceae	<i>Crescentia cujete</i> L	Fruits	Eruptive fever	[25]
Bombacaceae	<i>Adansonia digitata</i> L.	Bark	Fever, growth retardation, diarrhea, painful rule, sexually transmitted infection, anemia, delay in walking	[25, 26, 30]
	<i>Ceiba pentandra</i> (L.) Gaertn	Roots	Gastric ulcer	12]
Boraginaceae	<i>Heliotropium indicum</i> L.	Fruits	Treatment of childhood diseases	[25]
Bromeliaceae	<i>Ananas comosus</i> (L.) Merrill	Fruits	Treatment of intestinal worms, purification of the reproductive system, malaria, anemia, stomach-aches	[25, 30, 39]
Burseraceae	<i>Boswellia dalzielii</i> Hutch	Roots, bark	Fever, rheumatism, wounds, leprosy, hepatitis	[40]

Continuation (02) of table 1

Caesalpiniaceae	<i>Burkea africana</i> Hook	Bark	Edema, fever, dysentery, malaria	[41]
	<i>Cassia sieberiana</i> DC.	Leaves, roots	Stomach-aches, dermatosis, hypoglycemic	[26, 42]
	<i>Daniellia oliveri</i> (Rolfe)	Bark, roots	Female sterility, madness, constipation, jaundice, treatment of cardiovascular diseases	[16]
	<i>Detarium microcarpum</i> Guill. & Perr.	Roots, leaves	Hypertension, diabetes, malaria, stomach-aches	[24, 25, 42, 43]
	<i>Dialinum guirensis</i> Willd.	Leaves	Dental caries, headache, cough, diarrhea, fever, colds, high blood pressure	[25, 42]
	<i>Senna alata</i> (L.) Roxb.	Leaves	Malaria, treatment of cardiovascular diseases	[16]
	<i>Tamarindus indica</i> L.	Leaves, bark	Varicella, constipation, asthenia, hemorrhoids, allergies	[12, 26]
	<i>Piliostigma reticulatum</i> (DC.) Hochst.	Bark	Diarrhea, cough, kidney diseases	[38, 16]
	<i>Piliostigma thonningii</i> (Schumach.) Milne-Redh.	Bark	Mycosis, hypertension	[24, 44]
Caparaceae	<i>Boscia angustifolia</i> A. Rich.	Leaves	Treatment of the mentally ill	[35]
Caricaceae	<i>Carica papaya</i> L.	Roots, leaves	Malaria, hypertention, hepatitis, diseases, malaria, stomach-aches, jaundice, sickle cell disease	[12, 25, 45]



Celastraceae	<i>Gymnosporia senegalensis</i> (Lam.) Loes	Leaves	Colic	[21]
Cochlospermaceae	<i>Cochlospermum planchonii</i> Hook. f. ex Planch.	Roots	Diarrhea, malaria	[23]

Continuation (03) of table 1

Combretaceae	<i>Anogeissus leiocarpus</i> (DC.) Guill. & Perr.	Bark, roots	Diarrhea, hypertention, malaria, anemia, candidiasis, teething	[24, 25]
	<i>Combretum micranthum</i> G. Don	Leaves	Candidiasis, diarrhea, acts, colds, diabetes, hypertension, anemia	[25, 42]
	<i>Combretum molle</i> R.Br	Leaves, bark	Diarrhea	[26]
	<i>Combretum nigricans</i> Lepr. ex Guill. et Perr.	Bark, leaves	Cardivascular diseases	[16]
	<i>Guiera senegalensis</i> J.F. Gmel.	Leaves	Increase lactation	[21]
	<i>Pteleopsis suberosa</i> Engl	Leaves, bark	Malaria, candidiasis, teething, colic	[27]
	<i>Terminalia laxiflora</i> Engl	Roots	Dysentery, hemorrhoids, malaria	[46]
	<i>Terminalia macroptera</i> Guill & Perr	Bark, roots	Dysentery, diarrhea, malaria, hepatitis, fever, leper, tuberculosis, colic, hypertension	[47]
Ebenaceae	<i>Diospiros mespiliformis</i> Hochst. ex A. DC	Roots	Diarrhea, earache	[26]
Euphorbiaceae	<i>Euphorbia hirta</i> L.	Whole plant	Dysentery, diarrhea, stomach-aches	[26, 42]
	<i>Euphorbia poissonii</i> Pax	Whole plant	Caries and tooth extraction, cancer	[48]
	<i>Fluggea virosa</i> Roxb. ex Willd.	Leaves, roots	Infection treatment, malaria, rhino-bronchitis, splenomegaly, staphylococcal disease	[26]
	<i>Manihot esculenta</i> Crantz	Leaves	Inflammatory disorder, jaundice	[12,49]

Continuation (04) of table 1

Fabaceae	<i>Acacia albida</i> Del	Leaves	Hypertension	[24]
	<i>Afzelia africana</i> Sm.	Roots	Hypertension disease	[25]
	<i>Chamaecrista nigricans</i> (Vahl) Greene	Bark	Skin diseases	[50]
	<i>Pterocarpus erinaceus</i> Poir	Bark	Diarrhea, fatigue, col, anemia, bloody hemorrhoids	[42]
Lamiaceae	<i>Ocimum basilicum</i> L.	Leaves	Treatment of childhood diseases, the treatment of diabetes, cardiac and renal diseases, fever, mental disorder and stimulant	[19, 25,51]
Lauraceae	<i>Laurus nobilis</i> L.	Leaves	Treatment of microbial infections	[51]
Loranthaceae	<i>Tapinanthus dodoneifolius</i> (DC.) Danser	Leaves	Gynecologic disturbances, digestive disorders, nervous confusions	[52]
	<i>Tapinanthus globiferus</i> (A. Rich.) Van Teigh	Leaves	Rheumatoid arthritis	[53]

	<i>Martynua annua</i> L.	Leaves	Epilepsy, tuberculosis, sore throat	[54]
Lythraceae	<i>Lawsonia inermis</i> L.	Leaves	Jaundice, leprosy, diarrhea, candidiasis, rash fever	[25]

Continuation (05) of table 1

Malvaceae	<i>Abelmoschus esculentus</i> (L.) Moench	Leaves	Leucorrhoea, diarrhea, malaria, hypertension	[55]
	<i>Gossypium herbaceum</i> L.	Fruits	Diarrhea, dysentery, rheumatoid arthritis	[56]
	<i>Sterculia setigera</i> Delile	Roots bark	Vomiting, constipation, diarrhea	[42]
	<i>Walteria indica</i> L.	Whole plant	Malaria, anemia, teething, colic	[25]
Meliaceae	<i>Azadirachta indica</i> A. Juss.	Bark	Malaria	[11]
	<i>Khaya senegalensis</i> (Desr.) A. Juss.	Leaves, roots, bark	Malaria, candidiasis, teething	[25]
	<i>Pseudocedrela kotschyi</i> (Schweinf.) Harms	Roots	Muscle bruises, internal wounds, toothache, malaria, rash fever	[25]
	<i>Trichilia emetica</i> Vahl	Leaves, roots, bark	Malaria	[41]
Mimosaceae	<i>Acacia amythethophylla</i> Steud. ex A. Rich.	Bark	Necrosis, viraleskin nodule	[57]
	<i>Acacia nolitica</i> (L.) Willd. ex Del.	Fruits	Dysentery, bloating, earache, candidiasis, colic, rhino-bronchitis	[25, 26]
	<i>Acassia seyal</i> DC.	Roots	Urological disorders	[21]
	<i>Acacia polyacantha</i> Willd.	Bark	Tooth decay, malaria, sore throat, cough	[23]
	<i>Acacia tortilis</i> subsp.	Roots	Dermatosis, asthma, wounds, stomach-aches	[21]

Continuation (06) of table 1

Mimosaceae	<i>Cassia alata</i> L.	Leaves	Malaria, constipation, dermatitis	[11]
	<i>Dicrostachys cinerea</i> (L.)	Bark	Cough, earache, toothache	[23]
	<i>Entada africana</i> Guill. & Perr.	Leaves, roots	Treatment of cardiovascular diseases	[16]
	<i>Parkia biglobosa</i> (Jacq.)	Roots, bark	Diarrhea, measles	[26]
Moraceae	<i>Ficus carica</i> L.	Bark	Treatment of cardiovascular diseases	[16]
	<i>Ficus ingens</i> (Miq.) Miq.	Bark	Dermatological disorders	[21]
	<i>Ficus platyphaylla</i> Delile	Bark	Mental illness treatment	[35]
	<i>Ficus polita</i> Vahl	Roots	Diarrhea, Treatment of cardiovascular diseases	[16]
	<i>Ficus thonningii</i> Blume	Bark	Cough, cold, rickets, fever, hepatitis, rheumatism	[26]
Moringaceae	<i>Moringa olivera</i> Lam.	Leaves	Malaria, hemorrhoids	[25]
Musaceae	<i>Musa acuminata</i> Colla.	Leaves	Malaria	[39]
Myrtaceae	<i>Eucalyptus camaldulensis</i> Dehnh.	Leaves	Cold, bronhitis, sickle cell, crisis, anemia	[12]
	<i>Psidium guajava</i> L.	Leaves	diarrhea, malaria, diabetes	[27]
	<i>Syzygium aromaticum</i> (L.) Merr.	Fruits	Stomach-aches, hemorrhoids, asthma	[25]

Continuation (07) of table 1

Ochnaceae	<i>Lophira lanceolata</i> Van Tiegh. ex Keay	Bark	Treatment of childhood diseases, malaria	[25]
Olacaceae	<i>Ximenia americana</i> L.	Roots	Dysentery, sore eye, mouth wounds, rheumatism, diarrhea	[23, 24]
Opiliaceae	<i>Opilia amentaceae</i> Roxb	Bark	Diabetes	[58]
Orobanchaceae	<i>Striga hermontheca</i> (Del.) Benth.	Whole plant	Treatment of bacterial infections	[59]
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	Whole plant	Fever, malaria, sexual weakness, yellow fever, malaria	[11, 25, 60]
	<i>Cymbopogon schoenanthus</i> (L.) Spreng	Whole plant	Hypertension	[24]
	<i>Bambousa vulgaris</i> Schard. Ex J. C. Wendl.	Leaves	Typhoid fever, hypertention, anorexia	[11]
	<i>Sorghum bicolor</i> (L.) Moench.	Seeds	Treatment of cardiovascular diseases	[16]
	<i>Zea mays</i> L.	Beard	Fever, common cold, treatment of cardiovascular diseases	[16]
Polygalaceae	<i>Securidaca longipedunculata</i> Fres.	Leaves, roots	Malaria, bloating, Wounds, infected eruption, intestinal worms, candidiasis, rhino-bronchitis, stomach-aches, splenomegaly	[23, 25]
Rhamnaceae	<i>Zizifus mauritiana</i> Lam.	Roots	Stomach-aches, hypertension	[25]
Rubiaceae	<i>Gardenia aqualla</i> Stapf & HUTCH	Fruits	Treatment of germs	[61]

Continuation (08) of table 1

Rubiaceae	<i>Gardenia ternifolia</i> Schumach & Thonn	Bark	Hypertension, sickle cell disease, diabetes	[62]
	<i>Mitragyna inermis</i> (Wild.) K. Schum	Leaves	Urological, dermatological disorder	[21]
	<i>Sarcocephalus latifolius</i> (Sm) E. A: Bruce	Roots, bark	Malaria	[42, 39]
Rutaceae	<i>Zanthoxylum zanthoxyloides</i> (Lam.)	Bark	Malaria, candidiasis, colic, stomach-aches	[25]
Sapotaceae	<i>Vitellaria paradoxa</i> C. F. Gaertn.	Bark	Dysentery, common cold, diarrhea, teething, colic, rhino-bronchitis	[25]
Scrophulariaceae	<i>Scoparia dulcis</i> L	Whole plant	Fear of heights	[11]
Sterculiaceae	<i>Cola nitida</i> (Vent) Schott. & En.	Fruits	Facilitates childbirth	[11]
Tiliaceae	<i>Grewia bicolor</i> Juss.	Leaves	Respiratory and dermatological diseases	[63]
Verbenaceae	<i>Lippia chevalieri</i> Moldenke	Whole plant	Physical asthenia, sedative	[11]
	<i>Tectona grandis</i> L. f.	Roots	Anamia, sickle cell disease	[26]
	<i>Vitex doniana</i> Swect	Bark	Diarrhea, acts	[25]

Zingiberaceae	<i>Aframomum melegueta</i> (Roscoe) K. Schum.	Leaves	Treatment of childhood diseases, uterine fibroids, malaria, rash fever, depression	[25,30]
---------------	--	--------	--	---------

#### 4. Conclusion

Our study represents an inventory of medicinal plant recipes used in the treatment of peptic ulcers in four (04) cities in Burkina Faso. This study allowed the collection of interesting ethnobotanical data from the respondents. These data collected could help avoid the loss of endogenous knowledge on the use of medicinal plants held by traditional health practitioners. They also represent preliminary information for a more in-depth study on the most commonly used medicinal plants. This study will allow for the development of improved traditional anti-ulcer medicine accessible to all.

#### Compliance with ethical standards

##### Acknowledgments

The authors thank the various groups of traditional practitioners ("Association of Traditional healers of Houët", "Association of Wisdom Traditional healers", "Regional Union of Traditional Practitioners' Association of Mouhoun Loop", "Associations of Practitioners of the Bale Pharmacopoeia" and "Gulmu Traditional Practitioners Association") who have accepted to share their know-how on recipes based on medicinal plants against peptic ulcers. We commend their frank and kind collaboration.

##### Disclosure of conflict of interest

Armandine LEMA, Mindiériba Jean BANGOU, Mamadou SAWADOGO, Hyacinthe Mindiempo THIOMBIANO and Hermann Yempabou OUOBA declare that there is no conflict of interest in relation to this article.

##### Statement of ethical approval

This research does not contain any studies performed on animal/human subjects by any of the authors.

##### Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

#### References

- [1] Ehilé EH, Goze NB, Kouakou KL, Yapo AP, Ehilé EE. Acute toxicity and gastric antiulcer activity of an aqueous extract of the leaves of *Macaranga barteri* Müll. Arg (Euphorbiaceae) on rat models. *Journal of Medicinal Plants Research*. 2018 Mar;12(9):96-105.
- [2] Ngo NJC, Mvogo OPB, Kenmogue STC, Etamé LG, Ninanga NE, Dibong SD, Mpondo ME. Contribution to the knowledge of medicinal plants used in the treatment of peptic ulcer sold in the markets of Douala and Yaoundé. *Sciences, Technologies and Development*. 2017 Sep;19:75-86.
- [3] Kamguia GHF, Fokunang C, Ngameni B, Njinkio NB, Tembe-Fokunang E. Cytoprotective effect of aqueous extract of *Dorstenia psilurus* Welw roots on gastric ulcer in male wistar rats. *Health Sci. Dis*. 2011 Dec;12(4):1-11.
- [4] Yeomans ND, Hawkey CJ, Brailsford W, Næsdal J. Gastrointestinal toxicity of low-dose acetylsalicylic acid: a comparison with non-steroidal anti-inflammatory drugs. *Current Medical Research Opinion*. 2009 Jul;25:2785-2793.
- [5] Andoulo FA, Noah ND, Tagni-Sartre M, Ndam ECN, Blackett KN. Epidemiology of *Helicobacter Pylori* infection in Yaoundé: from the particularity to the African enigma. *Pan African Medical Journal*. 2013 Jul;16(115):1-6.
- [6] Ouedelhachemi MS. Peptic Ulcer: Therapeutic management and accompaniment in the pharmacy [Doctoral thesis in Pharmacy]. Mohamed V University; 2012.
- [7] Togola A, Karabinta K, Dénou A, Haidara M, Sanogo R, Diallo D. Protective effect of *Opilia celtidifolia* (Guill. & Perr.) Endl. leaves against ethanol-induced ulcer in rats. *Int. J. Biol. Chem. Sci*. 2014 Dec; 8(6):2416-2423.

- [8] El-Hilah F, Akka FB, Dahmani J, Belahbib N, Zidane L. Ethnobotanical study of medicinal plants used in the treatment of respiratory system infections in the central Moroccan plateau. *Journal of Animal & Plant Sciences*. 2015 Jun;25(2):3886-3897.
- [9] Mpondo ME, Ngene JP, Mpounze SL, Etame GL, Ngo BPC, Yinyang J, Dibong SD. Knowledge and traditional uses of medicinal plants in the Upper Nyong Department. *Journal of Applied Biosciences*. 2017 May;113:11229-11245.
- [10] Sylla Y, Silue DK, Ouattara K, Koné MW. Ethnobotanical study of plants used against malaria by traditional therapists and herbalists in the district of Abidjan. *Int. J. Biol. Chem. Sci*. 2018 Jun;12(3):1380-1400.
- [11] Béné K, Camara D, Fofie NBY, Anga KY, Yapi AB, Yapo YC, Ambé S, Zihiri GN. Ethnobotanical study of medicinal plants used in the Department of Transua, District of Zanzan (Ivory Coast). *Journal of Animal & Plant Sciences*. 2016 Jan;27(2):4230-4250.
- [12] Jazy MA, Morou SB, Sanogo R, Mahamane S. Ethnobotanical survey of traditional health practitioners in the Niamey and Tillabéri regions of Niger: Data 2012-2017. *European Scientific Journal*. 2017 Nov;13(33):277-304.
- [13] Gnagné AS, Camara D, Fofie NBY, Béné K et Zirihi GN. Ethnobotanical study of medicinal plants used in the treatment of diabetes in the Department of Zouénoula (Ivory Coast). *Journal of Applied Biosciences*. 2015 May;113:11257-11266.
- [14] Guinnin FDF, Sacramento IT, Sezan A, Ategbo JM. Ethnobotanical study of medicinal plants used in the traditional treatment of viral hepatitis B and C in some departments of Benin. *Int. J. Biol. Chem. Sci*. 2015 Jun;9(3):1354-1366.
- [15] Olou BA, Bio A, Deleke KEIK, Djego GJ, Sinsin AB. Ethnobotanical knowledge and valorization of two antihypertensive plants (*Carissa edulis* L. and *Crateva adansonii* DC.) in South and Central Benin (West Africa). *Int. J. Biol. Chem. Sci*. 2018 Dec;2(6):2602-2614.
- [16] Dongock DN, Bonyo AL, Mapongmestem PM, Bayegone E. Ethnobotanical and phytochemical study of medicinal plants used in the treatment of cardiovascular diseases in Moundou (Tchad). *Int. J. Biol. Chem. Sci*. 2015 Feb;12(1):203-216.
- [17] Dougnon TV, Attakpa E, Bankolé H, Hounmanou YMG, Dèhou R, Agbankpè J, Souza M, Fabiyi K, Gbaguidi F, Baba-Moussa L. Ethnobotanical study of medicinal plants used against a contagious skin disease: Human scabies in South Benin. *CAMES Journal-Pharm. Med. Trad. Afr*. 2016 Dec;18(1):16-22.
- [18] Lema A, Bangou MJ, Couliadiati TH, Sawadogo M, Hyacinthe M Thiombiano HM, Ouoba B, Ouoba HY, Ouedraogo GA. Ethnobotanical study, phytochemistry and antioxidant activity of medicinal plants used in the treatment of inflammation in two cities of Burkina Faso. *Magna Scientia Advanced Research and Reviews*. 2021 May;02(02):001-012.
- [19] Tahri NN, Basti AE, Zidane L, Rochdi A, Douira A. Ethnobotanical Study of Medicinal Plants in the Province of Settat (Morocco). *Journal of Forestry Faculty*. 2012 Jan;12(2):192-208.
- [20] Mangambu MJD, Mushagalusa KF, Kadima NJ. Contribution to the phytochemical study of some anti-diabetic medicinal plants from the city of Bukavu and its surroundings (South Kivu, R.D. Congo). *Journal of Applied Biosciences*. 2014 Mar;75:6211-6220.
- [21] Ramdé-Tiendrébéogo A, Zerbo R, Ouattara B, Doulkoum A Guissou IP. Sahelian plants adapted in the recovery of degraded lands and their uses for health: case of the Soun province of Northern Burkina Faso. *Journal of animals and plants sciences*. 2019 Jul;1:6767-6783.
- [22] Adou LMD, Gonezieti BBHJ, Zirihi GN. Ethnobotanical survey and use of pteridophytes in Bancro National Park, Abidjan district (Ivory Coast). *Journal of Animal & Plant Sciences*. 2018 Nov;38(2):6206-6216.
- [23] Koné WM, Kamanzi AK, Terreaux C, Hostettmann K, Traoré D, Dosso M. Traditional medicine in North Ivory Coast: screening of 50 medicinal plants for antibacterial activity. *Journal of Ethnopharmacology*. 2004 Mar;93:43-49.
- [24] Belemnaba L, Nitiema M, Traoré S, Somé N, Traore A, Ouédraogo S, Guissou IP. Research of plants with antihypertensive potentialities in the biodiversity of Burkina Faso. *CAMES Review-Pharm Series. Med. Trad. Afr*. 2014 Jul;17(1):33-40.

- [25] Kouchadé AS, Adomou AC, Tossou G M, Yédomonhan H, Dassou GH, Akoègninou A. Ethnobotanical study of medicinal plants used in the treatment of childhood diseases and sold in markets in southern Benin. *Journal of Animal & Plant Sciences*. 2016 Apr;28(2):4418-4438.
- [26] Ambé ASA, Ouattara D, Tienbré MS, Vroh BTA, Zirihi GN, N'Guessan KE. Diversity of medicinal plants used in the traditional treatment of diarrhea in the markets of Abidjan (Ivory Coast). *Journal of Animal & Plant Sciences*. 2015 Oct;26 (2):4081-4096.
- [27] Nga NE, Yinyang J, Bidias BE, Etame-Loe G, Dibong SD. Phytochemical and pharmacological study of *Alchornea cordifolia* (Schum. & Thonn.) Mull. Arg. and *Mangifera indica* L. in the traditional treatment of hemorrhoidal disease. *Journal. Appl. Biosci*. 2017 Jan;109:10649-10661.
- [28] Adiza A. Study of a traditional recipe, the bark of *Sclerocarya birrea* hosch and *Uapaca togoensis* pax trunk used in the treatment of diabetes [PhD thesis in Pharmacy]. University of Bamako; 2007.
- [29] Mounkaila S, Soukaradji B, Boube M, Saley K, Hassane BAI, Mahamane A, Ikhiri K, Mahamane S. Inventory and management of medicinal plants in four localities of Niger. *European Scientific Journal*. 2017 Aug;13(24):498-521.
- [30] Assouma AF, Koudovo K, Diatta W, Bassene ET. Ethnobotanical survey on the traditional management of female infertility in the Savannah health region of Togo. *European Scientific Journal*. 2018 Jan;14(3):357-383.
- [31] Yeo D, Dinica R, Yapi HF, Furdui B, Praisler M, Djaman AJ, N'Guessan JD. Evaluation of the anti-inflammatory activity and phytochemical screening of *Annona senegalensis* Pers. leaves. *Phytotherapy*. 2011 Apr;66(1):73-80.
- [32] Tsabang N, Fokoub PVT, Tchokouahab LRY, Noguema B, Bakarnga-Viab I, Nguepib MSD, Nkongmeneck BA, Boyomb FF. Ethnopharmacological survey of Annonaceae medicinal plants used to treat malaria in four areas of Cameroon. *Journal of Ethnopharmacology*. 2012 Nov;139:171-180.
- [33] Yaméogo J, Ouédraogo SJ, Bayala J, Ouédraogo MB. Medicinal and Food Potential of seventeen favorite tree species in agroforestry Parklands in southwestern Burkina Faso. *Fruit, Vegetal and Cereal and Biotechnology* 4. 2010 Jun;1:55-61.
- [34] Kadri Y, Moussaoui A, Benmebarek A. Ethnobotanical study of some medicinal plants in a hyper arid region of South-West Algeria "Case of Touat in the wilaya of Adrar». *Journal of Animal & Plant Sciences*. 2018 May;36(2):5844-5857.
- [35] Couliadiaty AGV, Savadogo LGB, Busia K, Siranyan S. Da SB, Nadembega P, Fofana S, Kpoda HN, Youl EI. Traditional management of mental diseases in Diapaga, Burkina Faso. *Health Sci. Dis*. 2019 Feb;20(1):95-101.
- [36] Jansen O, Frédéric M, Tits M, Angenot L, Cousineau S, Bessot L, Crunet C, Nicolas JP. Ethnopharmacology and malaria in Burkina Faso: selection of 13 species with unknown antiplasmodial potentialities. *Ethnopharmacologia*. 2008 Jun;41:74-81.
- [37] Yapi AB, Kassi NJ, Fofie NBY, Zirihi BN. Ethnobotanical study of medicinal Asteraceae sold on the marches of the autonomous district of Abidjan (Ivory Coast). *Int. J. Biol. Chem. Sci*. 2015 Dec;9(6):2633-2647.
- [38] Lengani A, Lompo LF, Guissou IP, Nikiema JB. Traditional medicine in kidney diseases in Burkina Faso. *Nephrology & Therapy*. 2009 Jul; 6:35-39.
- [39] Kpabi I, Agban A, Hoekou Y, Pissang P, Tchacondo T, Batawila K. Ethnobotanical study of plants with antiparasitic activities used in traditional medicine in the prefecture of Doufelgou in northern Togo. *Journal of Applied Biosciences*. 2020 Apr;148:15176-15189.
- [40] Onoriose DA, Uwakwe AA, Monago CC, Odeghe OB. Hepatoprotective effect of methanolic leaf extract of *Boswellia dalzielii* hutch on carbon tetrachloride induced hepatotoxicity in wistar rats. *Indian Journal of Medicine and Healthcare*. 2012 Jun;1(3):54-63.
- [41] Dénou A, Koudouvo K, Togola A, Haïdara M, Dembélé SM, Ballo FN, Sanogo R, Diallo D, Gbeassor M. Traditional knowledge on anti-malarial plants with analgesic properties, used in the district of Bamako (Mali). *Journal of Applied Biosciences*. 2017 Apr;112:10985-10995.
- [42] Cisse A, Gueye M, Ka A, Ndiaye F, Koma S, Akpo LE. Ethnobotany of medicinal plants among the Fulani herders of Widou Thiengoly in the commune of Téssékéré (Ferlo-North Senegal). *Journal of Applied Biosciences*. 2016 Feb;98:9301-9308.

- [43] Okolo CE, Akah PA, Uzodinma SU. Antidiabetic activity of the root extract of *Detarium microcarpum* (Fabaceae) Guill and Perr. *Phytopharmacology* 2012 Mar;3(1):12-18.
- [44] Ouattara EK, Coulibaly K, Etien TD, Zirihi NG. Ethnobotanical study of antifungal plants traditionally used in Ivory Coast and the potential of *Piliostigma Thonningii* (schumach.) milne-redh. (Fabaceae) in the control of telluric strains. *Int. J. Biol. Chem. Sci.* 2020 Jan;14(1):239-253.
- [45] Sawadogo M, Bangou MJ, Dakio B, Lema A, Thiombiano MH, Ouoba B, Ouoba HY, Ouedraogo GA. Ethnobotanical survey on medicinal plants (*Carica papaya* L. and *Agelanthus dodoneifolius* (DC.) Polhill & Wiens) used in the treatment of Hepatitis in Burkina Faso, phytochemistry and antioxidant activity. *World Journal of Advanced Pharmaceutical and Life Sciences.* 2021 May;01(01):024-035.
- [46] Bla KB, Trebissou JND, Bidié AP, Assi YJ, Zirihi GN, Djaman AJ. Ethnopharmacological study of antimalarial plants used by the Baule-N'Gban of Toumodi in central Ivory Coast. *Journal of Applied Biosciences.* 2014 Jan;85:7775-7783.
- [47] Pham AT, Dvergsnes C, Togola A, Wangenstein H, Diallo D, Paulsen BS, Malterud KE. *Terminalia macroptera* Guill. & Perr. , its current medicinal use and future perspectives. *Journal of Ethnopharmacology.* 2011 Aug;137:1486-1491.
- [48] Thiombiano HM, Bangou MJ, Nacoulma AP, Ouoba B, Sawadogo M, Lema A, Couliadiati TH, Ouoba HY, Ouedraogo GA. Ethnobotanical survey on medicinal plants used in Burkina Faso in the treatment of breast cancer, phytochemistry and antioxidant activities: *Euphorbia poissonii* Pax and *Flueggea virosa* (WILLD.) VOIGT. (Euphorbiaceae). *African Journal of Biology and Medical Research.* 2022 Jan;5(1):1-16.
- [49] Onzo CF, Azokpota P, Agbani P, Gbaguidi F, Hounhouigan JD, Kossou D. Physicochemical and phytochemical characteristics and toxicity of plant species used as food packaging in West Africa. *Int. J. Biol. Chem. Sci.* 2014 Aug;8(4):1504-1516.
- [50] Tangavelou AC, Viswanathan MB, Balakrishna K, Patra A. Phytochemical Analysis in the Leaves of *Chamaecrista nigricans* (Vahl) (Leguminosae). *Pharmaceutica Analytica Acta.* 2018 Jan;9(3):2-5.
- [51] Ouibrahim A, Tlili-Ait-kaki Y, Bennadja S, Amrouni S, Djahoudi AG, Djebbar MR. Evaluation of antibacterial activity of *Laurus nobilis* L. , *Rosmarinus officinalis* L. and *Ocimum basilicum* L. from Northeast of Algeria. *African Journal of Microbiology Research.* 2013 Oct;7(42):4968-4973.
- [52] Khan ME, Hati SS, Abdu KB, Babale A, Achi MI. Chemical analysis and antibacterial of *Acacia nilotica* (L.) Willd. ex Del. and *Tapinanthus dodoneifolius* (DC.) Danser Growing in Nigeria. *Medical and Aromatic Plant Science and Biotechnology.* 2011 Jul;2(2):128-130.
- [53] Gounoue KR, Noukeu KBA, Tsakem NMJ, Youmsi FD, Ngueguim TF, Dzeufiet DPD, Dimo T, Penlap BV. Anti-inflammatory potential of *Tapinanthus globiferus* subsp. *bangwensis* (Engl. & K. Krause) S. Balle (Loranthaceae) leaves as an alternative treatment against arthritis. *The Journal of Phytopharmacology.* 2019 May;8(3):96-103.
- [54] Lodhi S, Jain A, Jain AP, Pawar RS, Singhai AK. Effects of flavonoids from *Martynia annua* L. and *Tephrosia purpurea* (L.) Pers. on cutaneous wound healing. *Avicenna Journal of Phytomedicine,* 2016 Dec;6(5):578-591.
- [55] Dolourou D, Ouattara K, Dembele DD, Aka S, Tuo A, Bagré I. Contribution to the knowledge of aromatic plants used in the production of sweet must and Tchapalo, two traditional drinks of Ivory Coast. *European Journal of Scientific Research.* 2021 Jun;159(3):23-38.
- [56] Kumar SP, Singh SS, Singh NP, Mayur P. In vitro antioxydant activity of *Gossypium herbaceum* LINN. *Internationnal Reseach Journal of Pharmacy.* 2011 Jun;2(7):166-170.
- [57] Gradé JT, Tabutic JRS, Dammea PV. Ethnoveterinary knowledge in pastoral Karamoja, Uganda. *Journal of Ethnopharmacology.* 2009 Jan;122:273-293.
- [58] Lawin IF, Laleye OAF, Agbani OP. Vulnerability and endogenous strategies of conservation of plants used in the treatment of diabetes in the communes of Glazoué and Savè in Centre-Benin. *Int. J. Biol. Chem. Sci.* 2016 Jun;10(3):1069-1085.
- [59] Koua FHM, Babiker HA, Halfawi A, Rabie OI, Abbas FM, Elgaali EI, Khlafallah MM. Phytochemical and biological study of *Striga hermonthica* (Del.) Benth callus and intact plant. *Research In Pharmaceutical Biotechnology.* 2011 Jun;3(7):85-92.

- [60] Dibong SD, Mpondo Mpondo E, Ngoye A, Kwin MF, Betti JL. Ethnobotany and phytomedicine of medicinal plants sold in Douala markets. *Journal of Applied Biosciences*. 2011 Jan;37:2496-2507.
- [61] Nyemb JN, Magnibou LM, Talla E, Tchinda AT, Tchuenguem RT, Henoumont C, Laurent S, Mbafor JT. Lipids constituents from *Gardenia aqualla* Stapf & Hutch. *Open Chem*. 2018 Feb;16:371-376.
- [62] Agbodjento E, Klotoé JR, Dramane G, Dougnon TV, Ategbo JM. *Gardenia ternifolia* Schumach. & Thonn: review on ethnobotanical, ethnopharmacological, phytochemical and toxicological aspects. *Int. J. Biol. Chem. Sci*. 2018 Dec;12(6):2922-2932.
- [63] Diop RD, Mbaye MS, Diop I, Bassene C, Sarr O, Camara AA, Sy MTA, Noba K. Medicinal uses of plants by the riparian population of the Michel Adanson Botanical Conservatory of Mbour (Senegal). *Journal of Animal & Plant Sciences*. 2019 Jun;40(3):6690-6711.

---

### Author short biography



**Armandine LEMA** is Biochemist by training at the Nazi BONI University of Bobo-Dioulasso. She was born on December 28, 1992 in Lah (Burkina Faso). In 2020, she obtained her Master's degree in Biochemistry and Chemistry of Natural Substances. She is pursuing her PhD in the same field. She author of an article entitled: "Ethnobotanical study, phytochemistry and antioxidant activity of medicinal plants used in the treatment of inflammation in two cities of Burkina Faso". She is also co-author of two other articles.