

A review of some medicinal plants with the potential to defeat antimicrobial resistance: Cases of Benin, Togo, Ghana, Burkina Faso, and Cape Verde

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Abstract

Antimicrobial resistance (AMR) is a global public health problem. In the alternatives being explored for developing new antimicrobials, medicinal plants occupy an important place, particularly in Africa, where they are widely used. This review aims to analyze the potential of medicinal plants from Benin, Togo, Ghana, Burkina-Faso, and Cape Verde in the fight against AMR. A bibliographic search was conducted to explore scientific databases such as PubMed and Google Scholar. During this search, particular attention was given to epidemiological data related to AMR in these countries, medicinal plants traditionally used to treat microbial infections and medicinal plants that have been shown to be active on multidrug-resistant microbial strains. In total, 94 manuscripts were investigated. Epidemiological data showed that the problem of AMR is worsening in each target country. In addition, several medicinal plants have been demonstrated to be effective against microbial strains resistant to conventional antibiotics. A total of 532 medicinal plants were identified according to their ethnomedical uses for the treatment of microbial infections. Scientific evidence was collected on the antimicrobial potential of 91 plants. This study showed the potential of medicinal plants in the fight against AMR. Their documented traditional use, coupled with the evidence of efficacy provided, make them interesting sources for developing new antimicrobials.

Keywords: Africa, antimicrobial, drug resistance, medicinal plants.

Introduction

Infectious diseases are one of the major threats to public health, especially in Africa [1, 2]. They have been a major cause of human suffering, both in terms of morbidity and mortality, throughout human history [3]. The control of infectious diseases involves the use of antimicrobials. Antimicrobials have been of great interest in the fight against microbial infections. Their discovery in the 1910s and 1928s significantly impacted conventional medicine's ability to effectively combat infectious diseases [4]. However, this phenomenon reached its peak in the mid-1950s. Since then, a gradual decline in the discovery and development of antibiotics and the evolution of drug

resistance in many human pathogens has led to the current antimicrobial resistance (AMR) crisis.

Antimicrobial resistance is generated mainly by the inappropriate, nonrational, and inconsistent use of antibiotics [5]. It is responsible for numerous socio-economic impacts and is estimated to have caused more than 700,000 deaths worldwide in 2014 [6]. Several other environmental and socio-behavioral factors contribute to the development of this resistance [7]. The dissemination of resistance genes through pollution generated by biomedical waste, hospital effluents, and others places the environment at the center of interest in the issue of AMR [8]. Furthermore, natural resistance to antibiotics favored by the interaction between protozoists and bacteria contributes to the therapeutic failure of using these antibiotics [9]. Thus, the phenomenon of AMR integrates the dimensions of humans, animals and the environment, highlighting the One Health concept. This poses an unprecedented risk to human, animal, and environmental health [10]. In recent years, the growing evolution of drug resistance has accentuated the current AMR crisis and further complicates possible treatment options now and, in the future [11]. The multiple

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dimensions of this phenomenon point to the urgent need for a global solution involving socioeconomic and ecological efforts to ensure the sustainability of human development and the interactions between human and natural ecosystems [12]. Thus, this health problem has fuelled several scientific reflections around the world on possible solution approaches for the discovery of new antimicrobials. The scientific literature at the international level reports the exploration of promising solutions resulting from scientific investigations concerning nanoparticles of plant origin [13, 14].

Among the alternatives explored for discovering new bioactive molecules with antimicrobial potential, medicinal plants occupy a special place. Indeed, several scientific studies have mentioned the hope raised by the use of medicinal plants for the discovery of new antimicrobials in both animals and humans [15] and in humans [16–19]. Some data in the literature have reported the antimicrobial potential of plants belonging to the family Apocynaceae [20].

The flora of many African countries is rich in medicinal plants that serve as the first line of health care for the population of these countries. This study was initiated from the perspective of having an ethnobotanical documentation that can serve as a basis for further studies leading to the discovery of new antimicrobials. This review presents an inventory of medicinal plants used in West Africa to address the problem of AMR, particularly in Benin, Togo, Ghana, Burkina Faso, and Cape Verde.

Literature Search

A two-step approach was used. First, studies on ethnopharmacological investigations of the selected plants were identified, and second, data from this collection were analyzed.

Data collection strategy: Database and keywords

English and French language studies investigating antimicrobial plant species published between 1989 and 2021 were included in the study. Scientific databases such as Medline, Embase, Scopus, EconLit, Google Scholar, and PubMed were searched. Title/abstract followed by full-text independent screening was performed using prespecified criteria. Examples of keywords used for the search included AMR, medicinal plants, aqueous extract, ethanolic extract, methanolic extract, minimum inhibitory concentration, Benin, Togo, Ghana, Burkina Faso, and Cape Verde.

Inclusion and exclusion criteria

Exploratory works and studies conducted on resistant bacterial strains were included in the present review. In addition, studies conducted in Benin, Togo, Ghana, Burkina Faso, and Cape Verde using different plant extracts to treat microbial infections were included in the study.

Data processing

The articles were analyzed for plant names, usages, parts used, and pharmacological activities, and the information is summarized in Table-1.

Status of AMR in Benin, Togo, Ghana, Burkina Faso, and Cape Verde

Antibiotic resistance is a major health problem worldwide [21]. It has been associated with the overuse of antimicrobials in food and animals and the subsequent contamination of the environment [22]. According to the WHO, more than 10 million deaths/year and up to \$100 trillion in global economic losses will occur by 2050 if AMR is not addressed [23]. Lawless prescribing and the ever-increasing use of antimicrobials have been identified as the sources of this growing phenomenon [24]. Intestinal, respiratory, sexually transmitted, and nosocomial infections are the main causes of morbidity and mortality in West Africa [25]. The emergence and rapid spread of resistance severely compromise the management of all of these conditions [26]. Approximately 40% of African countries do not have recent data on AMR [27].

Status of AMR in Benin

In Benin, food is one of the major sources of contamination and dissemination of antimicrobial agents. Indeed, most food products of animal origin are often contaminated by multiresistant microorganisms. Furthermore, the level of residues of veterinary antimicrobials can reach 94% [28, 29]. Cattle feces have been found to have multiple resistance genes [30]. Resistance genes have also been detected for strains of *Salmonella* spp., one of the main pathogens infecting animals and likely to be transmitted to people in direct contact with them [31, 32]. Fofana *et al.* [33] showed that AMR is the origin of important and continuous viral replication in children infected with HIV in Benin [34]. The question is more alarming when studies have shown multidrug-resistant strains involved in nosocomial infections in Benin [35, 36]. A high rate of resistance to antibiotics commonly used for the treatment of infections has also been demonstrated [37].

Status of AMR in Ghana

Laws and regulations controlling the use of antimicrobials in humans are available but not in animals with a lack of a National Antimicrobial Policy (NAP). However, national action is underway to raise awareness of bacterial resistance, building knowledge through research and surveillance and the development of NAPs in line with the Global Plan of Action on AMR [38]. Food security is seriously threatened. In fact, strains isolated from local cheese showed resistance to several antibiotics [39]. Faced with this situation, the Government of the Republic of Ghana recommends the prudent use of antimicrobials [40]. However, national action is underway to raise awareness of bacterial resistance, building knowledge through research and surveillance and the development of NAPs in line with the Global Plan of action on AMR [38]. Some authors also suggest controlling the prescription of antibiotics to decrease the extent of AMR [41, 42].

Table-1: Ethnobotanical information on medicinal plant uses in Benin, Togo, Burkina Faso, Capo-verde, and Ghana.

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
1	<i>Pithecellobium dulce</i> (Roxb.) Benth	Mimosaceae	Stem Bark Leaf	Powder	Infectious	Ethnobotanical investigation	Togo, Benin	[52, 53]
2	<i>Cryptolepis sanguinolenta</i> (Lindl.)	Periplocaceae/ Asclepiadaceae	Roots	Decoction	Fever, upper respiratory and urinary tract infections, septicemia Diarrhea, enteric diseases	Ethnobotanical investigation	Ghana	[54]
3	<i>Vernonia amygdalina</i>	Asteraceae	Leaves	Decoction and trituration	Bacterial Diarrhea	Ethnobotanical investigation	Benin	[55, 56]
4	<i>Sesamum radiatum</i>	Pedaliaceae	Leaves	Decoction	Bacterial Diarrhea	Ethnobotanical investigation	Benin	[55, 56]
5	<i>Ocimum gratissimum</i> L.	Lamiaceae	Leaves	Decoction and trituration	Stomach aches, Diarrhea Dysentery Hypertension Candidiasis	Ethnobotanical investigation	Benin	[55]
6	<i>Crateva adansonii</i> DC.	Capparidaceae	Leaves	Decoction	Diarrhea, Abscesses	Ethnobotanical investigation	Benin	[55]
7	<i>Moringa oleifera</i> Lam.	Moringaceae	Leaves	Decoction, maceration and trituration	Diarrhea	Ethnobotanical investigation	Benin	[55, 57]
8	<i>Solanum macrocarpon</i> L.	Solanaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
9	<i>Centrostachys aquatica</i>	Amaranthaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
10	<i>Amaranthus cruentus</i> L.	Amaranthaceae	Leaves	Decoction	Diarrhea, stomach ache	Ethnobotanical investigation	Benin	[55]
11	<i>Vitex doniana</i> Sweet.	Verbenaceae	Leaves	Decoction	Diarrhea, Measles	Ethnobotanical investigation	Benin	[55]
12	<i>Psidium guajava</i> L.	Myrtaceae	Leaves	Decoction and trituration	Diarrhea, Dysentery	Ethnobotanical investigation	Benin	[55]
13	<i>Hybanthus enneaspermus</i> L.	Violaceae	Leaves	Decoction and maceration	Diarrhea	Ethnobotanical investigation	Benin	[55]
14	<i>Macrosphyra longistyla</i> DC.	Rubiaceae	Leaves	Decoction	Diarrhea, Dysentery	Ethnobotanical investigation	Benin	[55]
15	<i>Solanum aethiopicum</i>	Solanaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
16	<i>Vernonia colorata</i> Willd.	Asteraceae	Leaves	Decoction and trituration	Diarrhea	Ethnobotanical investigation	Benin	[55]
17	<i>Ocimum americanum</i> L.	Lamiaceae	Leaves	Decoction and trituration	Diarrhea and Puking	Ethnobotanical investigation	Benin	[55]
18	<i>Pandiaka invalucrata</i> Moq.	Amaranthaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
19	<i>Aerva lanata</i> L.	Amaranthaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
20	<i>Momordica charantia</i> L.	Cucurbitaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
21	<i>Annona senegalensis</i> Pers	Annonaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
22	<i>Chassalia kolly</i> Schumach.	Rubiaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
23	<i>Lippia multiflora</i> Moldenke.	Verbenaceae	Leaves	Decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
24	<i>Hoslundia opposita</i> Vahl.	Lamiaceae	Leaves	Decoction and ethanolic decoction	Diarrhea	Ethnobotanical investigation	Benin	[55]
25	<i>Senna siamea</i> (Lam.) H. S. Irwin and Barneby	Fabaceae	Leaves	Decoction	Abdominal and digestive disorders	Ethnobotanical investigation	Benin	[58]
26	<i>Uvaria chamae</i>	Annonaceae	Leaves, roots and fruits	Trituration and decoction	Diarrhea	Ethnobotanical investigation	Benin	[57, 59]
27	<i>Phyllanthus amarus</i>	Phyllanthaceae	Leaves	Trituration and decoction	Typhoid fever, infection diseases	Ethnobotanical investigation	Benin	[57, 58]
28	<i>Lantana camara</i>	Verbenaceae	Leaves	-	-	Ethnobotanical investigation	Benin	[57]
29	<i>Corchorus oltorius</i> L.	Tiliaceae	Leaves	Maceration	Typhoid fever	Ethnobotanical investigation	Benin	[60]
30	<i>Crataeva religiosa</i> Forst	Capparaceae	Leaves	Decoction	Infection	Ethnobotanical investigation	Benin	[61]
31	<i>Abrus precatorius</i> L.	Leguminosae	Leaves	Infusion and decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
32	<i>Adansonia digitata</i> Linn.	Bombacaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
33	<i>Aframomum melegueta</i> , (<i>Roscoe</i>) K. Schum.	Zingiberaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
34	<i>Allium sativum</i> L.	Alliaceae	Leaves	Maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
35	<i>Alstonia boonei</i> De Wild.	Apocynaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
36	<i>Annona senegalensis</i> L.	Annonaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
37	<i>Anthocleista nobilis</i>	Loganiaceae	Leaves	Infusion	Infectious disease	Ethnobotanical investigation	Togo	[62]
38	<i>Bridelia ferruginea</i> Benth.	Euphorbiaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
39	<i>Byrsocarpus coccineus</i> Sch. Et Th.	Connaraceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
40	<i>Caesalpinia bonduc</i> Roxb.	Caesalpinaceae	Leaves	Maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
41	<i>Capsicum annuum</i> L.	Solanaceae	Leaves	Maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
42	<i>Cassia sieberiana</i> DC.	Caesalpinaceae	Leaves	Decoction and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
43	<i>Ceiba pentandra</i> (L.)	Bombacaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
44	<i>Cocos nucifera</i> Linn.	Arecaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
45	<i>Cola millenii</i> K. Schum.	Sterculiaceae	Leaves	Maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
46	<i>Cymbopogon citratus</i> Stapf.	Poaceae	Leaves	Decoction and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
47	<i>Dichapetalum madagascariense</i> (DC) Keay.	Dichapetalaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
48	<i>Eugenia caryophyllata</i> Madagascar	Myrtaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
49	<i>Ficus platyphylla</i> Del	Moraceae	Leaves	Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
50	<i>Gomphrena celosioides</i> Mart.	Amaranthaceae	Leaves	Maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
51	<i>Hibiscus sabdariffa</i> Linn.	Malvaceae	Leaves	Decoc-tionand maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
52	<i>Holarrhena floribunda</i> (G. Don) Dw. Sch.	Apocynaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
53	<i>Jatropha gossypifolia</i> Linn.	Euphorbiaceae	Leaves	Tritura-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
54	<i>Khaya senegalensis</i> (Desr.) A. Juss.	Meliaceae	Sterm bark and Leaves	Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
55	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
56	<i>Lannea kerstingii</i> A. Rich.	Anacardiaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
57	<i>Lippia multiflora</i> Moldenke	Verbenaceae	Leaves	Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
58	<i>Mangifera indica</i> Linn.	Anacardiaceae	Sterm bark and Leaves	Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
59	<i>Monodora myristica</i> (Gaertn.) Dunal	Annonaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
60	<i>Morinda lucida</i> Linn	Rubiaceae		Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
61	<i>Moringa oleifera</i> Linn.	Moringaceae	Leaves and fruits	Decoction, tritura-tion and maceretion	Infectious disease	Ethnobotanical investigation	Togo	[62]
62	<i>Ocimum gratissimum</i> Linn.	Lamiaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
63	<i>Oldenlandia corymbosa</i> L.	Rubiaceae		Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
64	<i>Parkia biglobosa</i> (Jacq.) Benth	Fabaceae		Maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
65	<i>Paullinia pinnata</i> Linn.	Sapindaceae		Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
66	<i>Pavetta corymbosa</i> (DC) F.N. Will.	Rubiaceae		Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
67	<i>Piliostigma thonningii</i> (Sch.) Miln. Redh.	Caesalpiniaceae		Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
68	<i>Pleiocarpa pycnantha</i> (K. Sch.) Stapf.	Apocynaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
69	<i>Pteleopsis suberosa</i> Engl. and Diels.	Combretaceae	Leaves	Decoc-tion and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
70	<i>Rauvolfia vomitoria</i> Afzel	Apocynaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
71	<i>Sansevieria liberica</i> Ger. and Labr.	Agavaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
72	<i>Sarcocephalus latifolius</i> (Sm.) E.A.Bruce	Rubiaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
73	<i>Senna rotundifolia</i> Linn.	Fabaceae	Leaves	Decoction and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
74	<i>Sorghum caudatum</i> Linn. var. <i>colorans</i>	Poales	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
75	<i>Thonningia sanguinea</i> Vahl.	Balanophoraceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
76	<i>Uvaria chamae</i> P. Beauv.	Annonaceae	Fruits, leaves	Decoction and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
77	<i>Vitellaria paradoxa</i> Gaertn C.F	Sapotaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
78	<i>Waltheria indica</i> Linn.	Sterculiaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
79	<i>Xylopi aethiopica</i> (Dunal) A. Rich.	Annonaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
80	<i>Zanthoxylum xanthoxyloides</i> Lam.	Rutaceae	Leaves	Decoction and maceration	Infectious disease	Ethnobotanical investigation	Togo	[62]
81	<i>Zingiber officinale</i> Rosc. Trans. Linn	Zingiberaceae	Leaves	Decoction	Infectious disease	Ethnobotanical investigation	Togo	[62]
82	<i>Abutilon mauriti</i> (Jacq.) Medik.	Malvaceae	Leaves and stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
83	<i>Acacia nilotica</i> (L.) Delile	Leguminosae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
84	<i>Acacia nilotica</i> (L.) Delile	Leguminosae	Fruit, powder, gum, dried fruit powder	Extractions, decoction	Diarrhée, Dysenterie, antifongique	Ethnobotanical investigation	Togo	[64]
85	<i>Acalypha wilkesiana</i> Müll. Arg	Euphorbiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
86	<i>Aframomum melegueta</i> K. Schum.	Zingiberaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
87	<i>Azalia africana</i> Pers.	Leguminosae	Leaf stem	Powder	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
88	<i>Allium cepa</i> L.	Amaryllidaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
89	<i>Allium sativum</i> L.	Amaryllidaceae	Fruit	Decoction; Maceration	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
90	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Leaf stem	Dec; Maceration; Powder	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
91	<i>Anacardium occidentale</i> L.	Anacardiaceae	Leaves, fruit and stem bark	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
92	<i>Annona muricata</i> L.	Annonaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
93	<i>Anogeissus leiocarpa</i> (DC) Guill. and Perr.	Combretaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
94	<i>Antiaris toxicaria</i> Lesch.	Moraceae	Leaves, Stem	Powder	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
95	<i>Bambusa vulgaris</i> Schrad.	Poaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
96	<i>Bauhinia reticulata</i> DC.	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
97	<i>Blighia sapida</i> K. D. Köening	Sapindaceae	Fruit	Powder	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
98	<i>Bridelia ferruginea</i> Benth.	Phyllanthaceae	Bark, Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
99	<i>Caesalpinia bonduc</i> (L.) Roxb.	Leguminosae	Leaf stem	Decoction; Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
100	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
101	<i>Cajanus cajan</i> (L.) Millsp.	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
102	<i>Carica papaya</i> L.	Caricaceae	Root	Powder	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
103	<i>Carissa spinarum</i> L.	Apocynaceae	Root, Bark	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
104	<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
105	<i>Ceropegia fusiformis</i> N.E.Br.	Apocynaceae	Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
106	<i>Citrus aurantiifolia</i> (Christm.) Swingle	Rutaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
107	<i>Clausena anisata</i> (Willd.) Hook.f. ex, Benth.	Rutaceae	Leaves, Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
108	<i>Clerodendrum capitatum</i> (Willd.) Schumach. and Thonn.	Lamiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
109	<i>Cola nitida</i> (Vent.) Sebott and Endl.	Malvaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
110	<i>Combretum micranthum</i> G.Don	Combretaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
111	<i>Combretum paniculatum</i> Vent.	Combretaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
112	<i>Commiphora africana</i> (A.Rich.) Engl.	Burseraceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
113	<i>Crateva adansonii</i> DC.	Capparaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
114	<i>Croton gratissimus</i> Burch.	Euphorbiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
115	<i>Croton lobatus</i> L.	Euphorbiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
116	<i>Curculigo pilosa</i> (Schumach. and Thonn.) Engl.	Hypoxidaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
117	<i>Cyanthillium cinereum</i> (L.) H.Rob.	Compositae	Whole plant	Maceration	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
118	<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	Leaves	Decoction; Pounding; Grilling	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
119	<i>Daniellia oliveri</i> (Rolfe) Hutch. and Dalziel	Leguminosae	Leaf stem, Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
120	<i>Desmodium velutinum</i> (Willd.) DC.	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
121	<i>Detarium microcarpum</i> Guill. and Perr.	Leguminosae	Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
122	<i>Dialium guineense</i> Willd.	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
123	<i>Dichapetalum madagascariense</i> Poir	Dichapetalaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
124	<i>Dichrostachys cinerea</i> (L.) Wight and Arn.	Leguminosae	Leaves	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
125	<i>Diodella scandens</i> (Sw.) Bacigalupo, and E.L.Cabral	Rubiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
126	<i>Dysphania ambrosioides</i> (L.) Mosyakin and Clemants	Amaranthaceae	Whole plant	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
127	<i>Echinochloa pyramidalis</i> (Lam.) Hitchc. and Chase	Poaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
128	<i>Ehretia cymosa</i> Thonn.	Boraginaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
129	<i>Entada gigas</i> (L.) Fawc and Rendle	Leguminosae	Leaves	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
130	<i>Erythrina senegalensis</i> DC.	Leguminosae	Bark	Powder	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
131	<i>Eucalyptus camaldulensis</i> Dehnh.	Myrtaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
132	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
133	<i>Flacourtia flavescens</i> Willd	Salicaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
134	<i>Garcinia kola</i> Heckel	Clusiaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
135	<i>Gladiolus dalenii</i> van Geel	Iridaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
136	<i>Gossypium hirsutum</i> L.	Malvaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
137	<i>Gymnanthemum coloratum</i> (Wild.) H.Rob. and B.Kahn	Compositae	Whole plant	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
138	<i>Heliotropium indicum</i> L.	Boraginaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
139	<i>Hymenocardia acida</i> Tul.	Phyllanthaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
140	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Whole plant	Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
141	<i>Imperata cylindrica</i> (L.) Rausch.	Poaceae	Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
142	<i>Indigofera pulchra</i> Willd.	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
143	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
144	<i>Kedrostis foetidissima</i> (Jacq.) Cogn.	Cucurbitaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
145	<i>Khaya senegalensis</i> (Desr.) A. Juss.	Meliaceae	Bark	Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
146	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
147	<i>Lantana camara</i> L.	Verbenaceae	Leaf stem	Decoction; Maceration;	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
148	<i>Lawsonia inermis</i> L.	Lythraceae	Leaf stem	Decoction; Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
149	<i>Lippia multiflora</i> Moldenke	Verbenaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
150	<i>Mangifera indica</i> L.	Anacardiaceae	Bark, Root	Decoction ; Pounding	Treatment of candidiasis	Ethno-botanical investigation	Benin	[63]
151	<i>Melaleuca leucadendra</i> (L.) L.	Myrtaceae	Leaf stem	Dec	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
152	<i>Mitracarpus hirtus</i> (L.) DC.	Rubiaceae	Whole plant	Decoction;	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
153	<i>Momordica charantia</i> L.	Cucurbitaceae	Whole plant	Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
154	<i>Mondia whitei</i> (Hook.f.) Skeels	Apocynaceae	Leaf stem	Decoction; Maceration;	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
155	<i>Monodora myristica</i> (Gaertn.) Dunal	Annonaceae	Fruit	Pounding; Maceration	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
156	<i>Morinda lucida</i> Benth.	Rubiaceae	Root	Decoction; Maceration; Grilling	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
157	<i>Musa paradisiaca</i> L.	Musaceae	Leaves	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
158	<i>Ocimum americanum</i> L.	Lamiaceae	Whole plant	Dec	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
159	<i>Ocimum gratissimum</i> L.	Lamiaceae	Leaf stem	Decoction; Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
160	<i>Olox subscorpioides</i> Oliv.	Olacaceae	Root	Decoction; Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
161	<i>Parkia biglobosa</i> (Jacq.) G Don	Leguminosae	Bark	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
162	<i>Paullinia pinnata</i> L.	Sapindaceae	Leaf stem	Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
163	<i>Persicaria senegalensis</i> (Meisn.) Soják	Polygonaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
164	<i>Philenoptera laxiflora</i> (Guill. and Perr.) Roberty,	Leguminosae	Leaves	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
165	<i>Phymatosorus scolopendria</i> (Burm. f.) Pic. Serm.	Polypodiaceae	Leaf stem	Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
166	<i>Piper nigrum</i> L.	Piperaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
167	<i>Pleiocarpa pycnantha</i> (K.Schum.) Stapf	Apocynaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
168	<i>Pseudocedrela kotschyi</i> (Schweinf.), Harms	Meliaceae	Leaf stem, Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
169	<i>Pteleopsis suberosa</i> Engl. and Diels	Combretaceae	Bark	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
170	<i>Pterocarpus erinaceus</i> Poir.	Leguminosae	Bark	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
171	<i>Rhaphiostylis beninensis</i> (Hook.f. exPlanch.) Planch. ex Benth.	Icacinaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
172	<i>Ricinus communis</i> L.	Euphorbiaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
173	<i>Rourea coccinea</i> (Thonn. exSchumach.) Benth.	Connaraceae	Root	Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
174	<i>Sarcocephalus latifolius</i> (Sm.) E. A. Bruce	Rubiaceae	Leaf stem, Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
175	<i>Schwenckia americana</i> L.	Solanaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
176	<i>Secamone afzelii</i> (Roem. and Schult.) K. Schum	Apocynaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
177	<i>Securidaca longipedunculata</i> Fresen	Polygalaceae	Root	Decoction Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
178	<i>Senna alata</i> (L.) Roxb.	Leguminosae	Leaf stem	Decoction Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
179	<i>Senna italica</i> Mill.	Leguminosae	Leaf stem	Decoction Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
180	<i>Senna occidentalis</i> (L.) Link	Leguminosae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
181	<i>Spondias mombin</i> L.	Anacardiaceae	Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
182	<i>Syzygium aromaticum</i> (L.) Merr. and Perr	Myrtaceae	Fruit	Decoction Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
183	<i>Terminalia glaucescens</i> Planch. Ex Benth	Combretaceae	Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
184	<i>Tetrapleura tetraptera</i> (Schumach. and Thonn.) Taub.	Leguminosae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
185	<i>Thalia geniculata</i> L.	Marantaceae	Leaf stem	Decoction Maceration	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
186	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Leaf stem	Decoction Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
187	<i>Uvaria chamae</i> P. Beauv.	Annonaceae	Root	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
188	<i>Xylopia aethiopica</i> (Dunal) A. Rich	Annonaceae	Fruit	Decoction Maceration Pounding	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
189	<i>Zea mays</i> L.	Poaceae	Leaf stem	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
190	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Fruit	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
191	<i>Zornia glochidiata</i> DC	Leguminosae	Root, Bark	Decoction	Treatment of candidiasis	Ethnobotanical investigation	Benin	[63]
192	<i>Alternanthera repens</i> (L.) Link	Amaranthaceae	Leaves extract	Decoction	Gastro-intestinal disorders	Ethnobotanical investigation	Cap Vert	[65]
193	<i>Anethum graveolens</i> L.	Apiaceae	Leaves, flowers, seeds	Decoction	Gastrointestinal disorders	Ethnobotanical investigation	Cap Vert	[65]
194	<i>Calotropis syriaca</i> (S.G.Gmelin) Woodson	Asclepiadaceae	Sap (resin/latex)	Decoction	Toothache, decayed teeth	Ethnobotanical investigation	Cap Vert	[65]
195	<i>Sonchus oleraceus</i> L.	Asteraceae	Aerial parts of plant	Decoction	Skin disease	Ethnobotanical investigation	Cap Vert	[65]
196	<i>Acanthospermum hispidum</i> DC.	Asteraceae	Aerial parts	Decoction	Asthma	Ethnobotanical investigation	Cap Vert	[65]
197	<i>Blainvillea gayana</i> Cass.	Asteraceae	Leaves	Decoction	Diarrhoea	Ethnobotanical investigation	Cap Vert	[65]
198	<i>Centaurea melitensis</i> L.	Asteraceae	Roots, sap (resin/latex)	Decoction	Toothache	Ethnobotanical investigation	Cap Vert	[65]
199	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	Leaves	Decoction	Skin problems, "athlete's foot"	Ethnobotanical investigation	Cap Vert	[65]
200	<i>Nasturtium officinale</i> R. Br.	Bombacaceae	Wole plant	Decoction	Breast diseases, tuberculosis	Ethnobotanical investigation	Cap Vert	[65]
201	<i>Chamaecrista nigricans</i> (Vahl)	Caesalpiniaceae	Leaves	Decoction	Open wounds	Ethnobotanical investigation	Cap Vert	[65]
202	<i>Senna occidentalis</i> (L.)Link	Caesalpiniaceae	Seeds, leaves, roots	Decoction	Breast disease, tuberculosis, colds	Ethnobotanical investigation	Cap Vert	[65]
203	<i>Cassia italica</i> (Mill) Lam.	Caesalpiniaceae	Leaves	Decoction	Intestinal disorders	Ethnobotanical investigation	Cap Vert	[65]
204	<i>Chenopodium ambrosioides</i> L	Chenopodiaceae	Leaves	Decoction	Colds and flu	Ethnobotanical investigation	Cap Vert	[65]
205	<i>Ipomoea turbinata</i> Lag.	Convolvulaceae	Seed oil	Decoction	Intestinal disorders, constipation	Ethnobotanical investigation	Cap Vert	[65]
206	<i>Commelina diffusa</i> Burm.f. subsp. diffusa	Commelinaceae	Aeral parts	Decoction	Fever	Ethnobotanical investigation	Cap Vert	[65]
207	<i>Momordica charantia</i> L.	Cucurbitaceae	Fruits	Decoction	Breast problems	Ethnobotanical investigation	Cap Vert	[65]
208	<i>Cyperus rotundus</i> L.	Cyperaceae	Roots, bulbs	Decoction	Postpartum uterine problem	Ethnobotanical investigation	Cap Vert	[65]
209	<i>Cyperus esculentus</i> L.	Cyperaceae	Roots, bulbs	Decoction	Urinary problems	Ethnobotanical investigation	Cap Vert	[65]
210	<i>Dracaena draco</i> L.	Dracaenaceae	Tree sap (resin/latex)	Decoction	Pain, renal pain	Ethnobotanical investigation	Cap Vert	[65]
211	<i>Jatropha curcas</i> L	Euphorbiaceae	Sap (resin/latex), seed oil , Tree	Decoction	Constipation, joint pain, bleeding, Purgative, antimicrobial, antiseptic, mouth wash	Ethnobotanical investigation	Cap Vert	[65,66]
212	<i>Ricinus communis</i> L.	Euphorbiaceae	Seeds (oil)	Decoction	Constipation, scabies	Ethnobotanical investigation	Cap Vert	[65]
213	<i>Abrus precatorius</i> L.	Fabaceae	Seeds, roots, leaves	Decoction	Conjunctivitis and skin diseases	Ethnobotanical investigation	Cap Vert	[65]
214	<i>Clitoria ternatea</i> L.	Fabaceae	Root extracts	Decoction	Cough	Ethnobotanical investigation	Cap Vert	[65]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
215	<i>Crotalaria retusa</i> L. var. <i>retusa</i>	Fabaceae	Whole plant, seeds	Decoction	Cough, fever, diarrhea	Ethnobotanical investigation	Cap Vert	[65]
216	<i>Indigofera tinctoria</i>	Fabaceae	Sub-shrub	Decoction	Cosmetics for face	Ethnobotanical investigation	Cap Vert	[65]
217	<i>Lonchocarpus laxiflorus</i> Guill. and Perr	Fabaceae	Leaves, bark, roots	Decoction	Cough, liver disorders, stomach aches	Ethnobotanical investigation	Cap Vert	[65]
218	<i>Ocimum basilicum</i> L.	Lamiaceae	Leaves	Decoction	Antispasmodic	Ethnobotanical investigation	Cap Vert	[65]
219	<i>Rosmarinus officinalis</i> L.	Lamiaceae	Leaves, flowers	Decoction	Cough, asthma, rheumatism, depression	Ethnobotanical investigation	Cap Vert	[65]
220	<i>Persea americana</i> Mill	Lamiaceae	Tree Leaves, fruits	Decoction	Colds, liver pain, kidney pain	Ethnobotanical investigation	Cap Vert	[65]
221	<i>Allium sativum</i> L.	Liliaceae	Perennial herb	Decoction	Bulbs Itching, skin problems, worms	Ethnobotanical investigation	Cap Vert	[65]
222	<i>Punica granatum</i> L.	Lythraceae	Fruits	Maceration	Mouth and eyes disorders. Skin problems	Ethnobotanical investigation	Cap Vert	[65]
223	<i>Sida rhombifolia</i>	Malvaceae	Aerials parts of plants	Decoction	Cough, Phlegm	Ethnobotanical investigation	Cap Vert	[65]
224	<i>Malva parviflora</i> L.	Malvaceae	Leaves	Decoction and maceration	Inflammation and abscesses	Ethnobotanical investigation	Cap Vert	[65]
225	<i>Eucalyptus spp</i>	Myrtaceae	Tree, Leaves	Decoction, maceration and essential oil	Cough, flu, colds	Ethnobotanical investigation	Cap Vert	[65]
226	<i>Argemone mexicana</i> L.	Papaveraceae	Seed oil, sap (resin/ latex)	Decoction and maceration	Purgative (oil), pains	Ethnobotanical investigation	Cap Vert	[65]
227	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Leaves, roots	Decoction and maceration	Skin problems. Trouble urinating	Ethnobotanical investigation	Cap Vert	[65]
228	<i>Artemisia gorgonum</i> Webb	Asteraceae	Aerial parts	Essential oil	Antiplasmodial	<i>in vitro</i> activity	Cap Vert	[67, 68]
229	<i>Gymnanthemum amygdalinum</i>	Asteraceae	leaves	Macerated	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
230	<i>Moringa oleifera</i>	Moringaceae	leaves	Dried	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
231	<i>Carica papaya</i>	Caricaceae	leaves and seeds	Dried	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
232	<i>Manihot esculenta</i>	Euphorbiaceae	Leaves	Maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69, 17]
233	<i>Cjanus caja</i>	Fabaceae	Leaves	Dried	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
234	<i>Ocimum gratissimum</i>	Lamiaceae	Leaves	Maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69, 70]
235	<i>Cassythia filiformis</i> L.	Lauraceae	Whole plant	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
236	<i>Psidium guayava</i> L.	Myrtaceae	Leaves and roots	Decoction and maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
237	<i>Jatropha gossypifolia</i>	Euphorbiaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
238	<i>Cola nitida</i>	Sterculiaceae	Fruits	Maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
239	<i>Vernonia amygdalina</i>	Asteraceae	Leaves	Decoction and trituration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
240	<i>Crateva adansonii</i> DC.	Capparidaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
241	<i>Xylopia aethiopica</i>	Apocynaceae	Fruits	Maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
242	<i>Caesalpinia pulcherrima</i>	Leguminosae-Caesalpinoideae	Whole plant	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
243	<i>Annona muricata</i>	Annonaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
244	<i>Citrus limon</i>	Rutaceae	Leaves	Infusion and decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
245	<i>Persea americana</i>	Lauraceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
246	<i>Cocos nucifera</i>	Arecaceae	Leaves	Maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
247	<i>Carica papaya</i>	Caricaceae	Roots	Infusion and decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
248	<i>Khaya senegalensis</i>	Meliaceae	Unripe fruit	Decoction and maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
249	<i>Acanthospermum hispidum</i> DC.	Asteraceae	Whole plant or bark	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
250	<i>Senna siamea</i> (Lam.) H.S. Irwin and Barneby.	Leguminosae-Caesalpinoideae	Whole plant	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
251	<i>Eugenia Caryophyllata</i>	Myrtaceae	Whole plant	Maceration and decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
252	<i>Allium sativum</i>	Liliaceae	Fruits	Infusion and maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69, 70]
253	<i>Corchorus olitorius</i> L.	Malvaceae	Leaves	Decoction	Diarrhoea Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
254	<i>Abrus precatorius</i> L.	Fabaceae	Whole plant	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
255	<i>Croton zambesicus</i> Muell.	Euphorbiaceae	Whole plant	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
256	<i>Cajanus cajan</i> (L.) Millsp.	Fabaceae	Leaves	Decoction and maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
257	<i>Kigelia africana</i> (Lam.) Benth	Bignoniaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]

(Contd...)

Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
258	<i>Momordica charantia</i> L.	Cucurbitaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
259	<i>Garcinia cola</i> Heckel.	Clusiaceae	Fruits	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
260	<i>Cucumis metuliferus</i>	Cucurbitaceae	Fruits	Maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
261	<i>Piper guineense</i> Schumach. and Thonn.	Piperaceae	Seeds	Maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
262	<i>Moringa Oléifera</i>	Moringaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
263	<i>Newbouldia laevis</i>	Bignoniaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
264	<i>Elaeis guineensis</i> Jacq.	Arecaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
265	<i>Ocimum gratissimum</i> L.	Lamiaceae	Leaves	Decoction and trturation	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
266	<i>Cocos nucifera</i>	Arecaceae	Coconut water	Drinking	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
267	<i>Catharanthus roseus</i>	Apocynaceae	Whole plant	Decoction and maceration	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
268	<i>Haematoxylum campechianum</i> L.	Leguminosae-Caesalpinoideae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
269	<i>Cola millenii</i>	Sterculiaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
270	<i>Cymbopogon citratus</i>	Poaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
271	<i>Ananas comosus</i>	Bromeliaceae	Fruits	Maceration and decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
272	<i>Caesalpinia bonduc</i> (L.) Roxb.	Leguminosae-Caesalpinoideae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
273	<i>Phyllostachys aurea</i>	Poaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
274	<i>Sansevieria liberica</i>	Dracaenaceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
275	<i>Argemone mexicana</i>	Papaveraceae	Leaves	Decoction	Treatment of typhoid fever in human	Ethnobotanical investigation	Benin	[69]
276	<i>Salix babylonica</i>	Salicaceae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
277	<i>Capsicum frutescens</i>	Solanaceae	Fruits	Maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
278	<i>Capsicum frutescens</i>	Solanaceae	Fruits	Maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
279	<i>Agelaea pentagyna</i> Lam.	Connaraceae	Leaves and roots	Decoction and maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
280	<i>Rourea coccinea</i> (Thonn. Ex Schumach.) Benth	Connaraceae	Leaves and roots	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
281	<i>Phyllanthus amarus</i> Schumach. and Thonn.	Phyllantaceae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
282	<i>Hyptis suaveolens</i> Poit.	Lamiaceae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
283	<i>Acanthospermum hispidum</i> DC.	Asteraceae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
284	<i>Bridela ferruginea</i> Benth.	Phyllanthaceae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
285	<i>Combretum micraanthum</i>	Combretaceae	Whole plant	Decoction and maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
286	<i>Acacia sieberiana</i> DC.	Leguminosae-Mimosoideae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
287	<i>Acanthospermum hispidum</i> DC.	Asteraceae	Leaves	Decoction	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
288	<i>Rauvolfia caffra</i>	Apocynaceae	Roots	Maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
289	<i>Baphia nitida</i>	Leguminosae-Papilionoideae	Fruits	Decoction and maceration	Treatment of typhoid fever in human.	Ethnobotanical investigation	Benin	[69]
290	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Stem bark	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
291	<i>Hygrophila auriculata</i> Heine.	Acanthaceae	Whole plant	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
292	<i>Chenopodium ambrosioides</i> L.	Amaranthaceae	Leaves	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
293	<i>Coix lacryma-jobi</i> L.	Poaceae	Glumes	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
294	<i>Solanum torvum</i> Sw.	Solanaceae	Unripe fruits and fruits	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
295	<i>Bidens pilosa</i> L. MNM24/7	Asteraceae	Whole plant	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
296	<i>Phyllanthus fraternus</i> G.L. Webster	Phyllanthaceae	Leaves	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
297	<i>Dissotis rotundifolia</i> (Sm.) Triana	Melastomataceae	Leaves	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
298	<i>Cymbopogon giganteus</i> Chiov.	Poaceae	Leaves	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
299	<i>Cyperus articulatus</i> L.	Cyperaceae	Roots	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
300	<i>Allium sativum</i> L.	Amaryllidaceae	Bulbs	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
301	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Rhizomes	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
302	<i>Allium cepa</i> L.	Amaryllidaceae	Bulbs and leaves	Decoctions or infusions	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
303	<i>Aloe vera</i> var. <i>barbadensis</i>	Xanthorrhoeaceae	Leaves	aqueous extract and Organic extract	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
304	<i>Cocos nucifera</i> Linn.	Arecaceae	Coconut	Water	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
305	<i>Cocos nucifera</i> Linn.	Arecaceae	Husk	Water	Treatment of Tuberculosis	Ethnobotanical investigation	Ghana	[71]
306	<i>Asparagus flagellaris</i> (Kunth) Baker	Asparagaceae	Whole plant (fresh)	Decoction and poultice	Tuberculosis	Ethnobotanical investigation	Ghana	[71]
307	<i>Borreria stricta</i> (L.f.) K. Schum.	Rubiaceae	Leaves (dried)	Decoction	Black spot on skin	Ethnobotanical investigation	Ghana	[72]
308	<i>Hannoa undulata</i> (Guill. and Perr.)	Simaroubaceae	Roots (dried)	Char into charcoal and add to shea butter and smear over boil with stone	Boils	Ethnobotanical investigation	Ghana	[72]
309	<i>Ipomoea eriocarpa</i> R.Br.	Convolvulaceae	Whole plants (fresh)	Decoction	Menstrual problems	Ethnobotanical investigation	Ghana	[72]
310	<i>Piliostigma thonnigii</i> (Schumach) MilneRedh.	Fabaceae	Root (dried)	Poultice to water	Abdominal pain	Ethnobotanical investigation	Ghana	[72]
311	<i>Tephrosia</i> spp.	Fabaceae	Leaves (fresh)	Decoction	Red eyes	Ethnobotanical investigation	Ghana	[72]
312	<i>Terminalia macroptera</i> Guill et Perr.	Combretaceae	Roots (fresh)	Decoction	Piles	Ethnobotanical investigation	Ghana	[72]
313	<i>Justicia flava</i> Vahl.	Acanthaceae	Leaves	Decoction	Diarrhoea	Ethnobotanical investigation	Ghana	[73]
314	<i>Mangifera indica</i> L.	Amaranthaceae	Stem Bark	Paste	Diarrhoea	Ethnobotanical investigation	Ghana	[73]
315	<i>Cleistopholis patens</i> (Benth.) Engl. and Diels	Annonaceae	Leaves, Stem Bark, Fruit	Decoction (Oral)	Typhoid	Ethnobotanical investigation	Ghana	[73]
316	<i>Alstonia boonei</i> De Wild.	Apocynaceae	Stem Bark	Decoction (Oral), Crush	Measles, Chicken pox, Boils, Shingles, Malaria stroke	Ethnobotanical investigation	Ghana	[73]
317	<i>Funtumia elastica</i> (Preuss) Stapf.	Apocynaceae	Stem Bark	Infusion (Orale)		Ethnobotanical investigation	Ghana	[73]
318	<i>Rauvolfia vomitoria</i> Afzel	Apocynaceae	Leaves, Roots and Stem Bark	Decoction (Oral)	Malaria, Body pains	Ethnobotanical investigation	Ghana	[73]
319	<i>Secamone afzelii</i> (Roem. and Schult.) K. Schum.	Asclepiadaceae	Leaves	Grind and apply (Topical)	Severe skin rashes	Ethnobotanical investigation	Ghana	[73]
320	<i>Elaeis guineensis</i> Jacq.	Arecaceae	Roots	Grind (Topical)	Stroke	Ethnobotanical investigation	Ghana	[73]
321	<i>Aloe tenuifolia</i> Lam.	Asphodelaceae	Leaves	Decoction (Oral/ Topical)	Appetizer, Skin Rashes	Ethnobotanical investigation	Ghana	[73]
322	<i>Melanthera scandens</i> Schu, Nach. and Thonn.	Asteraceae	Leaves	Paste (Topical)	Wounds	Ethnobotanical investigation	Ghana	[73]
323	<i>Vernonia amygdalina</i> Delile	Asteraceae	Leaves	Decoction (Oral)	Diarrhoea, Typhoid, Malaria	Ethnobotanical investigation	Ghana	[73]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
324	<i>Taraxacum officinale</i> F.H.Wigg.	Asteraceae	Leaves, Roots	Eaten/Decoction (Oral)	Blood tonic, Fever, Ulcer	Ethnobotanical investigation	Ghana	[73]
325	<i>Eclipta alba</i> Hassk.	Asteraceae	Leaves	Grind and squeeze (Nasal)	Catarrh, Malaria	Ethnobotanical investigation	Ghana	[73]
326	<i>Bidens pilosa</i> L.	Asteraceae	Leaves	Decoction/Paste (Oral/Topical)	Typhoid, Malaria,	Ethnobotanical investigation	Ghana	[73]
327	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	Stem Bark	Decoction (Oral)	Stomach ache	Ethnobotanical investigation	Ghana	[73]
328	<i>Spathodea campanulata</i> P. Beauv.	Bignoniaceae	Leaves, Stem Bark	Decoction (Oral)	Typhoid, Malaria	Ethnobotanical investigation	Ghana	[73]
329	<i>Spathodea campanulata</i> P. Beauv.	Bignoniaceae	Leaves, Stem Bark	Grind (Topical)	Wounds	Ethnobotanical investigation	Ghana	[73]
330	<i>Crescentia cujete</i> L.	Bignoniaceae	Leaves	Decoction (oral)	Fever, Pregnancy care	Ethnobotanical investigation	Ghana	[73]
331	<i>Newbouldia laevis</i> (P.Beauv.) Seem.	Bignoniaceae	Leaves	Paste and raw	Stomach upset, Waist pain,	Ethnobotanical investigation	Ghana	[73]
332	<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Fruits	Decoction	Worms, Itching ear	Ethnobotanical investigation	Ghana	[73]
333	<i>Carica papaya</i> L.	Caricaceae	Leaves	Cook (Oral)	Malaria	Ethnobotanical investigation	Ghana	[73]
334	<i>Terminalia catappa</i> L.	Combretaceae	Leaves	Decoction (Oral)	Severe fever, malaria	Ethnobotanical investigation	Ghana	[73]
335	<i>Terminalia ivorensis</i> A.Chev.	Combretaceae	Stem Bark	Powder (Oral)	Piles	Ethnobotanical investigation	Ghana	[73]
336	<i>Momordica charantia</i> L.	Cucurbitaceae	Leaves	Grind (topical);Decoction (oral)	Gonorrhoea, headache	Ethnobotanical investigation	Ghana	[73]
337	<i>Mareya micrantha</i> (Benth.) Müll.Arg.	Euphorbiaceae	Leaves	Paste	Waist pains	Ethnobotanical investigation	Ghana	[73]
338	<i>Ricinodendron heudelotii</i> (Baill.) Heckel	Euphorbiaceae	Leaves	Decoction	Malaria	Ethnobotanical investigation	Ghana	[73]
339	<i>Phyllanthus muellerianus</i> (Kuntze.) Exell.	Euphorbiaceae	Leaves, Roots	Grind	Waist pains	Ethnobotanical investigation	Ghana	[73]
340	<i>Mallotus oppositifolius</i> Müll.Arg.	Euphorbiaceae	Leaves	Grind	Waist pains	Ethnobotanical investigation	Ghana	[73]
341	<i>Alchornea cordifolia</i> (Schumach. and Thonn.)	Euphorbiaceae	Stem Bark and leaves	Decoction and infusion	Malaria, Sexual Infection	Ethnobotanical investigation	Ghana, Benin	[73,70]
342	<i>Phyllanthus urinaria</i> L.	Euphorbiaceae	Leaves	Decoction	Malaria	Ethnobotanical investigation	Ghana	[73]
343	<i>Senna occidentalis</i> (L.) Link	Fabaceae	Leaves	Decoction (Oral)	Stomachaches, Malaria	Ethnobotanical investigation	Ghana	[73]
344	<i>Tetrapleura tetraptera</i> (Schum. and Thonn.) Taub.	Fabaceae	Fruits	Decoction (Oral)	Typhoid, Asthma, Blood tonic	Ethnobotanical investigation	Ghana	[73]
345	<i>Hoslundia opposita</i> Vahl.	Lamiaceae	Leaves, Seeds	Decoction (Oral)	Malaria, phlegm	Ethnobotanical investigation	Ghana	[73]
346	<i>Ocimum gratissimum</i> L.	Lamiaceae	Leaves, Seeds	Decoction (Oral)	Headache, Diarrhea, Malaria	Ethnobotanical investigation	Ghana	[73]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
347	<i>Khaya senegalensis</i> (Desv.) A.Juss.	Meliaceae	Leaves, Stem Bark	Infusion (Oral)	Malaria	Ethnobotanical investigation	Ghana	[73]
348	<i>zadirachta indica</i> A. Juss.	Meliaceae	Neem tree, Leaves, Stem Bark	Decoction (Oral)	Malaria	Ethnobotanical investigation	Ghana	[73]
349	<i>Ficus exasperata</i> Vahl.	Moraceae	Leaves	Decoction (Oral)	Malaria	Ethnobotanical investigation	Ghana	[73]
350	<i>Psidium guajava</i> L.	Myrtaceae	Leaves	Rub (topical)	Chicken pox, Measles, and candidiasis	Ethnobotanical investigation	Ghana	[73]
351	<i>Saccharum officinarum</i> L.	Poaceae	Leaves	Decoction (Oral)	Malaria	Ethnobotanical investigation	Ghana	[73]
352	<i>Cymbopogon citratus</i> (DC.)	Poaceae	Leaves	Decoction	Fever, Malaria, Typhoid	Ethnobotanical investigation	Ghana	[73]
353	<i>Bambusa vulgaris</i> Schrad. ex J.C. Wendl.	Poaceae	Leaves	Decoction	Malaria	Ethnobotanical investigation	Ghana	[73]
354	<i>Morinda lucida</i> Benth.	Rubiaceae	Leaves	Decoction	Malaria	Ethnobotanical investigation	Ghana	[73]
355	<i>Citrus aurantiifolia</i> (Christm.) Swingle	Rutaceae	Fruits, Roots	Decoction	Fever, Cough, Typhoid	Ethnobotanical investigation	Ghana	[73]
356	<i>Citrus sinensis</i> (L.) Osbeck	Rutaceae	Leaves, Roots, Seeds	Decoction	Malaria, diarrhea	Ethnobotanical investigation	Ghana	[73]
357	<i>Paullinia pinnata</i> L.	Sapindaceae	Roots,	Raw	Profuse cough	Ethnobotanical investigation	Ghana	[73]
358	<i>Solanum torvum</i> Sw.	Solanaceae	Leaves	Rub (Topical)	Cough, Typhoid, Headache	Ethnobotanical investigation	Ghana	[73]
359	<i>Theobroma cacao</i> L.	Sterculiaceae	Roots, Leaves	Pound, Decoction (Oral)	Cough, Malaria	Ethnobotanical investigation	Ghana	[73]
360	<i>Tectona grandis</i> L.f.	Verbanaceae	Leaves, Stem Bark	Decoction (Oral)	Malaria	Ethnobotanical investigation	Ghana	[73]
361	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Rhizomes	Raw (Oral)	Cough, Diarrhea, Wounds	Ethnobotanical investigation	Ghana	[73]
362	<i>Acanthospermum hispidum</i> (DC)	Asteraceae	Stem/leaves	cold decoction Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]
363	<i>Cassia siamea</i> (Lam)	Caesalpiniaceae	Leaves	cold decoction, Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]
364	<i>Crossopteryx febrifuga</i> (AFZ. Ex G. Don) Benth	Rubiaceae	Leaves	cold decoction Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]
365	<i>Fadogia agrestis</i> (Schweinf. Ex Hiern) B	Rubiaceae	Leaves	cold decoction Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]
366	<i>Ficus sycomorus</i> (L)	Moraceae	Leaves, Stem bark	cold decoction Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
367	<i>Pavetta crassipes</i> (K. Schum)	Rubiaceae	Leaves	cold decoction Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]
368	<i>Terminalia macroptera</i> (Guill. et Perr)	Combretaceae	Bark root	cold decoction Body bath, orally	Malaria	Ethnobotanical survey and <i>in vitro</i> antiplasmodial activity	Burkina Faso	[74]
369	<i>Hygrophila auriculata</i> (Schum.) Heine	Acanthaceae	Stem bark	Trituration	Respiratory disease	Ethnobotanical survey	Burkina Faso	[75]
370	<i>Lepidagathis anobrya</i> Nees	Acanthaceae	Leaves	Decoction	Stomacheache	Ethnobotanical survey	Burkina Faso	[75]
371	<i>Alternanthera nodiflora</i> R. Br.	Amaranthaceae	Leaves	Cataplasm	Growth retardation	Ethnobotanical survey	Burkina Faso	[75]
372	<i>Pupalia lappacea</i> (L.) Juss.	Amaranthaceae	Leaves	Calcination	Wound healing stomachache	Ethnobotanical survey	Burkina Faso	[75]
373	<i>Anacardium occidentale</i> L	Anacardiaceae	Stem bark	Infusion	Hypertension, Diarrhoea, infection diseases	Ethnobotanical survey	Burkina Faso, Benin	[75,70]
374	<i>Lannea acida</i> A. Rich.	Anacardiaceae	Stem bark	Decoction	Stomachache, ulcer	Ethnobotanical survey	Burkina Faso	[75]
375	<i>Lannea velutina</i> A. Rich.	Anacardiaceae	Stem bark/Root	Decoction	Tonic	Ethnobotanical survey	Burkina Faso	[75]
376	<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	Anacardiaceae	Stem bark	Decoction, infusion	Dysentery, Ulcer	Ethnobotanical survey	Burkina Faso	[75]
377	<i>Annona senegalensis</i> Pers.	Annonaceae	Leaves, stem bark, Root	Decoction, calcination	Wound healing, stomachache, somniferous malaria	Ethnobotanical survey	Burkina Faso	[75]
378	<i>Baijsea multiflora</i> A.DC.	Annonaceae	Leaves, stem bark, Root	Decoction	Tonic, Diarrhea	Ethnobotanical survey	Burkina Faso	[75]
379	<i>Saba senegalensis</i> (A. DC.) Pichon	Apocynaceae	Leaves	Decoction	Wound healing, stomachache	Ethnobotanical survey	Burkina Faso	[75]
380	<i>Cynanchum viminale</i> (L.) L	Apocynaceae	Stem bark	Trituration	Eye infection	Ethnobotanical survey	Burkina Faso	[75]
381	<i>Leptadenia hastata</i> (Pers.) Decne.	Apocynaceae	Leaves, stem bark	Decoction	Malaria, jaundice, sexual impotence	Ethnobotanical survey	Burkina Faso	[75]
382	<i>Chrysanthellum americanum</i> (L.) Vatke	Asteraceae	Leaves, stem bark, Root	Decoction, infusion	Liver diseases	Ethnobotanical survey	Burkina Faso	[75]
383	<i>Adansonia digitata</i> L.	Bombacaceae	Leaves	Decoction	Dysentery	Ethnobotanical survey	Burkina Faso	[75]
384	<i>Heliotropium indicum</i> L.	Boraginaceae	Leaves, stem bark	Decoction	Diarrhea, hypertension	Ethnobotanical survey	Burkina Faso	[75]
385	<i>Boswellia dalzielii</i> Hutch.	Burseraceae	Leaves	Decoction	Wound healing, stomachache	Ethnobotanical survey	Burkina Faso	[75]
386	<i>Maytenus senegalensis</i> (Lam.) Exell	Celastraceae	Leaves, Roots	Decoction	Malaria, diarrhea, dental pain, headache	Ethnobotanical survey	Burkina Faso	[75]
387	<i>Hippocratea africana</i> (Willd.) Loes.	Celastraceae	Stem bark	Decoction	Sickle-cell disease	Ethnobotanical survey	Burkina Faso	[75]
388	<i>Cochlospermum planchonii</i> Hook.f.	Cochlosperma-ceae	Roots	Decoction	Malaria	Ethnobotanical survey	Burkina Faso	[75]
389	<i>Cochlospermum tinctorium</i> Perrier ex A. Rich.	Cochlosperma-ceae	Leaves, Roots	Decoction	Malaria, ulcer	Ethnobotanical survey	Burkina Faso	[75]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
390	<i>Anogeissus leiocarpa</i> (DC.) Guill. and Perr.	Combretaceae	Stem Bark	Decoction	Respiratory disease	Ethnobotanical survey	Burkina Faso	[75]
391	<i>Combretum aculeatum</i> Vent.	Combretaceae	leaves	Decoction	Dental pain	Ethnobotanical survey	Burkina Faso	[75]
392	<i>Combretum adenogonium</i> Steud. ex A. Rich.	Combretaceae	Leaves, Stem Bark	Decoction	Dysentery	Ethnobotanical survey	Burkina Faso	[75]
393	<i>Combretum glutinosum</i> Perr. ex DC.	Combretaceae	Leaves	Decoction	Stomachache, liver trouble	Ethnobotanical survey	Burkina Faso	[75]
394	<i>Combretum micranthum</i> G. Don	Combretaceae	Leaves	Decoction	Malaria	Ethnobotanical survey	Burkina Faso	[75]
395	<i>Combretum paniculatum</i> Vent.	Combretaceae	Leaves	Decoction, maceration	Hemoroids	Ethnobotanical survey	Burkina Faso	[75]
396	<i>Combretum sericeum</i> G. Don	Combretaceae	Leaves, Stem Bark	Decoction	General fatigue	Ethnobotanical survey	Burkina Faso	[75]
397	<i>Guiera senegalensis</i> J.F. Gmel.	Combretaceae	Leaves, Stem Bark	Decoction	Malaria, Diarrhea, Cold, Sinusitis	Ethnobotanical survey	Burkina Faso	[75]
398	<i>Pteleopsis suberosa</i> Engl. and Diels	Combretaceae	Leaves, Stem bark	Decoction, Maceration	Dysentery, stomachache, cough, hemorrhoids	Ethnobotanical survey	Burkina Faso	[75]
399	<i>Terminalia avicennioides</i> Guill. and Perr.	Combretaceae	Leaves, stem bark, Root	Decoction	Liver trouble, heartache, diarrhea	Ethnobotanical survey	Burkina Faso	[75]
400	<i>Terminalia macroptera</i> Guill. and Perr	Combretaceae	Roots	Decoction	Hemoroids	Ethnobotanical survey	Burkina Faso	[75]
401	<i>Pterocarpus erinaceus</i>	Ebenaceae	Leaves, stem bark, roots	Decoction	Wound healing, sexual impotence, parasite infections	Ethnobotanical survey	Burkina Faso, Benin	[75, 70]
402	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Leaves, stem bark, roots	Decoction, Maceration	Dysentery, respiratory diseases	Ethnobotanical survey	Burkina Faso	[75]
403	<i>Afzelia africana</i> Smith ex Pers.	Fabaceae	stem bark, roots	Decoction	Stomachache	Ethnobotanical survey	Burkina Faso	[75]
404	<i>Alysicarpus glumaceus</i> (Vahl) DC.	Fabaceae	Leaves	Decoction	Diarrhea	Ethnobotanical survey	Burkina Faso	[75]
405	<i>Bauhinia rufescens</i> Lam.	Fabaceae	Leaves, Stem bark, Root, Fruit	Trituration	Cold, sinusitis, tonic	Ethnobotanical survey	Burkina Faso	[75]
406	<i>Burkea africana</i> Hook.	Fabaceae	Stem bark	Decoction, infusion	Cough, heart disease	Ethnobotanical survey	Burkina Faso	[75]
407	<i>Cassia alata</i> L.	Fabaceae	Leaves	Decoction, Trituration	Skin disorders, liver diseases	Ethnobotanical survey	Burkina Faso	[75]
408	<i>Cassia italica</i> (Mill.) Lam. ex F.W. Andrews	Fabaceae	Leaves	Decoction	Stomachache, skin disorders	Ethnobotanical survey	Burkina Faso	[75]
409	<i>Cassia nigricans</i> Vahl	Fabaceae	Leaves	Decoction, trituration	Wound healing, stomachache	Ethnobotanical survey	Burkina Faso	[75]
410	<i>Cassia occidentalis</i> L.	Fabaceae	Leaves, stem bark	Decoction	Tonic, stomachache	Ethnobotanical survey	Burkina Faso	[75]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
411	<i>Cassia sieberiana</i> DC.	Caesalpiniaceae	Leaves, stem bark, roots	Decoction, trituration	Stomachache, malaria, kidney diseases, sexual impotence	Ethnobotanical survey	Burkina Faso	[75]
412	<i>Cassia singueana</i> Del.	Fabaceae	Leaves, Roots	Decoction	Stomachache	Ethnobotanical survey	Burkina Faso	[75]
413	<i>Detarium microcarpum</i> Guill. and Perr.	Fabaceae	Leaves, stem bark	Decoction	Headache, stomachache	Ethnobotanical survey	Burkina Faso	[75]
414	<i>Dichrostachys cinerea</i> (L.) Wight and Arn.	Mimosaceae	Roots	Decoction	Respiratory diseases	Ethnobotanical survey	Burkina Faso	[75]
415	<i>Entada africana</i> Guill. and Perr.	Fabaceae	stem bark	Decoction, maceration	Cold, sinusitis, cough	Ethnobotanical survey	Burkina Faso	[75]
416	<i>Faidherbia albida</i> (Del.) A. Chev.	Mimosaceae	Leaves	Decoction	Kidney diseases, malaria	Ethnobotanical survey	Burkina Faso	[75]
417	<i>Senegalia macrostachya</i> (Rchb. ex DC.) Kyal and Boatwr.	Fabaceae	Leaves	Decoction	Headache	Ethnobotanical survey	Burkina Faso	[75]
418	<i>Senegalia senegal</i> (L.) Britton	Fabaceae	Leaves, stem bark	Decoction	Diarrhea, hemorrhoids	Ethnobotanical survey	Burkina Faso	[75]
419	<i>Vachellia nilotica</i> (L.) P.J.H. Hurter and Mabb.	Fabaceae	Fruits, Stem bark	Decoction	stomaches, cough	Ethnobotanical survey	Burkina Faso	[75]
420	<i>Parkia biglobosa</i> (Jacq.) R. Br. ex G. Don	Fabaceae	Fruits, Stem bark	Decoction, calcination, trituration	Wound healing, hemorrhoids	Ethnobotanical survey	Burkina Faso	[75]
421	<i>Piliostigma reticulatum</i> (DC.) Hochst.	Fabaceae	Leaves	Decoction, infusion	Cold, sinusitis	Ethnobotanical survey	Burkina Faso	[75]
422	<i>Piliostigma thonningii</i> (Schum.) Milne-Redh.	Caesalpiniaceae	Leaves	Decoction	Diarrhea, dysentery	Ethnobotanical survey	Burkina Faso	[75]
423	<i>Pterocarpus erinaceus</i> Poir.	Fabaceae	Roots	Decoction	Diarrhea	Ethnobotanical survey	Burkina Faso, Benin	[75, 70]
424	<i>Tamarindus indica</i> L.	Fabaceae	Stem bark, seeds	Decoction	Stomachache, wound healing	Ethnobotanical survey	Burkina Faso	[75]
425	<i>Tephrosia bracteolata</i> Guill. and Perr.	Fabaceae	Leaves	Decoction	Dental pain, headache	Ethnobotanical survey	Burkina Faso	[75]
426	<i>Hyptis specigera</i> Lam.	Lamiaceae	Leaves	Decoction	Malaria, Dental pain	Ethnobotanical survey	Burkina Faso	[75]
427	<i>Leonotis nepetaefolia</i> (L.) R.Br.	Lamiaceae	Leaves	Decoction	Cold, sinusitis	Ethnobotanical survey	Burkina Faso	[75]
428	<i>Ocimum americanum</i> L.	Lamiaceae	Leaves, Stem Bark	Decoction, infusion	Indigestion, Diarrhea, Rheumatism	Ethnobotanical survey	Burkina Faso	[75]
429	<i>Ocimum basilicum</i> L.	Lamiaceae	Leaves	Decoction	Children fears	Ethnobotanical survey	Burkina Faso	[75]
430	<i>Vitex cuneata</i> Schumach. and Thonn.	Lamiaceae	Leaves	Decoction	Diarrhea	Ethnobotanical survey	Burkina Faso	[75]
431	<i>Vitex doniana</i> Sweet	Verbenaceae	Leaves	Decoction	Hypertension	Ethnobotanical survey	Burkina Faso	[75]
432	<i>Lauraceae Cassytha filiformis</i> L.	Lauraceae	Leaves, Stem bark	Decoction, infusion	Stomachache	Ethnobotanical survey	Burkina Faso	[75]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
433	<i>Tapinanthus globiferus</i> (A. Rich.) Van Tiegh	Loranthaceae	Stem bark	Decoction	Diarrhea	Ethnobotanical survey	Burkina Faso	[75]
434	<i>Lawsonia inermis</i> L.	Lythraceae	Stem bark	Decoction	Kidney	Ethnobotanical survey	Burkina Faso	[75]
435	<i>Grewia mollis</i> Juss.	Malvaceae	Stem bark	Decoction	Growth retardation	Ethnobotanical survey	Burkina Faso	[75]
436	<i>Waltheria indica</i> L.	Malvaceae	Leaves, roots	Decoction, trituration	Growth retardation	Ethnobotanical survey	Burkina Faso	[75]
437	<i>Sida alba</i> L.	Malvaceae	leaves	Decoction	Pitting	Ethnobotanical survey	Burkina Faso	[75]
438	<i>Wissadula amplissima</i> (L.) R. E. Fries. var. <i>rostrata</i> (Sch. and Th.) R.E. Fries.	Malvaceae	Roots	Decoction	Cold	Ethnobotanical survey	Burkina Faso	[75]
439	<i>Khaya senegalensis</i> (Desr.) A. Juss.	Meliaceae	Leaves, Stem bark	Decoction, maceration	Malaria	Ethnobotanical survey	Burkina Faso	[75]
440	<i>Pseudocedrela kotschyi</i> (Schweinf.) Harms	Meliaceae	Leaves, Roots	Decoction, Calcination	Hemorrhoids, tiredness, tooth pain	Ethnobotanical survey	Burkina Faso	[75]
441	<i>Trichilia emetica</i> Vahl	Meliaceae	Leaves, stem bark	Decoction, trituration	Hemorrhoids, malaria	Ethnobotanical survey	Burkina Faso	[75]
442	<i>Ficus gnaphalocarpa</i> (Miq.) Steud. ex A. Rich.	Moraceae	Leaves	Decoction	Malaria	Ethnobotanical survey	Burkina Faso	[75]
443	<i>Ficus platyphylla</i> Del.	Moraceae	Leaves	Decoction	Stomachaches, Malaria	Ethnobotanical survey	Burkina Faso	[75]
444	<i>Moringa oleifera</i> Lam.	Moringaceae	Leaves, roots, stem bark	Decoction, infusion, trituration	Dysentery, malaria, stomachache, general fatigue, hypertension	Ethnobotanical survey	Burkina Faso	[75]
445	<i>Lophira lanceolata</i> Van Tiegh. ex Keay	Ochnaceae	Leaves	Trituration	Skin disorders	Ethnobotanical survey	Burkina Faso	[75]
446	<i>Ximenia americana</i> L.	Olacaceae	Stem bark	Trituration	Stomachache, wound healing	Ethnobotanical survey	Burkina Faso	[75]
447	<i>Phyllanthus amarus</i> Schum. and Thonn.	Phyllanthaceae	Leaves, stem bark, roots	Decoction, catapasm, infusion	Hemorrhoids, diarrhea, gout, stomachache, liver diseases	Ethnobotanical survey	Burkina Faso	[75]
448	<i>Scoparia dulcis</i> L.	Plantaginaceae	Leaves, stem bark, roots	Decoction	Cough, hemorrhoid, syphilis	Ethnobotanical survey	Burkina Faso	[75]
449	<i>Andropogon gayanus</i> Kunth	Poaceae	Leaves	Decoction	Cough, malaria	Ethnobotanical survey	Burkina Faso	[75]
450	<i>Bambusa vulgaris</i> Schrad. ex J.C. Wendl.	Poaceae	Leaves	Decoction	Malaria	Ethnobotanical survey	Burkina Faso	[75]
451	<i>Cymbopogon citratus</i> (DC.) Stapf	Poaceae	Leaves	Decoction	Cold, Sinusistis	Ethnobotanical survey	Burkina Faso	[75]
452	<i>Cymbopogon giganteus</i> Chiov.	Poaceae	Leaves, Roots	Decoction	Prostate diseases	Ethnobotanical survey	Burkina Faso	[75]
453	<i>Cymbopogon schoenanthus</i> (L.) Spreng.	Poaceae	Leaves, Stem Bark, roots	Trituration	Skin disorders	Ethnobotanical survey	Burkina Faso	[75]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
454	<i>Securidaca longipedunculata</i> Fres.	Polygalaceae	Roots	Infusion	Ulcer, liver diseases, respiratory diseases	Ethnobotanical survey	Burkina Faso	[75]
455	<i>Crossopteryx febrifuga</i> (Afzel. ex G. Don) Benth.	Rubiaceae	Leaves, Stem bark, fruits	Decoction	Tonic	Ethnobotanical survey	Burkina Faso	[75]
456	<i>Fadogia agrestis</i> Schweinf. ex Hiern	Rubiaceae	Leaves, Stem bark	Decoction	Rheumatism	Ethnobotanical survey	Burkina Faso	[75]
457	<i>Feretia apodantha</i> Del.	Rubiaceae	Leaves	Decoction	Stomachaches	Ethnobotanical survey	Burkina Faso	[75]
458	<i>Gardenia erubescens</i> Stapf and Hutch.	Rubiaceae	Leaves, Stem bark	Decoction	Healing of umbilical cord, Wounds	Ethnobotanical survey	Burkina Faso	[75]
459	<i>Gardenia sokotensis</i> Stapf and Hutch.	Rubiaceae	Leaves	Decoction	Tonic, Malaria, Wound healing, Stomachaches	Ethnobotanical survey	Burkina Faso	[75]
460	<i>Gardenia ternifolia</i> Schum. and Thonn.	Rubiaceae	Fruits, Stem bark	Decoction	Tonic	Ethnobotanical survey	Burkina Faso	[75]
461	<i>Mitragyna inermis</i> (Willd.) Kuntze	Rubiaceae	Leaves, stem bark	Decoction, infusion	Malaria, tiredness, hypertension	Ethnobotanical survey	Burkina Faso	[75]
462	<i>Nauclea latifolia</i> Smith	Rubiaceae	Leaves, roots	Decoction, infusion	Wound healing, stomachache	Ethnobotanical survey	Burkina Faso	[75]
463	<i>Sarcocephalus latifolius</i> (Smith) Bruce	Rubiaceae	Stem bark	Decoction	Wound Healing, Stomachaches	Ethnobotanical survey	Burkina Faso	[75]
464	<i>Paullinia pinnata</i> L.	Sapindaceae	Leaves, stem bark, root	Decoction	Malaria, Stomachaches	Ethnobotanical survey	Burkina Faso	[75]
465	<i>Vitellaria paradoxa</i> Gaertn. f.	Sapotaceae	Stem bark	Decoction, trituration	Cold, sinusitis, wound healing, stomachache, hemorrhoids	Ethnobotanical survey	Burkina Faso	[75]
466	<i>Physalis angulata</i> L.	Solanaceae	leaves	Trituration	Skin disorders	Ethnobotanical survey	Burkina Faso	[75]
467	<i>Lantana camara</i> L.	Verbenaceae	Leaves, stem bark, roots	Decoction, infusion	Hypertension	Ethnobotanical survey	Burkina Faso	[75]
468	<i>Tectonia grandis</i> L.f.	Verbenaceae	Leaves	Decoction, maceration	Ulcer	Ethnobotanical survey	Burkina Faso	[75]
469	<i>Cissus quadrangularis</i> L.	Vitaceae	Stem bark	Cataplasm	Tiredness	Ethnobotanical survey	Burkina Faso	[75]
470	<i>Balanites aegyptiaca</i> (L.) Del.	Zygophyllaceae	Fruits, Stem bark	Decoction	Stomachaches	Ethnobotanical survey	Burkina Faso	[75]
471	<i>Sclerocarya birrea</i> (A.Rich.) Hochst.	Anacardiaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
472	<i>Saba senegalensis</i> (A.DC.) Pichon.	Apocynaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
473	<i>Tacazzea apiculata</i> Oliv.	Apocynaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
474	<i>Chrysanthellum americanum</i> (L.) Vatke.	Asteraceae	Whole plant	Infusion	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
475	<i>Cochlospermum planchonii</i> Hook.f.	Bixaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
476	<i>Terminalia avicennioides</i> Guill. et Perr.	Combretaceae	Leaves Roots	Decoction, Infusion	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
477	<i>Diospyros mespiliformis</i> Hochst. Ex A. DC.	Ebenaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
478	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Whole plant; Leaves; Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
479	<i>Acacia nilotica</i> (L.) Willd. ex Delile.	Fabaceae	Flowers	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
480	<i>Acacia seyal</i> Delile. Shrub	Fabaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
481	<i>Erythrina senegalensis</i> A.DC.	Fabaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
482	<i>Senna alata</i> (L.) Roxb.	Fabaceae	Flowers	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
483	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Fabaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
484	<i>Cassia sieberiana</i> DC.	Fabaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
485	<i>Acacia senegal</i> (L.) Willd.	Fabaceae	Stem Bark	Maceration	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
486	<i>Ocimum americanum</i> L.	Lamiaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
487	<i>Vitex doniana</i> Sweet.	Lamiaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
488	<i>Strychnos spinosa</i> Lam.	Loganiaceae	Leaves; Stem	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
489	<i>Waltheria indica</i> L.	Malvaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
490	<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt.	Phyllanthaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
491	<i>Andropogon gayanus</i> Kunth.	Poaceae	Whole plant; Leaves Powder	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
492	<i>Zanthoxylum zanthoxyloides</i> (Lam.) Zepern. and Timler.	Rutaceae	Stem barks; Roots	Maceration; Infusion	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
493	<i>Nicotiana tabacum</i> L. [cult.]	Solanaceae	Leaves	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
494	<i>Stachytarpheta indica</i> (L.) Vahl.	Verbenaceae	Leaves; Whole plant	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
495	<i>Cissus populnea</i> Guill. and Perr.	Vitaceae	Leaves	Ash	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
496	<i>Ximenia americana</i> L.	Ximeniaceae	Roots	Maceration Poudre	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
497	<i>Balanites aegyptiaca</i> (L.) Delile.	Zygophyllaceae	Roots	Decoction	Urinary infection	Ethnobotanical survey	Burkina Faso	[76]
498	<i>Chrysanthelium americana</i>	Asteraceae	Whole plant	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
499	<i>Combretum micranthum</i>	Asteraceae	Leaves; Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
500	<i>Anogeis susleiocarpus</i>	Asteraceae	Leaves; Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]

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Table-1: (Continued).

No.	Species	Family	Parts of plants	Form	Microbial infection	Methods	Country	References
501	<i>Terminalia macroptera</i>	Combretaceae	Leaves;- Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
502	<i>Guiera senegalensis</i>	Combretaceae	Leaves;	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
503	<i>Cochlospermum tinctorium</i>	Cochlospermaceae	Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
504	<i>Carica papaya</i>	Caricaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
505	<i>Entanda africana</i>	Mimosaceae	Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
506	<i>Parkia biglobosa</i>	Mimosaceae	Bark	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
507	<i>Citrus aurantifolia</i>	Rutaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
508	<i>Khaya senegalensis</i>	Meliaceae	Bark	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
509	<i>Trichillia emetica</i>	Meliaceae	Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
510	<i>Phyllanthus niruri</i>	Euphorbiaceae	Whole plant	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
511	<i>Manihot esculenta</i>	Euphorbiaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
512	<i>Commiphora africana</i>	Burseraceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
513	<i>Desmodium adscendens</i>	Burseraceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
514	<i>Burkea africana</i>	Fabaceae	Bark	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
515	<i>Erythrina senegalensis</i>	Fabaceae	Bark	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
516	<i>Pterocarcus erinaceus</i>	Fabaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
517	<i>Vitellaria paradoxa</i>	Sapotaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
518	<i>Mitracarpus scaber</i>	Rubiaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
519	<i>Mitragyna inermis</i>	Rubiaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
520	<i>Anona senegalensis</i>	Annonaceae	Leaves; Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
521	<i>Tamarindus indica</i>	Annonaceae	Fruits	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
522	<i>Cassia occidentalis</i>	Cesalpinaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
523	<i>Cassia sieberiana</i>	Cesalpinaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
524	<i>Piliostigma reticulatum</i>	Cesalpinaceae	Party	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
525	<i>Ximenia americana</i>	Olacaceae	Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
526	<i>Spondias mombin</i>	Anacardiaceae	Leaves, fruits	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
527	<i>Sclerocarya birrea</i>	Anacardiaceae	Bark	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
528	<i>Hibiscus sabdariffa</i>	Malvaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
529	<i>Ficus on</i>	Moraceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
530	<i>Adansonia digitata</i>	Bombacaceae	Bark; Roots	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
531	<i>Zea mays</i>	Poaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]
532	<i>Oxytenanthera abyssinica</i>	Poaceae	Leaves	Decoction	Viral hepatitis	Ethnobotanical survey	Burkina Faso	[77]

Table-2: Scientific exploration of antimicrobial activities of some medicinal plants.

S. No.	Species	Families	Plants parts	Extracts	Antimicrobial validation test	Microbial strains	Main phytochemicals	Country	References
1	<i>Acacia macrostachya</i> . (Rchb. ex DC.)	Fabaceae	Leafy stems	Ethanollic	Microdilution method	Gram-positive and Gram-negative bacteria	Phenolic acids and flavonoids	Benin	[79]
2	<i>Acacia polyacantha</i>	Mimosaceae	Leaves	Hydroethanolic	Microplates and in	<i>Staphylococcus aureus</i>	Secondary metabolites	Benin	[80]
3	<i>Acanthospermum hispidum</i> DC.	Asteraceae	Aerial part	Hydroethanolic extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i> (ABA)	Mucilage, gallic tannins and anthocyanins	Benin	[55, 61]
4	<i>Acmella uliginosa</i> (Sw.) Cass.	Asteraceae	Leaves	Dichloromethane extract Methanol extract	Microdilution method (MICs)	<i>Staphylococcus aureus</i>	Clavonoid, naphthoquinone, anthracene derivative, lignin and triterpene	Benin	[81]
5	<i>Adansonia digitata</i>	Bombacaceae	Leaves Roots, Bark	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
6	<i>Aeollanthus pubescens</i>	Lamiaceae	Whole plant Flowers	Essential oil	Microplates and in	<i>Escherichia coli</i>	n.d.	Benin	[83]
7	<i>Amaranthus graecizans</i> L.	Amaranthaceae	Leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[55]
8	<i>Ampelocissus africana</i> (Lour.) Merr.	Vitaceae	Leaves	Acetone and aqueous extracts	Disc diffusion and broth microdilution	<i>Bacillus subtilis</i> , Gram negative <i>Bacteria</i> , <i>Enterococcus faecalis</i>	Polyphenols	Burkina Faso	[84]
9	<i>Anthoclesta nobilis</i>	Gentianeaceae	Bark	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
10	<i>Argemone mexicana</i>	Papaveraceae	Whole plant	Methanol extracts	MIC ranking	<i>Pseudomonas aeruginosa</i>	n.d.	Benin	[61]
11	<i>Balanites aegyptiaca</i> L. Delile.	Balanitaceae	Aerial part	Methanol extract	Microdilution assay	<i>Plasmodium falciparum</i>	Total phenolic and Proanthocyanidins content	Togo	[86]
12	<i>Bambusa aurambinacea</i>	Bambusaceae	Leaves	Methanol extract	microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
13	<i>Bridelia ferruginea</i> Benth.	Euphorbiaceae	Leaves	Methanol extracts.	Microdilution method		Proanthocyanidins, phenolic compounds	Togo	[86]
14	<i>Byrsocarpus coccineus</i>	Connaraceae	Roots	Methanol extracts	MIC ranking	<i>Pseudomonas aeruginosa</i>	n.d.	Benin	[61]
15	<i>Caesalpinia bonduc</i> (L.) Roxb.	Caesalpinaceae	Leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[55]
16	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Asclepiadaceae	Leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[55]
17	<i>Calyptrochilum emarginatum</i>	Orchidaceae	Whole plant	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
18	<i>Canthium setosum</i>	Euphorbiaceae	Aerial part	Methanol extracts	MIC ranking	<i>Pseudomonas aeruginosa</i>	n.d.	Benin	[61]

(Contd...)

Table-2: (Continued).

S. No.	Species	Families	Plants parts	Extracts	Antimicrobial validation test	Microbial strains	Main phytochemicals	Country	References
19	<i>Casuarina equisetifolia</i> L.	Casuarinaceae	Fruits	Dichloromethane extract Hydroalcoholic extract	p-iodonitro-tetrazolium microdilution (MICs)	<i>Escherichia coli</i>	n.d.	Benin	[87]
20	<i>Centella asiatica</i> (L.) Urban	Apiaceae	Leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[55]
21	<i>Chrysanthellum americanum</i> (L.) Vatke	Asteraceae	Leaves	Hydroethanolic extract	Antibacterial activity	<i>Escherichia coli</i> , <i>Vibrio cholerae</i> isolated in contaminate	Polyphenols and flavonoids	Burkina Faso	[88]
22	<i>Chrysanthellum senegalensis</i>	Asteraceae	Whole plant	Methanol extract	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[52, 82]
23	<i>Cissus quadrangularis</i> (syn: <i>Vitis quadrangularis</i>)	Vitaceae	Stem	Ethanollic	Microplates and in	<i>Staphylococcus aureus</i>	Secondary metabolites	Benin	[89]
24	<i>Combretum micranthum</i> G. Don	Combretaceae	Leave	Hydroacetone extracts	Determination of MIC and MBC values and Antioxidant activity	<i>Shigella dysenteriae</i> , <i>Shigella boydii</i>	Polyphenols and phenolic compounds	Burkina Faso	[90]
25	<i>Conyza aegyptiaca</i>	Asteraceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
26	<i>Crateva adansonii</i>	Capparidaceae	Leaves	Hydroethanolic	<i>In vitro</i> , microdilution	<i>Staphylococcus aureus</i> ATCC 25923; <i>Pseudomonas mirabilis</i> A 24974 (reference strains); <i>Staphylococcus aureus</i> , <i>Vibrio cholera</i> and <i>Salmonella Typhi</i> (clinical isolates)	Alkaloids, Gallic tannins, Catechic tannins, Flavonoids, Quinone derivatives, Cyanogenic derivatives, sapononins	Benin	[91, 56]
27	<i>Crateva adansonii</i> DC.	Capparidaceae	Leaves and stem	Ethanollic Extract	Microdilution method	<i>Escherichia coli</i>	n.d.	Benin	[92]
28	<i>Crateva religiosa</i> Forst.	Capparidaceae	leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[56]
29	<i>Croton lobatus</i>	Euphorbiaceae	Aerial part	Methylene chloride extract.	Microculture radioisotope technique	<i>Plasmodium falciparum</i> 3D7	n.d.	Benin	[93]
30	<i>Croton membranaceus</i>	Euphorbiaceae	Roots	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
31	<i>Cryptolepis sanguinolenta</i>	Apocynaceae	Root	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana, Togo	[85, 52]
32	<i>Davallia chaerophylloides</i>	Davalliaceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
33	<i>Dichapetalum guineense</i>	Dichapetalaceae	Leaves	Methanol extracts	MIC ranking	<i>Pseudomonas aeruginosa</i>	n.d.	Benin	[61, 93]

(Contd...)

Table-2: (Continued).

S. No.	Species	Families	Plants parts	Extracts	Antimicrobial validation test	Microbial strains	Main phytochemicals	Country	References
34	<i>Eclipta alba</i> (L.) Hassk	Asteraceae	Leaves	Hydroethanolic extract	Antibacterial activity	<i>Escherichia coli</i> , <i>Vibrio cholerae</i> isolated in contaminate	Polyphenols and flavonoids	Burkina-Faso	[88]
35	<i>Elaeis guineensis</i>	Arecaceae	Leaves	Methanol extract	Microdilution (MICS)	<i>Staphylococcus aureus</i> (ATCC 25923)	Flavonoids	Ghana	[85]
36	<i>Entada africana</i> Guill. and Perr.	Mimosaceae	Aerials part	Methanol extract	Microdilution assay	<i>Escherichia coli</i> CIP 105182	Total phenolic and Proanthocyanidins content	Togo	[86]
37	<i>Eupatorium odoratum</i>	Asteraceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
38	<i>Ficus ovata</i>	Moraceae	Roots	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
39	<i>Gomphrena celosioides</i>	Amaranthaceae	Aerials part	Methylene chloride extract.	Microculture radioisotope technique	<i>Plasmodium falciparum</i> 3D7	n.d.	Benin	[93]
40	<i>Harrisonia abyssinica</i>	Simarubaceae	leaves	Methanol extracts	Cytopathic effects at minimum concentration	<i>Herpes simplex</i>	n.d.	Togo	[82]
41	<i>Hibiscus sabdariffa</i>	Malvaceae	Calyx	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
42	<i>Hybanthus enneaspermus</i>	Violaceae	Aerials part	Methylene chloride extract.	Microculture radioisotope technique	<i>Plasmodium falciparum</i> 3D7	n.d.	Benin	[93]
43	<i>Jatropha curcas</i> L.	Euphorbiaceae	Roots	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids, Mucilage, gallic tannins and anthocyanins	Ghana, Bénin	[85, 56]
44	<i>Khaya senegalensis</i> (Desr.) A. Juss	Meliaceae	Leaves and bark	Hydroacetone extracts	Determination of MIC and MBC values and Antioxidant activity	<i>Shigella dysenteriae</i> , <i>Shigella boydii</i>	Polyphenols and phenolic compounds, Mucilage, gallic tannins and anthocyanins	Burkina Faso, Bénin	[90, 56]
45	<i>Lantana camara</i>	Verbenaceae	Whole plant, leaves	Aqueous extracts	Well diffusion with the microdilution (MIC)	<i>Escherichia coli</i>	Polyphenols and flavonoids	Benin	[56, 94, 95]
46	<i>Leptadenia hastata</i> (Pers.) Decne.	Apocynaceae	Leaves	Aqueous extract	Peptone water microdilution (diameter of growth inhibition)	<i>Staphylococcus aureus</i> ATCC 29213	n.d.	Togo	[96]
47	<i>Lippia multiflora</i>	Verbenaceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
48	<i>Mallotus oppositifolius</i>	Euphorbiaceae	Leaves	Methanol extract	Microdilution (MICS)	<i>Pseudomonas aeruginosa</i> (ATCC 27853)	Flavonoids	Ghana	[85]
49	<i>Mitracarpus villosus</i>	Rubiaceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
50	<i>Momordica charantia</i>	Cucurbitaceae	Whole plant; Leafy stem	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana, Benin	[85], [56]
51	<i>Morinda lucida</i>	Rubiaceae	Bark	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
52	<i>Moringa oleifera</i>	Moringaceae	Roots	Methanol extract	Microdilution (MICS)	<i>Staphylococcus aureus</i> (ATCC 25923)	Flavonoids	Ghana	[85]

(Contd...)

Table-2: (Continued).

S. No.	Species	Families	Plants parts	Extracts	Antimicrobial validation test	Microbial strains	Main phytochemicals	Country	References
53	<i>Nauclea latifolia</i>	Rubiaceae	Roots	Methanol extracts	MIC ranking	<i>Pseudo-monas aeruginosa</i>	n.d.	Benin	[44]
54	<i>Ocimum gratissimum</i> L.	Lamiaceae	leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations semi microtest	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[56]
55	<i>Opilia celtidifolia</i>	Opiliaceae	Aerial part	Methanol extract	p-iodonitro-tetrazolium microdilution (MICs)	<i>Plasmodium falciparum</i>	Saponins	Togo	[79]
56	<i>Oxalis corniculata</i> L.	Oxalidaceae	Leaves	Dichloromethane extract	Inhibition in disk assay	<i>Escherichia coli</i> CIP 105182	n.d.	Benin	[81]
57	<i>Palisota hirsuta</i>	Commelinaceae	leaves	Methanol extracts	Microdilution assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
58	<i>Panarinari curatellifolia</i> Planch. ex Benth.	Chrysobalanaceae	Aerials part	Methanol extract	Microdilution assay	<i>Escherichia coli</i> CIP 105182	Total phenolic and Proanthocyanidins content	Togo	[82]
59	<i>Parkia biglobosa</i> (Jacq) benth	Mimosaceae.	Leaves Bark	Ethyl acetate extract	Disc diffusion method (MICs)	<i>Staphylococcus lentus</i>	Polyphenol, glycosides	Benin	[97]
60	<i>Paullinia pinnata</i>	Sapindaceae	Whole plant	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
61	<i>Pavetta corymbosa</i>	Rubiaceae	Aerials part	Methylene chloride extract.	Microculture radioisotope technique	<i>Plasmodium falciparum</i> 3D7	n.d.	Benin, Togo	[93], [98]
62	<i>Pergularia daemia</i>	Asclepiadaceae	Leaves	Aqueous extract	Peptone water microdilution (Diameter of growth inhibition)	<i>Escherichia coli</i> ATCC 25922	n.d.	Togo	[96]
63	<i>Phyllanthus amarus</i>	Phyllanthaceae	Leaves	Aqueous extracts	Well diffusion with the microdilution (MIC)	<i>Klebsiella pneumoniae</i>	n.d.	Benin	[94, 95]
64	<i>Pithecellobium dulce</i> (Roxb.) Benth	Mimosaceae	Stem bark	Crude extract	Microdilution assay	ESBL <i>Klebsiella pneumoniae</i> strains	Phenolic, flavonoid and proanthocyanidin contents	Togo	[52]
65	<i>Plumbago zeylanica</i>	Plumbaginaceae	Roots	Methanol extract	Microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
66	<i>Polygonum senegalensis</i>	Polygonaceae	Leaves	Hydroalcoholic	Minimum Inhibitory Concentration (MIC)	Gram-positive cocci (<i>Bacillus subtilis</i> , <i>Clostridium difficile</i> , <i>Enterococcus faecalis</i> , <i>Staphylococcus aureus</i>), Gram-negative bacilli (<i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Klebsiella pneumoniae</i>), and <i>Candida albicans</i>	Tanins, polyphenols and flavonoids	Benin	[99]
67	<i>Prosopis africana</i> Guill et Perr. Taub.	Mimosaceae	Leaves	Methanol extracts.	Microdilution method	<i>Proteus mirabilis</i> CIP 588104	Proanthocyanidins, phenolic compounds	Togo	[82]

(Contd...)

Table-2: (Continued).

S. No.	Species	Families	Plants parts	Extracts	Antimicrobial validation test	Microbial strains	Main phytochemicals	Country	References
68	<i>Pseudocedrela kotschy</i>	Meliaceae	Roots	Hydroalcoholic	Minimum Inhibitory Concentration (MIC)	Gram-positive cocci (<i>Bacillus subtilis</i> , <i>Clostridium difficile</i> , <i>Enterococcus faecalis</i> , <i>Staphylococcus aureus</i>), Gram-negative bacilli (<i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Klebsiella pneumoniae</i>), and <i>Candida albicans</i>	Tanins, polyphenols and flavonoids	Benin	[99]
69	<i>Psidium guajava</i>	Myrtaceae	Leaves	Methanol extract	microdilution (MICS)	<i>Escherichia coli</i> (NCTC 25922)	Flavonoids	Ghana	[85]
70	<i>Pterocarpus erinaceus</i> Poir	Fabaceae	Aerial part	Methanol extracts and Powder	MIC ranking	<i>Pseudomonas aeruginosa</i>	Alkaloids, Gallic tanins, Catechic tanins, Flavonoids, Alkaloids	Benin, Burkina Faso	[87, 90, 100]
71	<i>Sarcocephalus latifolius</i> (Sm.) E. A. Bruce	Rubiaceae	Leaves	Hydroethanolic extract	Macrodilution method and by solid culture medium			Benin	[101]
72	<i>Schrankia leptocarpa</i>	Papilionaceae	Aerial part	Methanol extracts	MIC ranking	<i>Pseudomonas aeruginosa</i>	n.d.	Benin	[87, 93]
73	<i>Secamone afzelii</i>	Asclepiadaceae	Aerial part	Methylene chloride extract.	Microculture radioisotope technique	<i>Plasmodium falciparum</i> 3D7	n.d.	Benin; Togo	[93, 96]
74	<i>Securidaca longepedunculata</i> Fresn	Polygalaceae	Roots	Crude extract	Microdilution assay	ESBL <i>Klebsiella pneumoniae</i> strains	Phenolic, flavonoid and proanthocyanidin contents	Togo	[86, 52]
75	<i>Senna alata</i> syn. <i>Cassia alata</i> L.	Caesalpinaceae	Leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[56]
76	<i>Senna siamae</i>	Fabaceae	Leaves	Aqueous Extract and Ethanolic Extract	Well diffusion technique combined with microdilution	Multidrug-resistant <i>Salmonella</i> : <i>Salmonella Typhimurium</i> ATCC 14028 and three <i>Salmonella</i> spp	Polyphenol and flavonoids	Benin	[94, 95]
77	<i>Sesamum radiatum</i>	Pedaliaceae	Leaves	Hydroethanolic	<i>In vitro</i> , microdilution	<i>Staphylococcus aureus</i> ATCC 25923; <i>Pseudomonas mirabilis</i> A 24974 (reference strains); <i>Staphylococcus aureus</i> , <i>Vibrio</i>	Alkaloids, Gallic tannins, Catechic tanins, Flavonoids, Quinone derivatives, Cyanogenic derivative	Benin	[56]

(Contd...)

Table-2: (Continued).

S. No.	Species	Families	Plants parts	Extracts	Antimicrobial validation test	Microbial strains	Main phytochemicals	Country	References
78	<i>Sida acuta</i>	Malvaceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>cholera and Salmonella typhi</i> (clinical isolates) <i>Staphylococcus aureus</i>	n.d.	Togo, Burkina Faso	[82, 90]
79	<i>Sida alba</i> L.	Malvaceae	Leaves	Methanol extracts	Microdilution method	<i>Proteus mirabilis</i> CIP 588104	Proanthocyanidins, phenolic compounds	Togo	[86]
80	<i>Spathodea campanulata</i>	Bignoniaceae	Leaves, Bark	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo, Ghana	[82, 85]
81	<i>Tagetes patula</i>	Asteraceae	leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
82	<i>Tamarindus indica</i>	Caesalpinaceae	Fruits	Methanol extract	semi microtest	<i>Plasmodium falciparum</i>	Tannins	Togo	[98]
83	<i>Terminalia macroptera</i> Guill. et Perr.	Combrretaceae	Leaves	Methanol extracts.	Microdilution method		Roanthocyanidins, phenolic compounds	Togo	[86]
84	<i>Thalia geniculata</i>	Marantaceae	Roots	Methylene chloride extract.	Microculture radioisotope technique	<i>Plasmodium falciparum</i> 3D7	n.d.	Benin	[93]
85	<i>Uvaria chamae</i>	Annonaceae	Leaves	Ethanol extract	In vivo assessment (MICs)	<i>Multiresistant strain of salmonella species</i>	Polyphenols and flavonoids	Benin	[94, 95]
86	<i>Vernonia amygdalina</i>	Asteraceae	Leaves	Hydroethanolic	<i>In vitro</i> , microdilution	<i>Staphylococcus aureus</i> ATCC 25923; <i>Pseudomonas mirabilis</i> A 24974 (reference strains); <i>Staphylococcus aureus</i> , <i>Vibrio cholera</i> and <i>Salmonella Typhi</i> (clinical isolates)	Alkaloids, Gallic tannins, Catechic tannins, Flavonoids, Quinone derivatives, Cyanogenic derivatives, sapononins,	Benin	[56]
87	<i>Vernonia colorata</i> (Willd.) Drake	Asteraceae	Leaves	Hydroethanolic extract	Antibacterial activity	<i>Escherichia coli</i> , <i>Vibrio cholerae</i> isolated in contaminate	Polyphenols and flavonoids	Burkina Faso	[88]
88	<i>Vernonia glaberrima</i>	Asteraceae	Leaves	Methanol extracts	Inhibition in disk assay	<i>Staphylococcus aureus</i>	n.d.	Togo	[82]
89	<i>Vetiveria nigriflora</i> Stapf.	Asteraceae	Roots	Methanol extracts.	Microdilution method	<i>Proteus mirabilis</i> CIP 588104	Proanthocyanidins, phenolic compounds	Togo	[86]
90	<i>Vitex doniana Sweet</i>	Verbenaceae	Leaves	Dichloromethane extract	Determination of minimum inhibitory and bactericidal concentrations	<i>Escherichia coli</i>	Mucilage, gallic tannins and anthocyanins	Benin	[55]
91	<i>Zanthoxylum zanthoxyloides</i>	Rutaceae	Roots, leaves	Methanol extracts	Inhibition in disk assay	<i>Escherichia coli</i>	n.d.	Togo	[82]

MIC=Minimal inhibitory concentration

Status of AMR in Burkina Faso

For Burkina Faso, there is an alarming spread of ESBL genes [43]. Karou *et al.* [44] isolated multidrug-resistant strains causing vaginal infections and diarrheal infections in children [45]. Strains isolated from food animals also show antibiotic resistance, threatening food

security [46]. Therefore, it is urgent to put in place rapid and effective strategies to control antibiotic resistance [47].

Status of AMR in Togo

Antibiotic resistance was observed in Togo even if low percentages were obtained for MRSA (14.3%)

compared to Benin and Congo (34.6 and 31, 9), respectively [48]. The previous study has reported the presence of multiple quinolone resistance genes and genes responsible for the production of ESBLs by enterobacteria [49]. Enterobacteriaceae-producing carbapenemases have also been identified in Togo [50].

Status of AMR in Cape Verde

In Cape Verde, there is increased resistance to methicillin and ESBL. Antibiotic resistance is on the rise [51]. Prevention of nosocomial infections through surveillance of infection risks and AMR is suggested.

Medicinal plants traditionally used for the fight against microbial infection in Togo, Ghana, Benin, Burkina Faso, and Cape-Verde

A total of 532 medicinal plants were listed in this study, and the most cited ailments for these plants were diarrhea and infectious diseases in general (Table-1) [52, 53–77]. A total of 203 medicinal plants were identified in Benin (Figure-1). The plants belong to 95 botanical families (Figure-2).

Medicinal plants active on pathogenic microbial germs and can be used as an alternative to conventional antimicrobials

Several studies have been conducted on the ethnopharmacological and ethnobotanical investigation

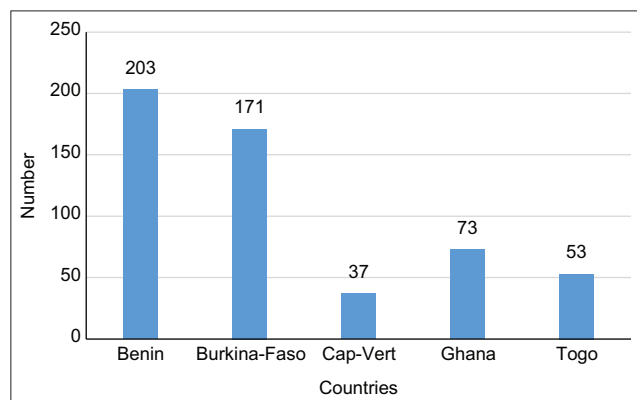


Figure-1: Medicinal plants listed by country.

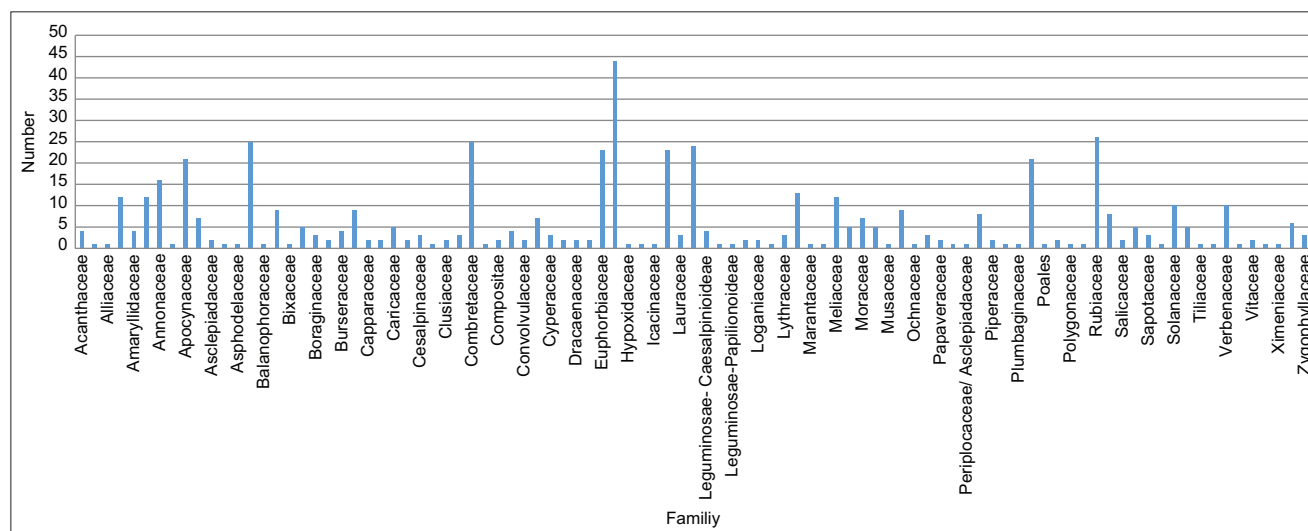


Figure-2: Family of medicinal plants listed.

of various medicinal plants used in Africa. This craze for this theme comes from the fact that nearly 80% of the world population and, in particular, Africans resort to traditional medicine for the treatment of various diseases [78]. Because of questions about the real efficacy of these plants, researchers in various African countries have been involved in exploring the real efficacy of these plants on multidrug-resistant microbial strains for some years. Various explorations of the antimicrobial activity of various plants carried out in Benin, Togo, Burkina Faso, Cape Verde, and Ghana are presented in Table-2 [79–101]. Aqueous and organic crude extracts of medicinal plants have been tested on different microbial strains, leading to interesting results. Bioactive compounds such as polyphenols and flavonoids in several medicinal plants.

Challenges in the use of medicinal plants against AMR

The current challenge regarding AMR is to use effective alternative solutions to curb the emergence of resistant germs responsible for various microbial infections [102]. Medicinal plants, widely used for therapeutic purposes in traditional medicine, appear to be one of the most credible solutions for this fight against microbial agents. Indeed, the traditional uses of these plants against infections or diseases of infectious origin are very well documented [103]. Several reports in the literature have validated the *in vitro* efficacy of medicinal plants on bacterial and/or microbial strains responsible for infectious diseases [104]. Similarly, *in vivo* studies have demonstrated the antibacterial potential against infections. Thus, scientific studies conducted thus far have testified to the strong potential of the African flora in the treatment of infectious diseases. At the phytochemical level, existing data agree that secondary metabolites such as alkaloids, tannins, and polyphenols act as potential antimicrobial and resistance modifiers. However, the antibacterial power of medicinal plants is well documented, and studies have sometimes reported opposite

results on the same bacterial strains. This discrepancy in results could be explained by factors intrinsic to the medicinal plants studied, but it is not excluded that the antibacterial test procedures adopted are also to blame. This state of affairs raises the need to standardize the available antimicrobial test protocols for a better appreciation of the antibacterial effects of medicinal plants.

Furthermore, very little data exist at this stage on the mechanisms of action of the antibacterial effect of medicinal plants. This suggests the need to undertake extensive studies to discover new active molecules useful in the treatment of infectious diseases. Moreover, very few studies on medicinal plants have been valorized by the development of drugs for managing infectious diseases. These limits of the scientific studies carried out until now evoke perspectives of scientific investigations centered on a better understanding of the antibacterial effects and the development of herbal drugs against diseases of infectious origin.

Avenues to explore for optimal use of medicinal plants in the fight against AMR

The fight against multidrug-resistant microorganisms such as bacteria, parasites, viruses, and fungi with plant extracts is becoming the only alternative to combat the invisible world becoming increasingly dangerous [105]. The use of natural substances isolated from medicinal plants with antimicrobial activity to treat multidrug-resistant infections is becoming an emergency. It is important to provide important data on the mechanism of action, advantages and disadvantages of the use of extracts of these medicinal plants used correctly in the African pharmacopeia to discover effective antimicrobial drugs. The use of the most effective and therapeutic plants must be under solid scientific evidence. Although traditional medicine has existed since immemorial times and continues to be used and, in the last decade, has grown in popularity, most countries do not officially recognize it. As a result, training and research in this area have not received the attention and support they deserve. The data on the safety and efficacy of traditional medicine are too insufficient in both quantitative and qualitative terms to justify its adoption worldwide. It should also be noted that there are published and unpublished research evidence on traditional medicine in a number of African countries. However, there is a need to promote further research on safety and efficacy and to improve the quality of the research [106]. It is also necessary to consider the likely effect of herbal extracts on the human microbiota because while the treatment may be life-saving for some infections, it also has a cost to the users. The bioactive molecules in herbal extracts may, for example, disrupt the intestinal microflora, leading to dysbiosis of the microbial community and opening up niches for the proliferation of other pathogens [107]. An important challenge is to accelerate the research, clinical approval, and application of

these phytochemicals to combat the clinical complications associated with antibiotic resistance [17].

Limitations

For scientific evidence of the antimicrobial efficacy of medicinal plants, the study did not establish a link between the antimicrobial activity of medicinal plant extracts and the bioactive compounds they contain. Furthermore, a comparison between the antimicrobial activity of medicinal plants and some reference antimicrobials has not been established.

Conclusion

At a time when multidrug resistance to antibiotics is growing exponentially, new approaches are needed for the development of new antimicrobial substances. This study has shown that Benin, Togo, Ghana, Burkina Faso, Cape Verde, and many other African countries, are rich in medicinal plants with proven efficacy against microbial infections. In the future, several innovative strategies must be pursued to harness this potential and develop alternative antimicrobials to conventional ones. The study showed that antimicrobial efficacy data were generated on a limited number of medicinal plants, leaving much room for the empirical use of medicinal plants. Furthermore, the scientific data collected are limited to *in vitro* tests. It is, therefore, necessary to strengthen the quantity and quality of scientific data on medicinal plants through *in vivo* studies and elucidation of the mechanisms of action of medicinal plant extracts. It is also imperative to examine complex plant extracts and individual compounds for activity against alternative bacterial targets, such as virulence and pathogenesis, as well as host-directed targets. Finally, all this work needs to be valorized through the development of improved traditional drugs, isolation of active principles for developing new antimicrobials and clinical trials.

Data Availability

All the data used to support the results of this study are included in the manuscript.

Authors' Contributions

VD, AJA, DR, IA, SA, AD, IJB, JRK, CA, and GAA: Conception and design of the study. BBL, EA, and BG: Data collection and writing. VD, BBL, and EA: Revision and editing of the manuscript. All authors have read and approved the final manuscript.

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Competing Interests

The authors declare that they have no competing interests.

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