

Ethnopharmacological Survey on *Chenopodium ambrosioides* Used by Togolese Traditional Practitioners for Cough Treatment

Abstract

Togo has an ethnobotanical potential with a great diversity of medicinal plants widely used to treat human diseases. Cough associated with respiratory diseases is one of the pathologies traditionally treated with medicinal plants in Togo. *Chenopodium ambrosioides* is a species used in the traditional treatment of cough in Togo. The aim of this study was to document the ethnopharmacological uses of *Chenopodium ambrosioides* in Togolese traditional medicine in the treatment of cough. An ethnopharmacological survey was conducted using the semi-structured interview method among Traditional Medicine Practitioners (TMPs) from six health districts spread across four health regions. The ethnopharmacological and ethnobotanical data collected were analyzed using the User Value (UV) and Frequency of Citation (FC) of medicinal plants associated with the species. A total of 127 TMPs participated in this study and 96 (76%) of them were male and 31 (34%) were female. 73% of the informants claimed usually use *Chenopodium ambrosioides* in the cough treatment compared to 27% who claimed to not use it to treat cough. *Chenopodium ambrosioides* was used in combination with fifty-two (52) other botanical species in the treatment of cough and in the study area, *Abrus precatorius* Linn. (13.59%) followed by *Ocimum gratissimum* Linn. (11.58%), *Zingiber officinale* Rosc. Trans. Linn. (9.73%), *Mangifera indica* Linn. (6.21%), *Eucalyptus citriodora* Hooker (4.87%), *Xylopiiaethiopica* (Dunal) A. Rich. (4.36%) and *Eugenia caryophyllata* Thunb. (4.19%) were the most popular plants used for cough treatment among the plants recorded. Sixteen (16) other pathologies including pulmonary infections are also treated by the species recorded. Abscesses, intestinal parasitic diseases, incurable wounds, stomach aches and headaches are the most pathologies commonly treated by this plant. The whole plant (72%) and the leaves (22%) are the parts most used to treat diseases. Decoction (77.50%) is the main method of preparation, and oral (80.83%) and cutaneous (10.83%) are the main routes of administration. The data of this study constitute a solid ethnopharmacological basis to be used for pharmacological and toxicological studies on this species.

Key words : *Chenopodium ambrosioides*, Cough, Ethnopharmacology, Togo.

INTRODUCTION

Cough is a protective immune response of the respiratory airways to expel or eliminate irritants and mucous. It is the most common symptom for which individuals seek medical advice [1,2]. Cough is the commonest symptom leading patients to consult with their doctor [3]. The epidemiology of cough can be neatly divided into these two diagnostic subgroups: acute cough, which is usually due

to viral respiratory tract infection, and chronic cough, which may be arbitrarily defined as cough lasting longer than eight weeks[3,4]. The common causes of cough may be either of viral, or bacterial or chemical origin that include common cold, chronic bronchitis, rhinitis, sinusitis, asthma, environmental agents smoke, dust, angiotensin converting enzymes inhibitors and synthetic opioid analgesic[5]. Most coughs are acute and self-limiting, secondary to respiratory tract infection, but when cough becomes chronic (8 weeks duration) it can account for up to one third of all referrals to chest physicians [6]. Chronic cough has a major effect on the quality of life, and patients consume substantial healthcare resources, often seeing several specialists over many years. It may prove diagnostically difficult, requiring multiple investigations and treatment trials, with diagnostic success quoted as ranging from 100% in a general respiratory clinic setting to 58% in the specialist cough clinic setting[6,7]. According to World Health Organization 80% of the Asian and African population relies on the medicinal plants for prevention and treatment of various diseases including cough[8,9]. Different communities and ethnic groups use medicinal plants, animal and minerals to treat different diseases. The people of the rural areas used traditional remedies to treat diseases[2]. They use traditional medicines due to i) knowledge from parents with firm belief, ii) knowledge of usage without consulting a physician, and iii) general perception of safety and economy[2]. *Chenopodium ambrosioides*, commonly called Mexican tea, is an aromatic plant belonging to Chenopodiaceae family and is known for its virtues[10]. Some research works have demonstrated that this medicinal plant is widely used by Togolese communities to treat several diseases including the treatment of abscesses, epilepsy, nausea, stomachache, skin infections[10,11]. Some studies showed that *Chenopodium ambrosioides* is used in the cough and respiratory infections management in several Africa countries such as Benin, Ghana, Gabon, Ivory coast, Maroc, Nigeria and Senegal[12–17]. But few studies have documented the endogenous uses of the species in the treatment of respiratory diseases in Togo. According to our literature review, no study on the endogenous knowledge of the uses of Togolese plants and *Chenopodium ambrosioides* in the treatment of cough in Togo is available. This is the main motivation of this study with the aim of documenting the uses of *Chenopodium ambrosioides* in the treatment of different forms of cough by traditional medicine practitioners in Togo. The objective of the study was to document and quantitatively analysed the traditional cough management recipes based on *Chenopodium ambrosioides* and preserve the traditional knowledge of the Togolese community for later uses. This ethnopharmacological study of *Chenopodium ambrosioides* is reported in Togo for the first time to treat cough and respiratory infections.

METHODOLOGY OF THE STUDY

Study Area

Togo is a Western African country surrounded in the North by the Republic of Burkina Faso, in the East by the Republic of Benin, in the West by the Republic of Ghana and in the South by the Atlantic Ocean. Togo has been divided into five economic regions from North to South: Savannah region, Kara region, Central region, Plateaux region, and Maritime region. After the general survey of the population in 2022[18], Togo has an estimated population of 8 095 498 residents including 4 150 988 females (51,3%) with a rate of population growth of 2,3%. Our study area has an estimated population of 2 270 209 residents[18]. According to the organization of the health ministry, Togo has thirty-nine health districts grouped into six health regions such as Savannah, Kara, Central, Plateaux, Maritime and Grand Lome[19]. The present ethnopharmacological study was carried out in six health districts including Golfe, Ave, Yoto, Vo, Ogou and Tchamba (Figure 1). Many languages are spoken in our study area but the most popular are Ewe, Mina, Ife and Tchamba.

Data collection period and data collection forms

The survey was carried out from August 2021 to July 2022, to identify and record ethnopharmacological treatment of cough by traditional healers using *Chenopodium ambrosioides* alone or with other medicinal plants. The study objectives were explained to the healers and the most frequently asked questions were related to the local name of *Chenopodium ambrosioides*, medicinal uses in the cough management, parts used of the plant, the method of preparation, complete ingredients of the recipes, administration route and adverse effects. The data collection forms were prepared and explained to the informants in their local language before the interview.[20–23]

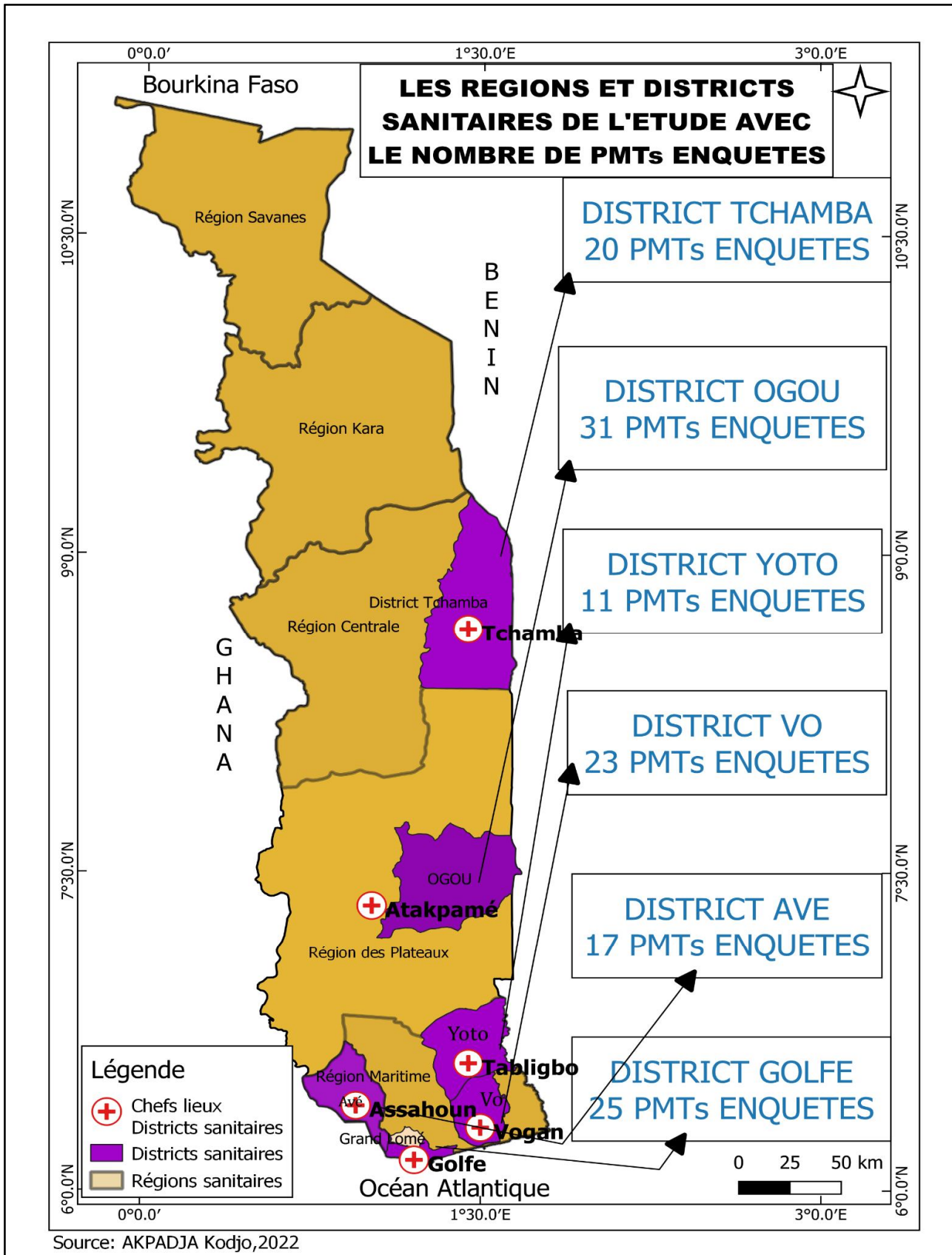


Figure 1: Map of Togo with focus on the survey areas.

Interview technics with the traditional healers

The data was collected through individual interviews following the semi-structured form previously prepared. The approach was in a first time, the group meeting with all the healers of the health district before the individual interview survey [21,24,25]. Conversations with the healers were used to obtain information on the uses of *Chenopodium ambrosioides* in the management of cough and respiratory infections. The healers that consented were asked to give their knowledge about the respiratory diseases they used *Chenopodium ambrosioides* against, the method of preparation of the remedy, details of administration, including the approximate amounts and number of doses per day or week, the composition of the remedy, the adverse effects of the remedy and how to treat these adverse effects. The conversations were built on trust with the common goal to improve the health situation in Togo and to preserve and increase the knowledge on medicinal plants, especially on *Chenopodium ambrosioides*.

Data processing and data analysis

Analytical Flora of Benin [26] and the online database of PROTA4U (www.prota4u.org), were used for the botanical identification of species of plants species collected. An ethnobotanical and ethnopharmacological studies were carried out following the studies of [20,24,27,28]. The local names confirmation was carried out with reference to [26,29], West Africa Monograph Dictionary [30] and to the West African Pharmacopoeia [31]. Data collected was tabulated and Excel 2016 spreadsheet software were used to make simple calculations. The collected data from the survey questionnaire were analyzed using a quantitative method including Use Value (UV) and Frequency of Citation (FC). This method enables us to make a consensus of the plant species which is frequently used to treat cough. FL indicates the percentage of informants who claimed to use plant species for the same purpose regarding diseases' treatment. $FL (\%) = (N_p/N) \times 100$, where N_p indicates the number of the interviewed healers who claimed to use a plant species to treat a particular disease and N indicates the interviewed healers who used herbs as a medicine to cure any disease [24,32]. $FC (\%) = (\text{number of remedies containing the plant} / \text{total of remedies collected}) \times 100$. The Use Value, a quantitative method that demonstrates the relative importance of species known locally, was also calculated as follows: $UV = \sum U/n$, where UV is the Use value of a species, U is the number of citations per species, and n is the number of informants [25].

RESULT AND DISCUSSION

A total of 127 participants was interviewed on average of 10 minutes. All the products of natural origin associated with *Chenopodium ambrosioides* were considered as part of the traditional recipes that were used to treat cough and respiratory diseases

Characteristics of Traditional Healers

Of the 127 traditional healers surveyed, 96 were men (76%) and 31 were women (24%). Most of them (89%) inherited the profession of “traditional healer” from their parents. This finding is in agreement with that of Dahounom et al., 2023 in Togo [33] and Umair et al., 2017 in Pakistan [34]. Sixty-two percent (62%) of the respondents claimed to have been practicing for 11–50 years (Table 1) with the majority (89%) having acquired the knowledge through ancestral inheritance. These findings are similar to those of Orch et al., 2020 in Morocco[35]and Odebunmi et al., 2022 in Nigeria[36].This profession requires a long experience for the practitioner to be able to identify plants for effective management of diseases. Traditional religion (53%) and Christianity (33%) were the predominant religions of the respondents. About 37% of the healers were in the age between 18 and 40 years, 54% between 41 and 70 years, and 09% between 70 and 105 years (Table 1).This age distribution confirms the findings in Togo [37] and is similar to the findings in Cameroon[38] where a significant dominance of elder or very aged healers was documented. It suggests that the profession of traditional healers was mainly done by elders. About healers' education level, 15% held a university degree, 38% attended high and middle school, 30% attended primary school, and 17% were illiterate (Table 1. This finding is in agreement with that of Odebunmi et., 2022 in Nigeria [36]

Table 1. Sociodemographic data of the respondents

Parameters	Respondents N(%)
Gender	
Male	96 (76%)
Female	31 (24%)
Age range (Years)	
[18-40]	47 (37%)
[41-70]	69 (54%)
71 and above	11 (9%)
Educational level	
Illiterate	22 (17%)
Primary	38 (30%)
Secondary	48 (38%)
University	19 (15%)
Ethnic group	

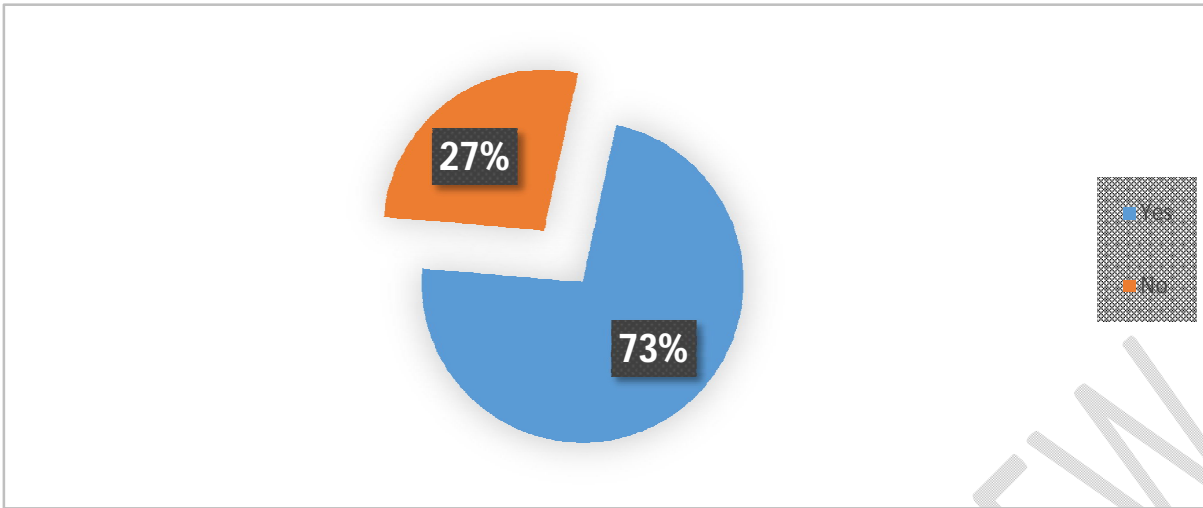
Ewe	81 (64%)
Ifè	18 (14%)
Tchamba	13 (10%)
Kabyè	05 (4%)
Others*	10 (8%)
Religion group	
Endogenous religion	67 (53%)
Christianism	42 (33%)
Muslim	17 (13%)
Buddism	01 (1%)
Origin of the knowledge	
Familial inheritance	113 (89%)
Initiation from traditional healers	12 (9%)
Divine revelation	02 (2%)
Period of practice (Years)	
[0-10]	44 (35%)
[11-50]	79 (62%)
51 and above	04 (3%)

*Kotocoli (2%), Fon (2%), Nawoudba (2%), Anyanga (1%) et Moba (1%)

***Chenopodium ambrosioides* and cough treatment in the study area**

Cough being a symptom associated with several diseases, especially respiratory diseases, it remains the most common pathology in our communities. For the cough treatment, our communities mainly use medicinal plants including *Chenopodiaceae* genus. In our study, 73% of traditional healers claim used *Chenopodium ambrosioides* to treat cough (Figure 2). Similarly, various authors have carried out the ethnobotanical studies in different countries and they reported *Chenopodium ambrosioides* for cough management [17,38–43]. Cough is a global issue so various traditional remedies have been reported by different communities. Some of the plants like *Abrus precatorius* Linn.; *Ocimum gratissimum* Linn.; *Zingiber officinale* Rosc. Trans. Linn.; *Mangifera indica* Linn.; *Eucalyptus citriodora* Hooker; *Xylopiya aethiopica* (Dunal) A. Rich. and *Eugenia caryophyllata* have also been reported in our study for the treatment of cough. This result is in agreement with the study carry out in Nigeria by Adesina et al., 2017 [40]. Similarly, various authors have carried out the ethnobotanical studies in different areas and they reported those species of plants for treating cough [17,36,43,44]. Our recent study corroborated the reported cough suppressive effect of *Chenopodium ambrosioides* L. [17]. This study with traditional practitioners revealed a varied use of *Chenopodium ambrosioides*, often in the form of decoctions, infusions or inhalations, to relieve cough symptoms. These practices are rooted in ancestral traditions that transmit not only knowledge about medicinal plants, but also cultural and social practices that shape the perception and application of treatments.

Others pathologies treated by *Chenopodium ambrosioides* L. in the study area



addition to its use to treat different forms of cough, participants in this study reported that *Chenopodium ambrosioides* L. is also used to treat 16 other pathologies including abscesses, intestinal parasitic diseases, incurable wounds, stomach-aches, headaches, dermatosis, angina and lung infections (Figure 3). This result is in agreement with other studies carried out in Togo by Tettegah et al., 2009 and Ouadja et al., 2021[11,25], in Nigeria by Adesina et al., 2017[40], in Benin by Alitonou et al., 2012 [15], in Morocco by Orch et al., 2020 [35] then in South Korea by Lee et al., 2023[45]

Figure 2: *Chenopodium ambrosioides* and cough treatment in the study area

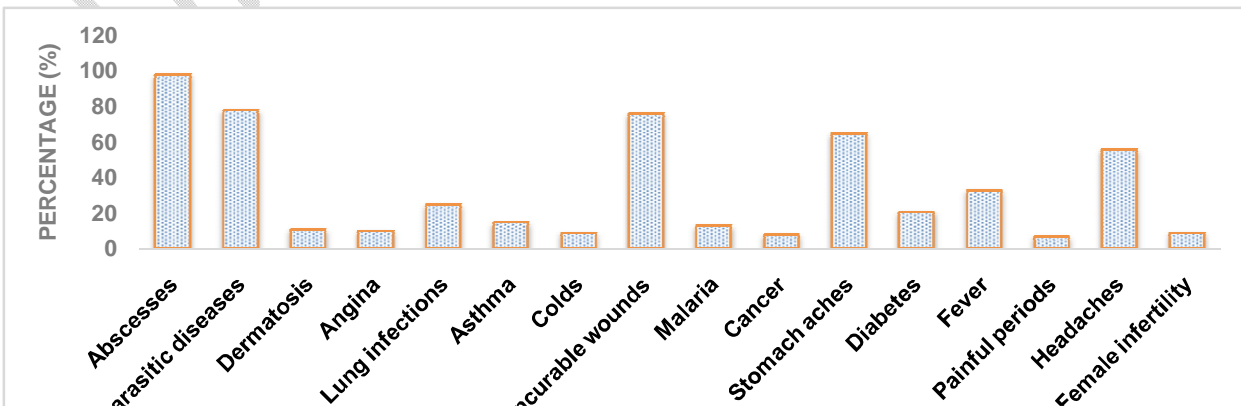
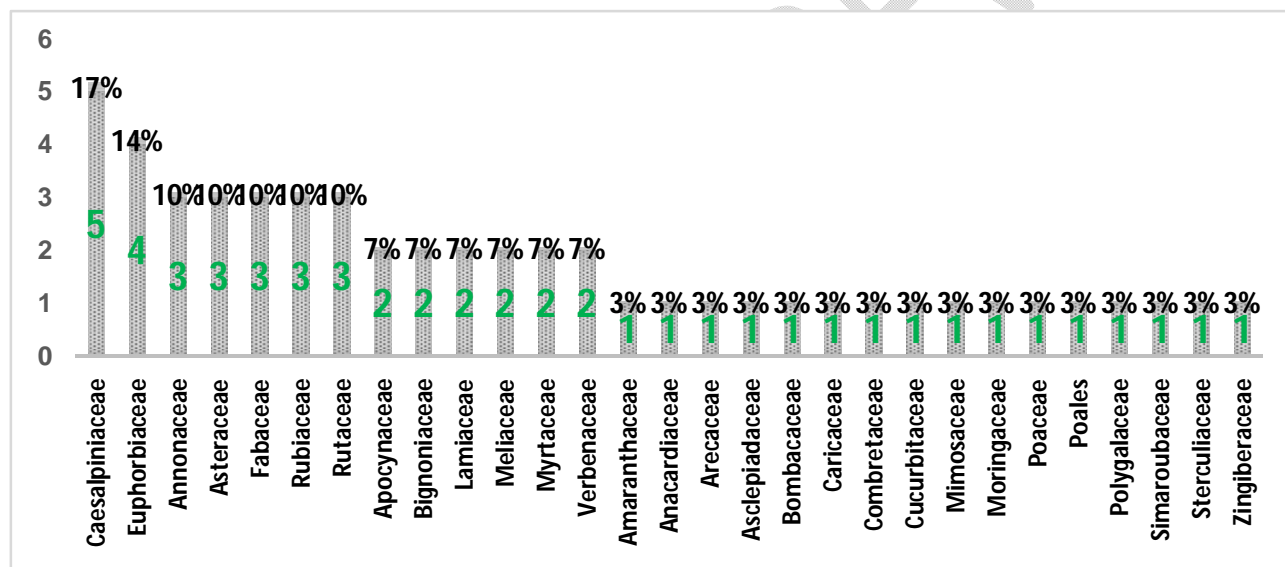


Figure 3: Others pathologies treated by *Chenopodium ambrosioides* in the study area

Botanical diversity and ethnobotanical indices of plants used in the treatment of cough associated with respiratory diseases

UNDER PEER REVIEW

Despite the relative high number of plants utilised for cough purpose, their ethnobotanical indices including FC (1-13%) and UV (0.03-0.64) were generally low (Table2). In the study area, *Abrus precatorius* Linn. (13.59%) followed by *Ocimum gratissimum* Linn. (11.58%), *Zingiber officinale* Rosc. Trans. Linn. (9.73%), *Mangifera indica* Linn. (6.21%), *Eucalyptus citriodora* Hooker (4.87%), *Xylopi aethiopica* (Dunal) A. Rich. (4.36%) and *Eugenia caryophyllata* Thunb. (4.19%) were the most popular plants used for cough treatment among the plants recorded. Locally known as “dzindzinkoudze (ewe) or vivima (ewe) or bibignakou (Tchamba)”, *Abrus precatorius* (Linn.) has long been regarded as a potent remedy for relieving cough among the Togolese population [25,32,37]. Member of the genus *Abrus* are known to often be used for diverse ailments including respiratory diseases in Africa [43,46,47] and in Togo [37]. The alkaloidal constituents, which are often characteristic of the family Fabaceae including the genus *Abrus*, are known to significantly contribute to their diverse medicinal attributes [48]. In total 52 medicinal plant species belonging to 29 families were documented (Table 2). Caesalpiniaceae (5 species) and

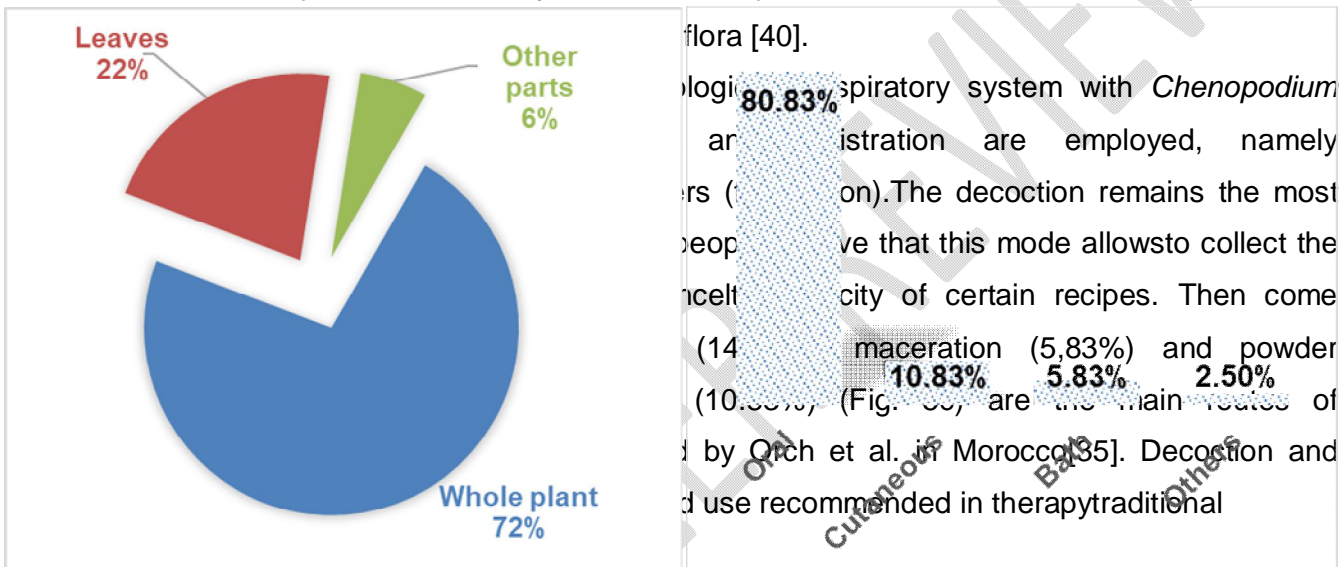


Euphorbiaceae (4 species) were the most dominant families, followed by Annonaceae, Asteraceae, Fabaceae, Rubiaceae and Rutaceae (3 species each) while other families were represented by one species only (Figure 4). The utilization of medicinal plant species belonging to Caesalpiniaceae, Euphorbiaceae, Annonaceae, Asteraceae and Fabaceae families was in agreement with ethnomedicinal flora reported from other parts of Togo and in other areas of the world [2,28,33,48–51]. This may be due to their wide distribution of plant species and their traditional uses known by the indigenous communities living in different parts of the world. Moreover, in a systematic review conducted by Lee et al., [45] in South Korea in 2023 on medicinal plants used to treat chronic cough, the most cited species (*Glycyrrhiza glabra*) with 61 citations is part of the Fabaceae family. This confirms the use of species from the main families listed in this study in the treatment of respiratory diseases including cough.

Figure 4: Families of medicinal plant species used to treat and manage cough in the study area

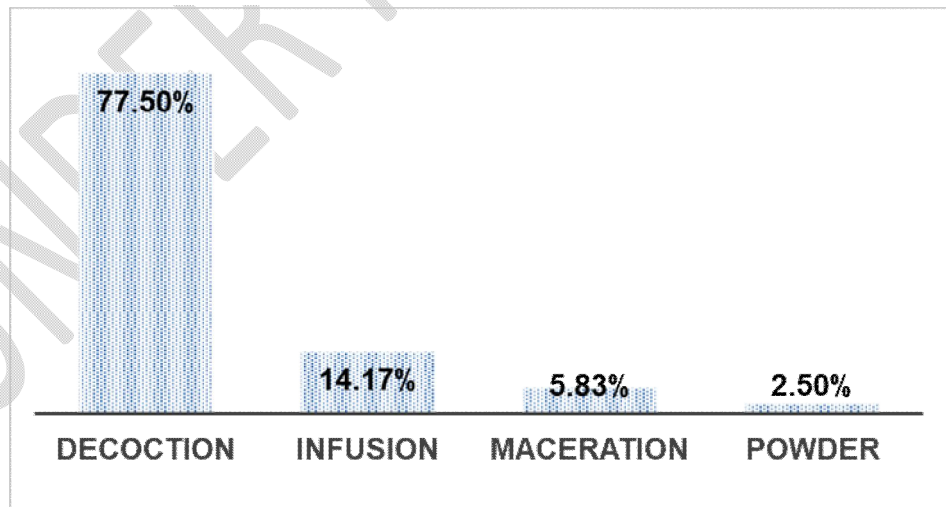
Plant parts, mode of preparation and rout of administration

Even though all plant parts are significant in the treatment of different ailments; nevertheless, in the present study as shown in Figure 5a, whole plant were the most commonly utilized part of *Chenopodium ambrosioides* with 72% application in traditional medicinal recipes, followed by leaves (22%) and others (root, seed, flower) with 5% application. Tettegah et al., 2009 and Ouadja et al., 2021 reported whole plants and leaves as commonly utilized plant part in herbal medicine used by the population of Togo [11,25]. However, it has been reported that the use of leaves is better for the survival of medicinal plants collected by herbalists compared to the collection of whole plant, roots



a) Plant parts used

b) Mode of preparation



c) rout of administration

Figure 5: a) Plant parts; b) Mode of preparation; c) Rout of administration

Table 2: Medicinal plants used for the management of cough in Togo

Vernacular names	Species	Families	Citation	FC*(%)	UV*
Dzedzinkoudzen (ewe), Bibignakou (Tchamba)	<i>Abrus precatorius</i> Linn.	Fabaceae	81	13,59%	0,64
Dzogbeti (ewe)	<i>Ocimum gratissimum</i> Linn.	Lamiaceae	69	11,58%	0,54
Dotè (ewe)	<i>Zingiber officinale</i> Rosc. Trans. Linn.	Zingiberaceae	58	9,73%	0,46
Mangoti (ewe)	<i>Mangifera indica</i> Linn.	Anacardiaceae	37	6,21%	0,29
Ekalypti (ewe)	<i>Eucalyptus citriodora</i> Hooker	Myrtaceae	29	4,87%	0,23
Etso (ewe); Ekamanté (Tchamba)	<i>Xylopia aethiopica</i> (Dunal) A. Rich.	Annonaceae	26	4,36%	0,20
Plingota (ewe)	<i>Eugenia caryophyllata</i> Thunb.	Myrtaceae	25	4,19%	0,20
Zanguarati (ewe)	<i>Cassia siamea</i> Linn.	Caesalpiniaeeae	19	3,19%	0,15
Zokon (mina)	<i>Indigofera pulchra</i> Willd.	Fabaceae	18	3,02%	0,14
Exeti (ewe)	<i>Zanthoxylum xanthoxyloides</i> Lam.	Rutaceae	17	2,85%	0,13
Nyimon (ewe)	<i>Sarcocephalus latifolius</i>	Rubiaceae	17	2,85%	0,13
Donti (ewe)	<i>Citrus sinensis</i>	Rutaceae	16	2,68%	0,13
Kpatima (ewe)	<i>Newbouldia laevis</i> Seem.	Bignoniaceae	14	2,35%	0,11
Tsaka-tsaka (ewe)	<i>Securinegavivosa</i> (Reyb.) Baill.	Euphorbiaceae	13	2,18%	0,10
Yovovigbe (ewe)	<i>Moringa oleifera</i> Linn.	Moringaceae	11	1,85%	0,09
Ahamè (ewe)	<i>Ocimum canum</i> Sams	Lamiaceae	9	1,51%	0,07
Aloma (ewe)	<i>Vernonia colorata</i> (Willd.) Drake Bull.	Asteraceae	9	1,51%	0,07
Mahougen (ewe)	<i>Khaya senegalensis</i> (Desr.)	Meliaceae	9	1,51%	0,07

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Avlokouigbe (ewe)	<i>Pleiocarpa pycnantha</i> (K. Sch.) Stapf.	Apocynaceae	8	1,34%	0,06
Ehlinvi (ewe)	<i>Phyllanthus amarus</i> Sch. et Th.	Euphorbiaceae	7	1,17%	0,06
Ewoti (ewe); Boudo (Tchamba)	<i>Parkia biglobosa</i> (Jacq.) Benth.	Mimosaceae	7	1,17%	0,06
Kiniti (ewe)	<i>Azadirachta indica</i> Linn.	Meliaceae	7	1,17%	0,06
Yovoninti (ewe)	<i>Cocos nucifera</i> Linn.	Arecaceae	7	1,17%	0,06
Akamati (ewe)	<i>Bridelia ferruginea</i> Benth.	Euphorbiaceae	6	1,01%	0,05
Damelatsu'nko (ewe); Efoulandikonkon (tchamba)	<i>Acanthospermum hispidum</i> (DC).	Asteraceae	6	1,01%	0,05
Pamplemousse	<i>Citrus Lemon</i>	Rutaceae	6	1,01%	0,05
Adako (ewe)	<i>Sorghum caudatum</i> Linn. var. colorans	Poales	5	0,84%	0,04
Anonsikan (ewe)	<i>Euphorbia hirta</i> Linn.	Euphorbiaceae	5	0,84%	0,04
Fefeti (ewe)	<i>Gardenia ternifolia</i> Sch. et Th.	Rubiaceae	5	0,84%	0,04
Hédjati (ewe)	<i>Harrisonia abyssinica</i>	Simaroubaceae	5	0,84%	0,04
Hehetsi (ewe)	<i>Anogeissus leiocarpus</i> Guill. et Pers.	Combretaceae	5	0,84%	0,04
Tsigbe (ewe)	<i>Cymbopogon citratus</i> Stapf.	Poaceae	5	0,84%	0,04
Ekloti (ewe)	<i>Piliostigma thonningii</i> (Sch.) Miln. Redh.	Caesalpiniaceae	4	0,67%	0,03
Fonti (ewe)	<i>Vitex doniana</i> Sweet	Verbenaceae	4	0,67%	0,03
Azingbe (ewe)	<i>Cassia rotundifolia</i> Linn.	Caesalpiniaceae	3	0,50%	0,02
Etritou (ewe), Forze (tchamba)	<i>Securidacalongo pedunculata</i> Fres.	Polygalaceae	3	0,50%	0,02
Adikouti (ewe)	<i>Caesalpinia bonduc</i> Roxb.	Caesalpiniaceae	2	0,34%	0,02
Alangbati (ewe), Ditori (tchamba)	<i>Adansonia digitata</i> Linn.	Bombacaceae	2	0,34%	0,02
Avakofé (mina), Faux kinkeliba	<i>Cassia occidentalis</i> Linn.	Caesalpiniaceae	2	0,34%	0,02
Somboegbé (ewe)	<i>Cleome viscosa</i> Linn.	Cucurbitaceae	2	0,34%	0,02
Tèckti (ewe)	<i>Tectona grandis</i> Linn.	Verbenaceae	2	0,34%	0,02
Adoubati (ewe)	<i>Carica papaya</i> Linn.	Caricaceae	1	0,17%	0,01
Agbanlan (mina)	<i>Uvariachamae</i> P. Beauv.	Annonaceae	1	0,17%	0,01
Agnigli (ewe); Choechoere (Tchamba)	<i>Annona senegalensis</i> Pers.	Annonaceae	1	0,17%	0,01
Assiviatoe (ewe)	<i>Cola millenii</i> K. Schum.	Sterculiaceae	1	0,17%	0,01
Gbolobavi (ewe)	<i>Calotropis procera</i> (Ait.) Ait.	Asclepiadaceae	1	0,17%	0,01

Gnakpekpe (ewe)	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	1	0,17%	0,01
Nawa (Kotocoli)	<i>Vernonia guineensis</i>	Asteraceae	1	0,17%	0,01
Nyamidua (Ashanti)	<i>Alstonia boonei</i> De Wild.	Apocynaceae	1	0,17%	0,01
Papatahé (ewe)	<i>Gomphrena celosioides</i> Mart.	Amaranthaceae	1	0,17%	0,01
Sifafa (ewe)	<i>Pavetta corymbosa</i> (DC) F.N. Will.	Rubiaceae	1	0,17%	0,01
Vénaviwogbe (ewe)	<i>Uraria picta</i> (Jacq.) DC	Fabaceae	1	0,17%	0,01

*FC = Frequency; *UV = Use Value

Conclusion

This ethnopharmacological survey on cough in the four regions of Togo revealed that traditional healers had an endogenous understanding of cough associated with the respiratory diseases. The present study documented anticough medicinal plant species. As the emergence of resistance of microorganisms that can cause cough such as *Streptococcus pneumoniae* and *Mycobacterium tuberculosis* to antibiotics is a deep concern, Togolese flora must be explored for new bioactive anticough drugs. The commonly recommended strategy in the discovery of drugs is to evaluate plant extracts in vitro and in vivo to confirm their therapeutic potential. Keeping this in mind, our ethnopharmacological survey is the first step before confirmation in vitro and in vivo. Some studies are in progress to validate the antioxidant, antimicrobial, and antitussive effects of *Chenopodium ambrosioides* associated with some species documented in this study.

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