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Ethnobotanical survey of the adverse and toxic effects of medicinal plants used in Guinean traditional medicine

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Abstract
This study aimed to identify undesirable and toxic effects of plants used in Guinean traditional medicine.
Materials and Methods: We surveyed 131 traditional practitioners in 2 prefectures of Guinea about their knowledge and experience with adverse or toxic events associated with the medicinal or non-medicinal use of plants, collecting samples of these plants for botanical analysis.
Results: Ethnobotanically, 54 species from 33 botanical families were identified. The main species identified as having adverse or toxic effects were *Erythrophleum suaveolens*, *Dichapetalum toxicarium*, *Mucuna pruriens*, *Datura metel*, *Anthostema senegalense*, *Gardenia erubescens*, *Detarium senegalense* and *Strophanthus hispidus*.
Conclusion: This work provides a basis for identifying and establishing a database on the toxicity of plants used for medicinal and non-medicinal purposes in Guinea.

Keywords: ethnobotany, Guinea, phytovigilance, toxic effects, traditional healers

Introduction
Medicinal plants occupy an important place in disease management in developing countries, such as the Republic of Guinea whose geographical and climatic characteristics provide a rich and varied flora [1]. Ethnobotanical surveys across Guinea have shown the wide use of plants to manage diseases, such as malaria, diabetes and hypertension [2-4].
Popular beliefs that plants are a natural means of treatment with few side effects and other socio-cultural reasons underlie their medicinal use [5, 6]. But medicinal plants are pharmacologically active and can thus be responsible for dangerous, even fatal, side effects [7, 8]. Their use therefore requires continuous vigilance. Patients in Guinea rarely report undesirable effects, however, so they are poorly documented and under-researched. Indeed, Guinea has no poison control center or phytovigilance strategy, which may explain the lack of research. But with their ancestral knowledge of ethno-medical uses of plants and, sometimes, precautions for such use as well, traditional medicine practitioners are an essential link in the recognition of adverse and toxic effects.

Study aim
We initiated this survey of traditional therapists in order to develop a list of medicinal plants' undesirable and toxic effects as a step toward setting up a database for phytovigilance in Guinea.

Materials and methods
Study area and population
The Republic of Guinea in West Africa is divided into four natural regions: Lower Guinea, Middle Guinea, Upper Guinea, and Forest Guinea. We conducted the survey in Lower Guinea in the prefectures of Fria and Coyah. Our sampling frame in Fria encompassed the sub-prefectures of Tormelin and Baguinet, along with Fria Centre. In Coyah the survey took place in Coyah Centre and the sub-prefecture of Wankifong (Figure 1). We recruited traditional healers and herbalists who used plants to treat illness. They included both men and women who were 18 years and older.

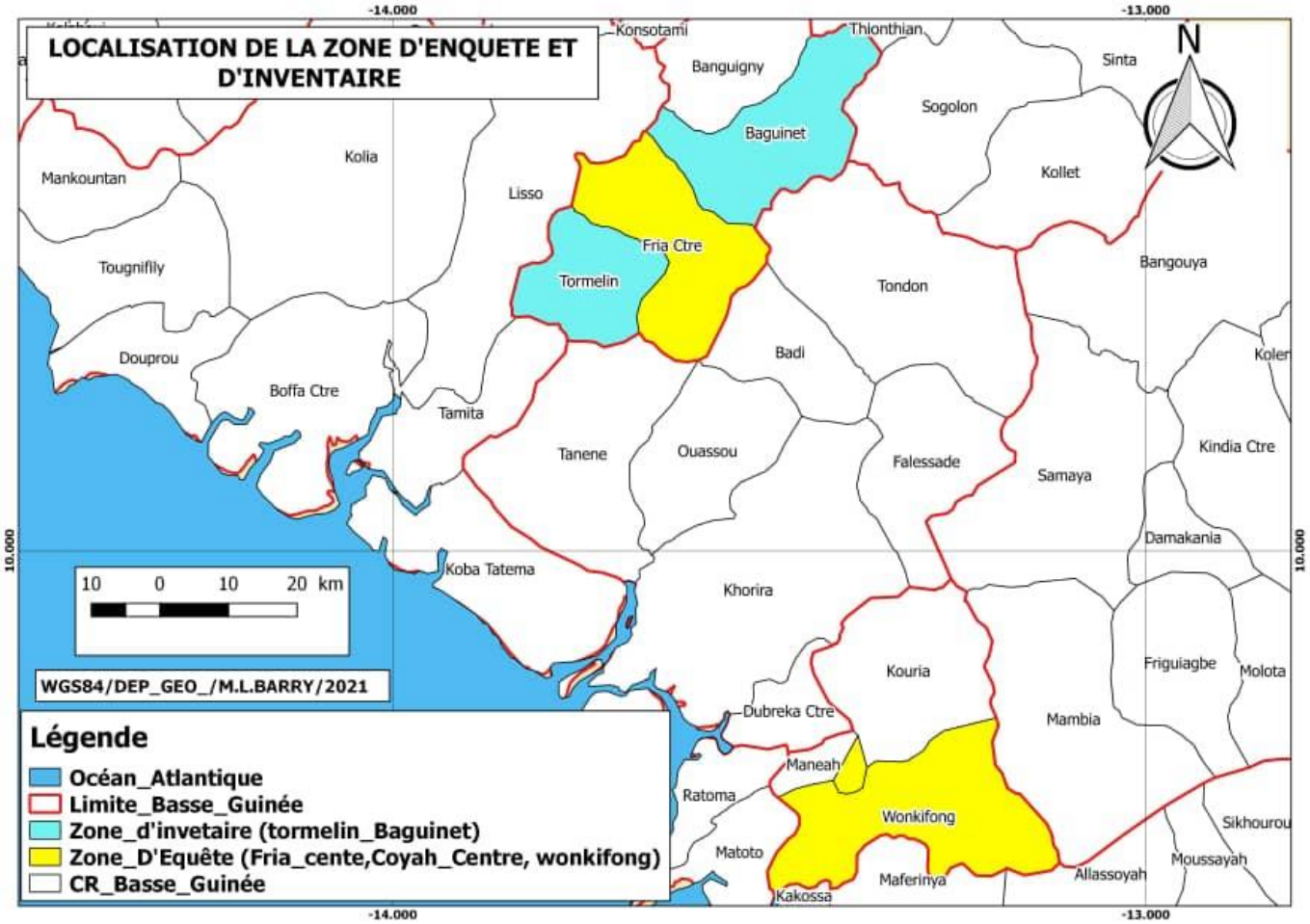

Fig 1: Map of the study area

Data collection and analysis

We interviewed the healers and herbalists individually using a questionnaire that focused on three main areas of their practice: 1) general information about the individual, such as age, mode of acquiring traditional knowledge, number of years of experience; 2) the local names of the plants they used, the parts used and the method of use; and 3) information about the disease treated by a particular plant and manifestations of toxic effects. The herbalists provided samples of the plants they identified and we accompanied healers to collect other samples. Botanists at the National Herbarium of Guinea and the "Institut de Recherche et Développement des Plantes Médicinales et Alimentaires de Guinée (IRDPMAG)" then identified the species of these samples and we carried out a complete bibliographic review of the collected plants via scientific databases of international peer-reviewed journals (Scifinder, PubMed, Web of Science), Our search terms were individual species names as well as the combination of species names with "toxicological activity" or "toxicity" or "pharmacological activity" or "chemical composition."

Taxonomy and denominations were validated using the database of world flora accessed via http://www.worldfloraonline.org/.

We estimated the percentage of respondents with knowledge (PRK) regarding the toxic effect of plant species using the formula: number of people interviewed citing toxic effect of plant (FC)/total number of interviewed people (N) ×100. To calculate the relative frequency of citation (RFC), we used the standard method of Vitalini *et al.* [9] (RFC=FC/N).

Ethical considerations

Approval of the internal Ethics Committee of IRDPMAG-Dubréka was obtained before starting the study.

The data were collected with the free and informed consent of the traditional healers and herbalists who voluntarily agreed to participate in the study.

Results and discussion

This is the first investigation of Guinean traditional healers' perceptions of risks associated with the use of medicinal plants.

Table 1: Socio-demographic characteristics of the traditional healers and herbalists

Variable	Number	Percentage
Location		
Fria	107	81.7
Coyah	24	18.3
Status		
Healers	116	88.5
Herbalists	15	11.5
Gender		
Male	54	41.2
Female	77	58.8
Age range (years)		
24 è33	16	12.7
34 – 43	32	24.4
44 -53	41	31.3
54-63	24	18.3
≥64	18	13.7
Education level		
None	123	93.9
Primary	2	1.5
Secondary	4	3.1
Higher	2	1.5
Mode of acquisition of knowledge		
Family heritage	117	89.3
Apprenticeship	8	6.1
revelation	6	4.6

We surveyed 131 traditional healers (107 in the Fria prefecture and 24 in Coyah prefecture (Table 1). Over half (58.8%) the sample were women, which indicates women's leading role in traditional disease management in Lower Guinea. This contrasts with previous findings[2] in other regions of Guinea where the role was primarily male (54.65%).

The majority (55%) of the participants were between the ages of 34 and 54 years, a trend that may reflect attachment to ancestral culture for some and/or for others, the search for immediate income.

Almost all (93.9%) the interviewees had no formal education, although a few were university graduates (1.5%). Most (89.3%) had acquired their knowledge through family heritage, reflecting the African tradition of transmitting knowledge orally from generation to generation, which is much simpler and easier to carry out within the family circle. Lack of schooling among traditional healers has similarly been found in Ivory Coast [10] in Togo [11] and in Mali [12].

This low education level could limit traditional healers' documenting their observations of adverse events.

Healers' knowledge and experience

Healers' notions of plant toxicity came from teachers or through professional experience. Their definition for toxicity in the Soussou language is "sé na khan mikhi törö ma," which literally translates as "that which tires" or "that which causes harm." They attributed the causes of intoxication to inappropriate dosage or mode of administration (46%; n = 60), or non-compliance with precautions (53.43%; n = 70) or by lack of experience and knowledge of plants (20.61%; n = 27). The traditional healers' approach to preventing toxicities was by controlling the mode of administration. For example, plants that are orally toxic are used as baths, fumigations or brushes, while those with local toxic effects are prepared by decoction and then administered orally.

One-fourth of the traditional healers (24.42%; n = 32) reported giving antidote treatments if patients came back to them and reported adverse effects; only 42% (n = 55) indicated they referred serious cases of intoxication to a hospital facility for management.

Ethnobotanical findings

Fifty-four (54) species were ethnobotanically identified, belonging to 33 botanical families (see Table 2). The botanical families most represented were Fabaceae (8 species), Rubiaceae (6 species), Poaceae and Moraceae, each represented by 3 species.

The main species identified as having adverse or toxic effects were: *Erythrophleum suaveolens (FC= 36, PRK=* 27.50*%), Dichapetalum Toxicarium (FC= 26, PRK= 20%), Mucuna pruriens (FC= 11, PRK= 8.40%), Datura metel* (*FC= 9, PRK=* 7.00*%), Anthostema senegalense (FC= 8, PRK=* 6.11*%), Gardenia erubescens (FC= 8, PRK=* 6.11*%), Detarium senegalense (FC= 6, PRK=* 4.60*%) and Strophanthus hispidus* DC *(FC= 5, PRK= 4.00%).*

Table 2: Plants with undesirable and toxic effects reported by traditional therapists in Lower Guinea

Botanical Family (Number of Species)	Botanical Name	Herbarium Number	Local Name	Toxic Parts	Adverse or Toxic Manifestations	Parts used in Traditional Medicine	Preparation	Mode of Use	Indication	FC	PRK	Toxicological Review
Anacardiaceae (1)	*Anacardium occidentale* L.	D3HK9	Koussou (s) Yalagué (p) Somon (M)	Sap	Irritation, Ulceration	Bark, leaves	Maceration, decoction	Oral	Hypertension, Diabetes	1	0.76	[31]
Apocynaceae (1)	*Holarrhena floribunda* G.Don) T.Durand&Schinz.	D7HK10	Kamouyètè (s) Indamma (p) Kesagba (M)	Leaves	Diarrhea	Leaves	Decoction	Oral	Malaria	1	0.76	[35]
Bignoniaceae (1)	*Markhamia tomentosa* (Benth.) K. Schum.	D18HK7	Billikérégni (s) Kafawadhou(p)	Leaves	Diarrhea	Leaves	Crushed	Decoction Maceration	Malaria, Sexual impotence	3	2.30	[32]
Celastraceae (1)	*Salacia sp.*	D32HK15	Forontongni (s)	Leaves	Delirium	Leaves	Maceration	Bath	Pain	5	4.00	
Chrysobalanaceae (1)	*Neocarya macrophylla* (Sabine). Prance.	D33HK9	Bansouma (s)	Leaves	Digestive Hemorrhage	Not used	Not used	Not used	Not used	1	0.76	
Combretaceae (3)	*Combretum nigricans* (Engl. & Diels)	D36HK8	Foubécine (s) Sembabali (M) Dhoki(P)	Leaves	Abdominal pain	Leaves	Decoction	Oral	Jaundice, Malaria	1	0.76	
	Terminalia ivorensis B. Chev.	D36HK12	Woly(s) Bori(p) Walissa (M)	Leaves	Diarrhea	Leaves	Decoction	Oral	Jaundice, Malaria	2	1.53	
	Terminalia albida Sc. Elliot.	D36HK5	Ouolo ninbhé(M); Bori billel (p); Koberafighè (s)	Roots	Abdominal pain	Roots	Decoction	Oral	Malaria	1	0.76	[36]
Commelinaceae (1)	*Palisota hirsuta* (Thunb.) K. Schum.	D147HK1	Siikhimbi (s)	Leaves	Diarrhea	Leaves, stem	Crushed	Brushing, Bath	skin condition	2	1.53	
Compositeae (1)	*Vernonia nigritiana* Oliv. &Hiern.	D177HK1	Khonikhonigni (s)	Leaves, Bark	Diarrhea	Not used	Not used	Not used	Not used	5	4.00	
Connaraceae (1)	*Manotes expansa* Sol ex. Planch.	D37HK3	Sakiri (s)	Leaves	Diarrhea	Leaves	Decoction	Bath	Skin conditions	1	0.76	
Cucurbitaceae (1)	*Raphidiocystis sp*	D40HK2	Gnamouléngni(s)	Whole plant	Itching, Vomiting	Leaves	Decoction, Powder	Bath, Brushing	Skin conditions	2	1.53	
Dichapetalaceae (1)	*Dichapetalum Toxicarium* (G.Don) Baill.	D42HK1	Maimai (s)	Leaves, Bark, Whole plant	Diarrhea, Vomiting, Delirum, Death	Not used	Not used	Not used	Not used	26	20.00	
Dilleniacea (1)	*Tetracera potatoria* Afzel. ex G.Don.	D42HK4	Ninntai(s)	Roots	Abdominal pain	Roots	Decoction	Oral	Respiratory problems	1	0.76	
Euphorbiaceae (2)	*Bridelia micrantha* (Hochst.) Baill.	D50HK7	Tolingni(s) Daafi (p) Daafinsagba (p)	Roots, Leaves	Diarrhea	Roots, Leaves	Decoction, Crushed	Oral, Brushing	Internal hemorrhoid, Inflammation, Constipation	3	2.30	
	Anthostema senegalense A. Juss.	D50HK3	Wannigni(s)	Sap	Blindness	Bark	Decoction, Maceration	Oral	Constipation, Skin conditions	8	6.11	
Ebenaceae (1)	*Diospyros heudelotii* Hiern.	D46HK1	Moulaifou (s)	Leaves	Irritation	Leaves	Decoction	Fumigation, Local application	Inflammation	1	0.76	
Gentianaceae (2)	*Anthocleista procera* Lepr.	D54HK3	Dissaa (s)	Leaves	Vomiting	Not used	Not used	Not used	Not used	1	0.76	
	Strophanthus hispidus DC.	D54HK4	Kindé	Leaves	Dizziness, death	Root	Decoction	Drink	Deworming	5	4.00	[37]
Ixonanthaceae (1)	*Phyllocosmus africanus* (Hook.f.) Klotzsch.	D54HK1	Marantangni(s)	Leaves	Diarrhea, delirium	Not used	Not used	Not used	Not used	1	0.76	
Lauraceae (1)	*Cassytha filiformis* L.	D67HK4	Donmai sa yèlè(s)	Whole plant	Diarrhea	Whole plant	Decoction	Bath	Dermatoses	2	1.53	
Lecythidaceae (1)	*Napoleonaea leonensis* Hutch. & Dalziel	D68HK2	Khoumbaböya (s)	Leaves	Irritation	Leaves	Decoction	Bath	Dermatoses	4	3.05	

Fabaceae (8)	*Lonchocarpus Cyanescens (*Schumach. &Thonn) Benth.	D51HK13	Guarai(s)	Roots	Death, abortion	Leaves	Not used	Not used	Not used	1	0.76	
	Mucuna pruriens (L.) DC.	D51HK14	Bagui(s)	Whole plant	Icthing, irritation	Seed	Maceration, Decoction	Oral	Snake bites	11	8.40	
	Parkia bicolor A. Chev.	D51HK15	Koulé néri (s)	Leaves	Diarrhea	Bark	Powder	Brushing	Wound	1	0.76	
	Albizia adianthifolia (Schumach.) W.Wight.	D51HK16	Wassa(s)	Leaves	Diarrhea	Leaves	Maceration	Bath	Protection against evil spells	1	0.76	
	Dialium pobeguinii Pellegr.	D51HK17	Mokai tamba(s)	Leaves	Abdominal pain	Leaves	Maceration	Bath	Convulsion	1	0.76	
	Detarium senegalense J.F.Gmel.	D51HK18	Bôtô (var toxique) (s) Selon le tradipraticien	Whole plant	Abdominal pain, death	Fruit	Calcination	Massage	Cracked heel	6	4.60	
	Erythrophleum suaveolens. (Guill. &Perr.) Brenan	D51HK19	Meli (s)	Whole plant	Diarrhea, delirium, vomiting, dizziness, digestive hemorrhage, death, abortion	Bark, leaves, root	Decoction	Bath, Brushing	Foot ache, Skin conditions	36	27.50	[15]
	Eriosema glomeratum (Guill. &Perr.) Hook.f.	D51HK20	Ségueri ningni (s)	Leaves	Diarrhea	Leaves	Crushed	Brushing	Inflammation	4	3.05	
Loganiaceae (1)	*Strychnos spinosa* Lam.	D73HK2	Gningaira kolingni (s)	Leaves	Death	Leaves	Powder	Inhalation	Sinusitis	2	1.53	[38]
Malvaceae (1)	*Hibiscus sterculiifolius* (Guill. &Perr.) Steud.	D77HK3	Loutii (s)	Whole plant	Death	Not used	Not used	Not used	Not used	1	0 .76	
Meliaceae(1)	*Carapa procera* DC.	D80HK4	Goby (s)	Leaves	Death	Root, bark	Crushed, Decoction	Bath	Rheumatic fever	4	3.05	[39]
Moraceae (3)	*Ficus exasperata* Vahl.	D86HK9	Gnongni (s)	Whole plant	Itching (corrosive to the skin)	Leaves	Decoction	Oral	Intestinal parasites	1	0.76	[40]
	Milicia excelsa (Welw.) C. C. Berg.	D86HK10	Simmai (s)	Leaves, Roots	Bloating, diarrhea	Leaves, root	Decoction, Maceration, Crushed	Bath, Brushing	Protection against evil spells, Inflammation, Headache.	4	3.05	[30]
	Ficus ovata Vahl.	D86HK11	Sokii (s)	Leaves	Diarrhea	Leaves	Crushed	Brushing	Wound	1	0.76	
Myrtaceae (1)	*Uromyrtus baumanii* (Guillaumin) N.Snow & Guymer	D90HK10	Kouroukaré (s)	Leaves	Vomiting	Leaves	Decoction	Cutaneous route	Skin conditions	1	0.76	
Plantaginaceae (1)	*Scoparia dulcis* L.	D175HK1	Céréré (s)	Leaves	Diarrhea	Leaves	Decoction, Maceration, Crushed	Bath, Brushing	Bad luck, Protection against evil spells, Bowed leg, inflammation	4	3.05	[41]
Phyllanthaceae (1)	*Hymenocardia acida* Tul.	D176HK4	Barambaran(s)	Roots	Abdominal pain	Root	Maceration, Powder	Oral	Aphrodisiac	1	0.76	[42]
Poaceae (3)	*Imperata cylindrica (*L.) P. Beauv.	D162HK2	Solongni	Whole plant	Bloating	Whole plant	Decoction	Oral	Undernutrition	1	0.76	[43]
	Oryza sativa L.	D162HK3	Malé (s) Maro(p) Malo (M)	Rhizomes	Death	Not used	Not used	Not used	Not used	1	0.76	[44]
	Eleusine indica L.	D162HK4	Tinguiringni (s)	Leaves	Death	Not used	Not used	Not used	Not used	1	0.76	
Rubiaceae (6)	Canthium venosum *(Oliv.) Hiern*	D117HK12	Dakka (p)	Leaves	Dizziness, headache, death	Not used	Not used	Not used	Not used	2	1.53	
	Morinda geminata DC.	D117HK13	Bombai (s)	Leaves, Roots	Diarrhea	Leaves, roots	Decoction	Bath, Fumigation	Jaundice, Internal hemorrhoid	3	2.30	
	Sarcocephalus esculentus	D117HK14	Doundakhaikindanmati (s)	Leaves	Diarrhea	Leaves	Maceration or	Oral	Malaria	1	0.76	[34]

	Afzel.						Decoction					
	Sabicea vogelii Benth.	D117HK15	Khouré safouingni (s)	Leaves	Diarrhea	Leaves	Decoction	Bath	Inflammation	1	0.76	
	Gardenia erubescens Stapf&Hutch.	D117HK16	Tinkhai (s)	Leaves,	Diarrhea, death, vomiting	Leaves, root, bark	Decoction, Maceration	Bath	Aphrodisiac, Jundice	12	9.16	[45]
	Psychotria vogelian Benth.	D117HK17	Bôkhidokhai (s)	Whole plant	Death	Not used	Not used	Not used	Not used	1	0.76	
Sapindaceae (2)	*Blighia welwitschii* (Hiern) Radlk.	D121HK6	Kinonai (s)	Leaves, Whole plant	Diarrhea, death	Not used	Not used	Not used	Not used	4	3.05	
	Allophylus africanus P.Beauv.	D121HK7	Foutaitai(s)	Leaves	Abortion	Leaves	Decoction	Bath, Fumigation	Hemorrhoids, Malaria	2	1.53	[33]
Selaginellaceae (1)	*Selaginella Myosurus* (Sw.) Alston.	D177HK1	Khaimafiri (s)	Whole plant	Irritation	Whole plant	Decoction	Bath	Skin conditions	1	0.76	
Solanaceae (2)	*Solanum torvum* Sw.	D125HK3	Baikhi (s)	Leaves	Delirium	Leaves	Maceration	Oral	Snake bite	2	1.53	[23]
	Datura metel L.	D125HK4	Mèringni (s)	Fruits	Delirium	Not used	Not used	Not used	Not used	9	7.00	[19, 21]

Reported adverse events (see Table 3) are mainly digestive, including diarrhea (21 species) and vomiting (6 species); neurological, including dizziness (3 species) and delirium (7 species); dermatogenic (9 species) and ophthalmic (1 species). Fifteen (15) plant species reportedly had major toxic events leading to death. Of these, the most cited were *Erythrophleum suaveolens* (FC=36, PRK=27.50%), *Dichapetalum toxicarium* (FC=26, PRK= 20%), *Gardenia erubescens* (FC=12, PRK=9.16%), *Detarium senegalense* (FC=6, PRK= 4.6%), *Strophanthus hispidus* (FC=5, PRK=4%).

Other plants with insidious effects cited by the traditional healers we interviewed include *Mucuna pruriens* (FC=11 PRK=8.4%), which causes skin irritation; *Datura metel* (FC=9, PRK=7%), which causes delirium; and *Anthostema senegalense* (FC=8, PRK=6.11%), whose latex causes blindness. Although the surveyed therapists reported that the latex of *Anthosthema senegalensis* is toxic in contact with the ocular mucosa, causing blindness, this plant is nevertheless used as a laxative in traditional Guinean medicine, especially the young leaves.

The plants cited as having undesirable or toxic effects are used in the treatment of various pathologies such as malaria, jaundice, constipation, dermatoses, among others (Table 3).

The seeds of *Mucuna pruriens* are used by traditional therapists as an oral treatment of snake bites. *Milisia excelsa* is used against headaches and as an anti-inflammatory.

However, no therapeutic use was reported for some plants such as *Dichapetalum, Toxicarium, Datura metel, Blighia welwitschii, Vernonia nigritiana, Hibiscus sterculiifolius, Canthium venosum.*

Table 3: Toxic manifestations reported according to the number of plants concerned

Type of manifestation	Symptoms	Number of Species	Percentage
	Diarrhea	21	39.00
Gastrointestinal	Vomiting	6	11.11
	Intestinal hemorrhage	2	3.70
	Bloating	2	3.70
	Abdominal pain	6	11.11
General	Death	15	27.80
	Delirium	7	5.36
Neurologic	Dizziness	3	5.36
	Headache	1	1.79
Ophthalmologic	Blindness	1	7.14
Dermatologic	Itching	4	7.14
	irritation	5	9.26
Gynecologic	Abortion	3	5.56

Previous laboratory investigations on some of these plant species highlighted toxic activities of their extracts and/or constituents:

- The alkaloids and cyanogenic glycosides present in *Erythrophleum suaveolens* are responsible for this plant's toxicity [13, 14]. The toxicity profile of its aqueous extract includes cardiorespiratory and central nervous system effects, such as dyspnea, bradycardia and increased contractile force, ataxia, convulsions, and coma leading to death [15].

  Although this plant's toxicity is well known in Guinea, it is nevertheless used medicinally, particularly by local application to treat skin conditions and pain.
- *Dichapetalum Toxicarium* has toxic effects attributed to the presence of fluoro-oleic acid in the seeds, which would act by reducing cardiac function until bradycardia and death ensue [16].
- The presence of a cyanogenetic glucoside derivative in the poisonous fruit of *Detarium senegalense* strongly suggests its ingestion is responsible for poisonings, a hypothesis borne out by the similarity of the symptoms observed in *D. senegalense* intoxication to those occurring with cyanide intoxication [17].
- Toxicity has been reported from all parts of *Datura sp* due to the presence of toxic anticholinergic tropane alkaloids, which cause neuronal toxicity [18]. Signs of anticholinergic toxic effects include acute confusion, fever, tachycardia, dilated pupils, dry mouth, urinary retention, hallucinations, headache, delirium, rapid and weak pulse, convulsions, coma and death [19, 20].
- Poisoning cases related to *Datura* species have been reported in many countries [19-22]. The addictive use of this plant by young people is increasingly reported in some West African countries, including the Republic of Guinea.
- Steroid glycoalkaloids are reportedly responsible for the toxicity of *Solanum torvum* [23, 24]. Its clinical symptoms are likely due to concomitant muscarinic and nicotinic stimulation [25].
- The toxic effects of *Strophanthus*, a plant historically used as an arrow poison could be related to the presence of cardiotonic heterosides, which are known to have a narrow therapeutic margin [26; 27].
- Apart from the aril, the fruit of *Blighia welwitschii* is very poisonous [28].
- The parasitic plant *Cassytha filiformis* is nontoxic and poisonings attributed to it in the literature are likely due to its parasitic relationship to *Gelsemium elegans,* a plant with very toxic alkaloids whose consumption lead to death [29].

However, studies of toxicity in animals on 19 of the 54 plants identified (35.18%) indicated that some are safe, such as *Milicia excelsa* [30], *A. occidentale* [31], *Markhamia tomentosa* [32], *Allophylus africanus* [33], and *Sarcocephalus latifolius* [34]. Meanwhile, some study participants reported plant toxicities not found in the literature. For example, *Gardenia erubescens*, one of the plants most cited (FC=12, PRK=9.16%) as having toxic effects, is valued medicinally as an aphrodisiac, as an anti-malarial and in the treatment of jaundice, among other conditions. It is possible that these toxicities reflect inadequate control of the therapeutic dose or to a misuse.

Conclusion

The findings herein, which demonstrate that traditional healers have useful knowledge about plant toxicity and adverse effects, support involving them in a phytovigilance system by promoting their awareness and training them to report adverse effects.

While more research is needed to further clarify the toxic effects of certain plants, these findings provide a basis for establishing a database identifying the toxicity of plants used medicinally and non-medicinally. They they are being used to develop a phytovigilance database in Guinea.

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Conflict of interest

The authors declare no conflicts of interest. The authors alone are responsible for the accuracy and integrity of the paper content.

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