



ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating: 3.53
www.plantsjournal.com
JMPS 2021; 9(3): 129-135
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Received: 15-03-2020
Accepted: 18-04-2021

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Ethnomedical inventory of antiulcer plants used by the tradipraticians of Yopohué sub-prefecture in central-western Côte d'Ivoire

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Abstract

The objective of this study, which focuses on the traditional treatment of gastroduodenal ulcerative disease, was to compile an inventory of the antiulcer plants sold and prescribed by the health tradipraticians of the sub-prefecture of Yopohué. For this purpose, ethnobotanical surveys were carried out among 28 practitioners of traditional medicine composed of fetishers, phytotherapists and herbalists. Fifteen species of plants, used in the development of 18 medicinal recipes have been listed. The leafy branches are the most stressed plant parts. Of the different forms of use of remedies, decocted is the predominant form. Oral medication is the most commonly used method of administration. Among the species surveyed, *Zanthoxylum gillettii* and *Clerodendrum splendens* are the best known, thus justifying an important consensus on their therapeutic use. With a view to verifying the therapeutic effects reported by the respondents and possibly the discovery of potentially effective active molecules to fight against the studied disease, Phytochemical and pharmacological testing of the most significant species would be beneficial.

Keywords: Ethnobotany, antiulcer plants, health tradipraticiens, Yopohué.

Introduction

Ulcers are one of the major gastroenterological disorders that affect many people around the world [1]. The incidence of this disease in Côte d'Ivoire gives it the status of a public health problem. Indeed, its prevalence is estimated at 6.8% with a clear predominance observed in men [2]. It is a condition of the mucous membrane and the sub mucous membrane of the stomach and duodenum that causes a loss of parietal substance more or less extensive of the digestive wall that can reach the deep layers due to active inflammation and without tendency to healing spontaneous [3,4]. When the mucous membrane is inflamed, it becomes the site of a recurrent wound or lesion with a loss of substance that may be minimal, but also wide and deep. When the lost substance is found only in the epithelium, the lesion is called abrasion. The chorion, muscular mucosa and musculoskeletal muscle may gradually be subject to loss of substance. Gastroduodenal ulcer, which is a chronic, recurrent and progressive condition, results from an imbalance between aggressive factors such as acid and pepsin, and the defense mechanisms of the integrity of the gastrointestinal mucosa [5]. Duodenal ulcer is localized in the majority of cases at the duodenal bulb and is favored by an increase in acidity while the gastric ulcer is preferentially localized at the level of the small gastric curvature (angulus). It is favored by decrease in cytoprotection. The incidence of peptic ulcer is increased due to a variety of factors including stress, smoking, alcohol, *Helicobacter pylori* infection and ingestion of nonsteroidal anti-inflammatory medication [6]. Current data suggest that *H. pylori*, a bacterium whose main reservoir is man [7], and she is the common cause of this pathology [8]. Transmission of *H. pylori* infection is primarily human-to-human via the faecal-oral and/or oral-oral route [9]. Normally, bacteria do not resist the acidic medium of the stomach. But *H. pylori* secretes an enzyme that allows it to survive gastric and intestinal juices by neutralizing them.

Gastroduodenal ulcer is a burning, cramping or weighty sensation that occurs in the supraumbilical region known as the epigastrium. Typically, the pain is aggravated by hunger and the use of anti-inflammatories and it is alleviated when the patient eats or takes an antacid. The course of ulcerative disease may be punctuated by complications such as gastrointestinal bleeding, acute perforations, pyloro-bulbar stenosis, or cancer [10].

The latter transform this benign pathology into a serious accident endangering the patient's life ^[11]. However, the peptic ulcer is a completely curable disease. The treatment, preceded by an essential fibroscopy to confirm the diagnosis and specify the site of the ulcer, aims to relieve pain, accelerate healing, prevent complications and reduce the frequency of recurrence ^[12]. The therapeutic arsenal consists of antibiotics, drugs that inhibit the secretion of acid and protective molecules of the mucosa. *Helicobacter pylori* eradication treatment is based on the combination of an anti-secretor (proton pump inhibitor) or bismuth and two antibiotics (amoxicillin, nitro-imidazoles). Antihistamines H2 (Cimetidine, Ranitidine, Famotidine and Nizatidine) may also be used orally or parenterally in combination with antibiotics ^[13]. However, the treatment of ulcers remains expensive, whereas patients of modest socio-economic status are the most affected; they are found in 50.3% of cases at the Treichville University Hospital in Abidjan ^[2]. In addition, some of the molecules used have many side effects ^[14]. For

these reasons, a large segment of the African population in general refers to the traditional treatment of ulcerative disease based mainly on medicinal plants ^[15].

Traditional medicine is indeed full of invaluable therapeutic potential. The products of this medicine have been exploited for many years by the Beté belonging to the Krou people ^[16]. Which follows that of the Akan among the ethnic groups that appear to be more exposed to ulcerative disease ^[2]. Thus, in this study we try to identify the medicinal plants and the medicinal recipes used by the Beté of the sub-prefecture of Yopohué to fight against the gastroduodenal ulcer.

Equipment and methods

Study area

Ethnobotanical investigations were carried out in the sub-prefecture of Yopohué located 38 km north-east of the department of Gagnoa itself located in the center-west of Côte d'Ivoire in the Gôh region (Figure 1).

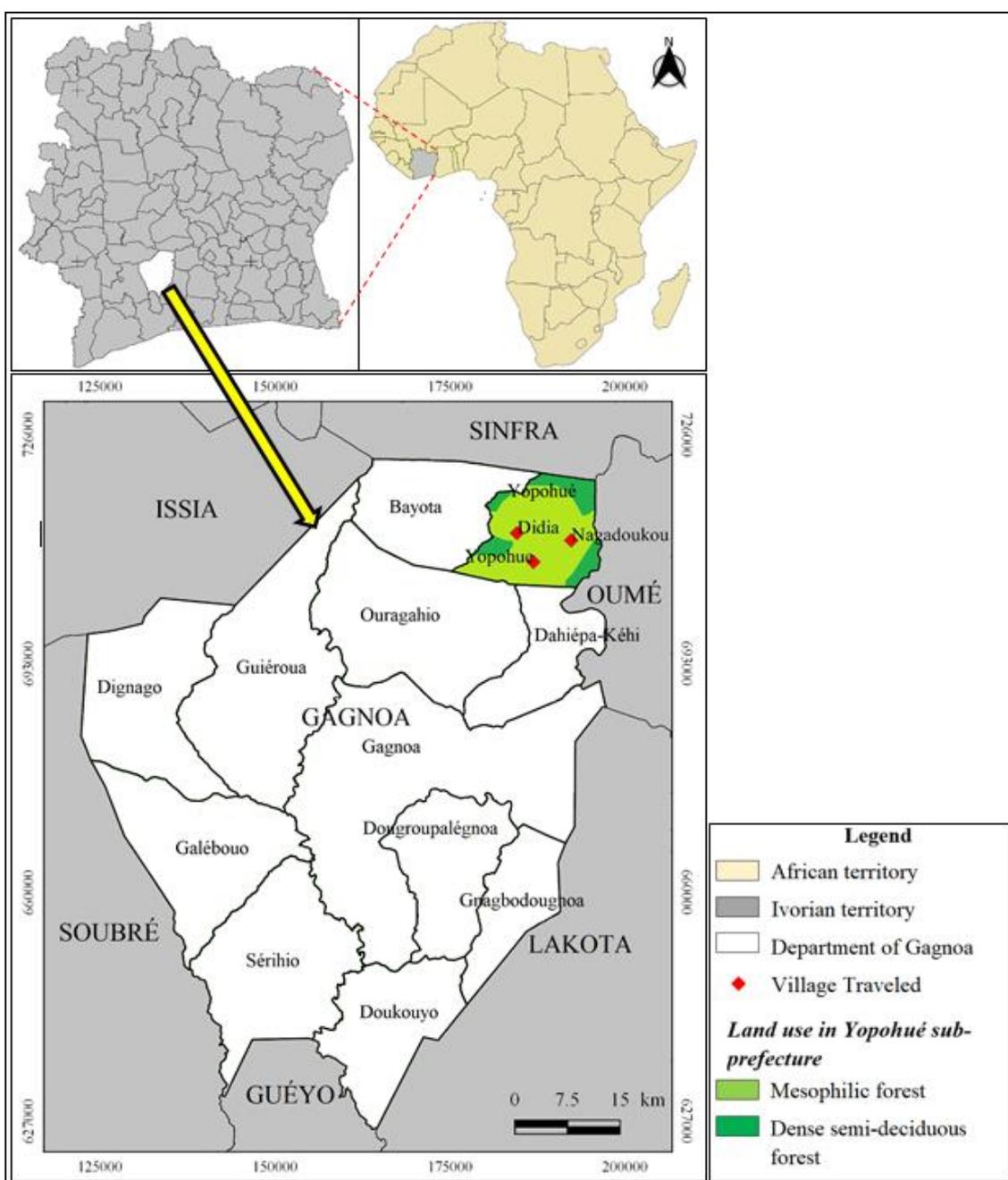


Fig 1: Geographical location of the Yopohué sub-prefecture

This sub-prefecture has 7 large towns, each with several villages called districts. Didia, Nagadoukou and Yopohué (capital of sub-prefecture) are the localities that were selected for this study taking into account the consent of community authorities authorizing our research team to make an incursion into their villages and the agreement of health tradipraticians wishing to share their knowledge in traditional therapy. The population of the sub-prefecture of Yopohué, estimated at 28,607 inhabitants with a male predominance (51.84%), is strongly anchored in the local traditional culture [17]. Yopohué has a vegetation dominated by dense, semi-deciduous humid forests littered with large tracts of herbaceous stands that offer the population a diversity of plants endowed with therapeutic properties. The Beté Aboriginal people of this locality have long held back this habit.

Study material

The study material is divided into two categories. A plant material consisting of the species inventoried during ethnobotanical investigations and herbarium specimens consulted at the National Floristic Center of Abidjan. Then technical equipment was required. It consists mainly of a survey sheet, a pruning shear, adhesive tapes, newspaper papers, plastic bags and a digital camera. The survey form in particular was used to collect information relating to both respondents and the medical recipes they recommend for the treatment of people with gastric and/or duodenal ulcers.

Method of study

Information was collected from healers and herbalists in the study area. Healers were visited at their homes while herbalists were met in the markets. These interviewees were interviewed for an average of 30 minutes, in French or Bété, with the help of an interpreter-guide on the basis of a non-exhaustive questionnaire prepared for this purpose [18]. The interviews concerned information on the identity of the informants themselves, their knowledge of ulcerative disease and the process of developing the phytodrug for the treatment of a patient or client with the disease, from the harvesting of plant organs to the obtaining of the remedy and even to the instructions for use. Local plant names were provided by informants. The hikes were carried out with some healers in particular or their disciples in the natural environment of life of the plant species with antiulcerative potentially cited, for shots and the harvest of representative organs for the preparation of a herbarium [19]. The species of plants inventoried were identified during the excursion or in the laboratory with or without systematic works while referring to the phylogenetic classification [20].

The information collected was carefully processed, which resulted in (i) the establishment of the sociological profile of the respondents by calculating various percentages; (ii) the identification of floristic features which has involved elucidating the different taxonomic groups and species typology identified by a bibliographic survey; (iii) the evaluation of the consensual use of species by the calculation of the frequency of citation (FC), which is a good indicator of the credibility of the information received. This index reflects the level of knowledge of plant uses and is obtained by the following mathematical operation $FC = (n/N) \times 100$ [21]; with n and N respectively representing the number of respondents who reported the species and the total number of respondents during the survey. Thus the most significant plants are those that are mentioned by more informants. Three species classes

have been established: a species is said to be well known if its frequency of citation is between 50% and 100% ($FC \geq 50$); a species is said to be moderately known if its citation frequency is between 25% and 50% ($25 \leq FC < 50$); a species is said to be little known if its citation frequency is between 0% and 25% ($0 \leq FC < 25$) [22].

Results

Profile of informants

A total of twenty-eight (28) health tradipraticians aged 37 to 68 years were prepared to provide information on medical practices in the traditional treatment of peptic ulcer in the Bété country. These informants consist of 3 fetishists (10.71%), 8 herbal therapists (28.57%) and 17 herbalists (60.71%). Only one of them belongs to the Baoulé ethnic group, originating in central Côte d'Ivoire, yet well integrated into the local ethnic community and recognized by the villagers as a resource person in traditional therapy. The majority of women are herbalists (Figure 2). The least experienced contact person has 15 years of traditional medical practice while the most experienced contact person has 40 years. The educational attainment rate of respondents is below average with 39.29% of informants who can read and write. The informants interviewed report that they receive very few people who complain of ulcers compared to all gastroenterological pathologies. Traditional therapies for gastroduodenal ulcers cost up to 10,000 F CFA and herbalist-recommended antiulcer plants are sold for up to 200 F CFA. Whether it is gastric ulcer or duodenal ulcer, informants incriminate the same factors and identify the same symptoms. For the onset of ulcerative disease, they involved inadequate nutrition (42.86%), rancour (35.71%) and frequent use of so-called modern oral medications (21.43%). The symptoms unanimously evoked are the sensation of burning and periodic pain and early satiety.

Ethnobotanical characteristics

These ethnobotanical surveys made it possible to identify 18 anti-ulcer recipes concocted from 15 plant species that were indicated by designations in local Ivorian languages. Fourteen species are named Bété (the native ethnic group) against a species that has been designated in Baoulé. With reference to their scientific identification, the species surveyed are divided into 14 genera belonging to 11 families dominated by the Fabaceae (33.33%). Based on their biomorphologic characteristics,

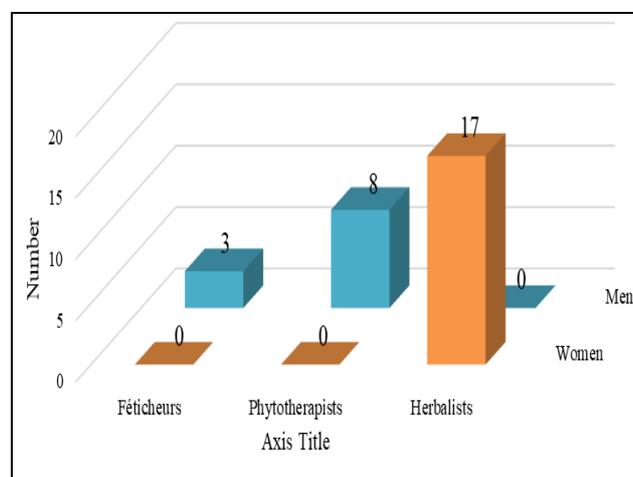


Fig 2: Distribution of health tradipraticians by sex

the taxa identified are grouped into five (5) morphological types and two (2) biological types. Shrubs (40%) and Phanerophytes (93.33%) are respectively the most represented morphological and biological types (Table 1). Phanerophytes consist of Mesophanerophytes (6.66%), Microphanerophytes (40%) and Nanophanerophytes (40.66%). Plants designated by informants are predominantly African; they represent 73.33% of the species surveyed. Pluricontinental taxa, of which there are 4 (or 26.66%) are a minority. Three (3) groups of plants were identified based on the distribution of species by plant type. Ten (10) taxa, or 66.66% of the species inventoried are from the Guineo-Congolese (GC) zone. They are followed by taxa common to the Guineo-Congolese and Soudano-Zambezi (GC-SZ) zones representing 26.66% of the floristic arsenal inventoried and a single introduced species (I)

representing the remaining 6.66%. *Desmodium adscendens* var. *adscendens* (Fabaceae) is the only listed species on the IUCN Red List of Threatened Plants [23]. This organization has classified it as a low-vulnerability species.

More than half of the listed species are well known to the tradipraticians of the investigation area. Indeed, 66.66% of all plants inventoried record citation frequencies ranging from 50% to 89%. *Zanthoxylum gillettii* (Photo 1), which has the highest frequency of quotation, is the plant with the best known antiulcerative potentiality of informants. It is followed by *Clerodendrum splendens* (Photo 2), whose citation frequency is 75%. The other species representing 33.33% of the total population are moderately known. *Mareya micrantha* (Photo 3) cited by 29% of respondents is the least known of the list.

Table 1: Ethnofloristic characteristics of plants used to control peptic ulcer in Yopohué sub-prefecture

| No | Species | Botanical families | local names | CF (%) | Morphological types | Biological types | Chorology | Phytogeographical types |
|----|--|--------------------|-------------------------|--------|---------------------|------------------|-----------|-------------------------|
| 1 | <i>Alchornea cordifolia</i> | Euphorbiaceae | Gboulou (Bété) | 57 | Shrub | mp | A | GC-SZ |
| 2 | <i>Capsicum frutescens</i> | Solanaceae | Déklé (Bété) | 75 | undershrub | np | PanT | I |
| 3 | <i>Chromolaena odorata</i> | Asteraceae | Zrégbéyi (Bété) | 32 | Grass | np | panT | GC |
| 4 | <i>Clerodendrum splendens</i> | Lamiaceae | Libitité (Bété) | 82 | Shrub | np | A | GC |
| 5 | <i>Desmodium adscendens</i> var. <i>adscendens</i> | Fabaceae | Kpôkpagôh (Bété) | 57 | Grass | Ch | AN | GC |
| 6 | <i>Desmodium velutinum</i> | Fabaceae | Siki-siki (Bété) | 57 | Grass | np | paléoT | GC-SZ |
| 7 | <i>Harungana madagascariensis</i> | Hypericaceae | Goglou (Bété) | 46 | Shrub | mp | AM | GC |
| 8 | <i>Hoslundia opposita</i> | Lamiaceae | Zôkpôlôbôh lékou (Bété) | 39 | Grass | np | AM | GC-SZ |
| 9 | <i>Mareya micrantha</i> | Euphorbiaceae | Gbogbo (Bété) | 29 | Shrub | np | A | GC |
| 10 | <i>Mezoneuron benthamianum</i> | Fabaceae | Djézô kélé (Bété) | 68 | Shrub | mp | A | GC |
| 11 | <i>Parquetina nigrescens</i> | Apocynaceae | Séréboué (Baoulé) | 50 | Liana | mp | A | GC |
| 12 | <i>Senna podocarpa</i> | Fabaceae | Namantoh (Bété) | 64 | Shrub | mp | A | GC |
| 13 | <i>Sida urens</i> | Malvaceae | Bôh boudou (Bété) | 61 | Grass | np | panT | GC |
| 14 | <i>Tetrapleura tetraptera</i> | Fabaceae | Kou-sèkèsèkè (Bété) | 43 | Tree | mp | A | GC-SZ |
| 15 | <i>Zanthoxylum gillettii</i> | Rutaceae | Gbessi (Bété) | 89 | Tree | mP | A | GC |

Biological types: mP: Mesophanerophyte; mp : Microphanerophyte ; np : Nanophanerophyte ; Ch : Chamephytes.

Chorology : A : African taxon (intertropical Africa) ; AM : Afro-malagasy taxon; AN : Taxon Afro-neotropical (commun to tropical Africa and America) ; paleoT : Paleotropical taxon (commun to ancient tropical world : Africa, Asia, Australia, Pacific islands) ; panT : Taxon pantropical (commun to all tropical countries of the world).

Phytogeographical types: GC : Guineo-Congolese ; GC-SZ : Guineo-Congolese et Soudano-Zambezi ; I : introduced.



Photo 1: *Zanthoxylum gillettii* (Rutaceae) trunk Gbessi (in Bété language)



Photo 2: Leafy twig of *Clerodendrum splendens* (Lamiaceae). Libitité (in Bété language)



Photo 3: Stem tip of *Mareya micrantha* (Euphorbiaceae). Gbogbo (in Bété language)

Drug receipts are mainly composed of single-specific recipes (83.33%) against a minority of bispecific recipes (16.66%).

They are obtained from different parts of plants (Table 2). Leafy twigs (38.10%) and leaves (33.33%) are the most stressed. Next come the bark of the stem and the fruits that are used each for the preparation of 14.29% of the recipes. Seven (7) methods of preparation are used for the development of remedies based on fresh or dry plants. The decoction used in 33.33% of cases is the predominant method of preparation. Spraying comes second (22.22%). It is followed by maceration (16.66%) and crushing (11.11%). The other methods of preparation (cooking, kneading and mixing the organ with a food without any transformation) are used each for 5.56% of the recipes. The remedies obtained come in different forms according to their methods of preparation. A total of seven (7) forms of use of medicinal recipes were recorded. The herbal tea obtained by decoction is naturally the predominant drug form (33.33%). The remedies in their different forms of use are administered orally, with the exception of one, which has a pasty form is applied locally on the abdominal surface.

Table 2: Medicinal recipes used in the treatment of peptic ulcer in Yopohué sub-prefecture

| No | Composition of receipts | Used parts | Employment status | Method of preparation | Drug form | Mode of administration |
|----|--|-----------------------|-------------------|---|-----------|------------------------|
| 1 | <i>Alchornea cordifolia</i> | Leaves | Dry | Decoction | Decocted | Drink |
| 2 | <i>Capsicum frutescens</i> | Fruit | Dry | Without preparation (to be added to the food) | Raw | Eating |
| 3 | <i>Chromolaena odorata</i> | Leafy Twigs | Fresh | Aqueous maceration | Macerated | Drink |
| 4 | <i>Clerodendrum splendens</i> | Leaves | Fresh | Kneading + Water | Paste | Local application |
| 5 | <i>Desmodium adscendens</i> var. <i>adscendens</i> | Leafy Twigs | Dry | Crushing + Water | Grinding | Eating |
| 6 | <i>Desmodium velutinum</i> | Leafy Twigs | Dry | Spraying : Powder + Palm wine | Mixture | Drink |
| 7 | <i>Desmodium velutinum</i> <i>Mezoneuron benthamianum</i> | Leafy Twigs Leaves | Dry | Spraying : Powder + Palm wine | Mixture | Drink |
| 78 | <i>Harungana madagascariensis</i> | Leafy Twigs | Fresh | Decoction | Decocted | Drink |
| 9 | <i>Hoslundia opposita</i> | Leaves | Fresh | Firing | Soup | Eating |
| 10 | <i>Mareya micrantha</i> | Leafy Twigs | Fresh | Decoction | Decocted | Drink |
| 11 | <i>Mezoneuron benthamianum</i> | Leaves | Dry | Spraying : Powder + Palm wine | Mixture | Drink |
| 12 | <i>Mezoneuron benthamianum</i> | Leaves | Dry | Decoction | Decocted | Drink |
| 13 | <i>Parquetina nigrescens</i> | Leaves | Fresh | Maceration with liquor | Macerated | Drink |
| 14 | <i>Senna podocarpa</i> | Leafy Twigs | Dry | Crushing + Water | Grinding | Eating |
| 15 | <i>Sida urens</i> | Leafy Twigs | Fresh | Decoction | Decocted | Drink |
| 16 | <i>Tetrapleura tetraaptera</i> | Stem bark | Dry | Aqueous maceration | Macerated | Drink |
| 17 | <i>Zanthoxylum gillettii</i> <i>Capsicum frutescens</i> | Stem bark Fruit | Dry | Spraying : Powder + Palm wine or sauce | Mixture | Drink |
| 18 | <i>Zanthoxylum gillettii</i> <i>Capsicum frutescens</i> | Stem bark Fruit | Dry | Decoction | Decocted | Drink |

Discussion

Ivorian society is divided into several ethnic communities which maintain their own cultural relations with plants. Some plants are solicited for their therapeutic virtues. Among the Bété, a people from the Central-West of Côte d'Ivoire, people recognized by the community as holders of traditional medical knowledge, called health tradipraticians are consulted to solve many health problems [16, 24]. Twenty-eight (28) traditional medicine practitioners were interviewed for this study. Although mostly illiterate, these wall-aged informants, who have at least a decade of experience in herbal medication, would provide reliable information for the discovery of new treatments for peptic ulcers, the implications of which remain high. significant within the population [2]. Compared to the results of numerous ethnobotanical studies, it is almost established that activities related to traditional medicine do not necessarily require a high level of education [16, 18, 24-29]. The choice of 3 entities, fetishers, phytotherapists and herbalists, composing the target population seemed necessary to have a global overview of the medicinal plants used by the inhabitants of the sub-Yopohué prefecture who do not necessarily attend the same categories of health tradipraticians. On the contrary, some studies have focused mainly on healers or herbalists to highlight the specificity of traditional treatments offered by each group of practitioners

[18, 25, 30, 31]. The low number of fetishists interviewed can be explained by the reluctance of this group of traditional healers, who are less willing to reveal their medical knowledge. The distribution of different categories of informants by gender supports the assertion that herbalists are often female and traditional healers are generally male [28]. The causes cited by informants are substantially the same as those indicated by conventional medicine [5, 6]. However, they are unaware of the involvement of *Helicobacter pylori* in the development of gastroduodenal ulcer, which is the recurrent cause of this pathology [32]. They would then use the 15 medicinal plants identified, potentially for their therapeutic virtues intended to eradicate *Helicobacter pylori* without knowing it. Considering that all stakeholders report fewer ulcer complaints compared to other gastroenterological pathologies, it could be seen as a low prevalence of peptic ulcer in the study area its surroundings.

Almost all of the species surveyed have names in the native language, which reveals the existence of a functional relationship between the plant world and the Bété community of Yopohué. Fabaceae are the best represented family in this study. In contrast, one study conducted on the traditional phytotherapy of gastroduodenal ulcer with *Helicobacter pylori* in North-East Algeria revealed the predominance of Lamiaceae (83.55%) among the 32 listed antiulcer

species; Fabaceae are counted among the less represented families (1.34%) [32]. The significant difference between the results of these two studies would be related to the difference in the physical environments in which the ethnomedical surveys were conducted. The variability of the anti-ulcer recipes recorded in ethnobotanical surveys, whose components are accessible at low cost or available in the immediate population environment would justify the interest of populations living in rural areas for traditional pharmacopoeia [33]. Although the investigated site is characterized by significant floristic diversity with respect to the presence of *Desmodium adscendens* var. *adscendens* (Fabaceae), a threatened species [23]. These mostly monospecific recipes reduce the health risks that mismatched plant combinations can cause [29]. Patients would benefit from this in terms of efficacy in terms of metabolic disorders induced by ulcer [32]. However, plant associations can be beneficial insofar as each plant plays a specific role in the treatment of the symptoms of the condition considered [34]. Leafy branches (38.10%) are the parts of plants most in demand for the preparation of antiulcerative medication recipes. The leaves come in second position with a significant frequency of citations (33.33%). In its study on the same topic, Bentahar recorder the preponderance of leaves with a representativeness rate of 41.01% [32]. All this shows that leaves concentrate large amounts of active molecules [35]. Their richness in active ingredients it attributed to the fact that they are the site of photochemical reactions that result in the synthesis of large amounts of organic matter [36]. For rapid and abundant extraction of the active ingredients contained in plant organs, decoction is the most appropriate method of preparation [37]. This would explain the high demand for this technique of preparing traditional remedies by the respondents. Almost all ulcer remedies are administered orally, probably because the condition studied affects the digestive organs whose natural pathway is the mouth [36].

Not all plant species identified in these ethnobotanical surveys are as well-known as each other. A consensus (FC \geq 50%) was found for the therapeutic use of 66.66% of the species surveyed. This reflects a collective understanding of the therapeutic potential of these plants and offers real possibilities for effective control of the studied disease [21]. These species, well known to all interviewees, are said to have secondary metabolites such as saponosides, terpenic compounds (sterols and triterpenes), phenolic compounds and mucilages whose biological properties confer gastric and duodenal antiulcerative activity [38]. Some saponosides also confer anti-inflammatory and analgesic properties to the plant while terpenic compounds (sterols and triterpenes) confer an antipyretic property, often analgesic and anti-inflammatory [39]. Plant phenolic compounds have been shown to be powerful protectors of gastric mucosa against various experimental ulcerative agents [40]. Mucilage is known for its healing and gastroprotective properties [41]. Thus *Zanthoxylum gillettii* (Rutaceae) and *Clerodendrum splendens* (Lamiaceae) which hold the highest citation frequencies (89% and 75% respectively) would constitute prolific resources for the development of new drugs.

Conclusion

At the end of this study, carried out with the help of 28 experienced traditional medicine practitioners living in the sub-prefecture of Yopohué, fifteen species of plants used against peptic ulcer were identified. Mostly well known by all informants, *Zanthoxylum gillettii* and *Clerodendrum splendens*

record a significant consensus on their traditional use in the treatment of ulcerative disease. Further studies would be necessary for the scientific verification by phytochemical and pharmacological tests of the therapeutic effect of the active molecules contained in these plant species.

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