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Article

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Ethnobotanical, Phytochemical, and Pharmacognostic investigation of Medicinal Plants Used to Treat Oral Diseases in Cameroon.

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Abstract

Oral diseases are a major public health burden in sub-Saharan Africa, particularly in Cameroon, where socioeconomic barriers and limited access to modern dental care affect thousands. In urban areas like Douala, self-medication and traditional remedies dominate, with 70-80% of the population relying on ethnobotanical knowledge for primary healthcare. Prior studies in rural Cameroon have documented over 30 to 289 plant species for oral affections, highlighting analgesic and antimicrobial properties, but such studies have not been carried out in urban coastal settings like Douala. This study was aimed at identifying the plants used to treat oral diseases and provide a scientific backing to the use of these plants. We carried out a descriptive, cross-sectional study from May to November 2025 in Douala, Cameroon. For the ethnobotanical surveys, we used semi-structured interview forms with healers in major markets (Marché Central, Mboppi, Nkoloulou) and workplaces. Laboratory analyses were carried out on prioritized plant species. We studied their physicochemical properties, pharmacognostic profile and phytochemical screening. Descriptive data analysis was used. The sex ratio of our informants was 0.54% to 0.46 in favour or males. The mean age was 43.5 years, while 56% had reached secondary education. We identified 78 species across 38 families, led by *Lamiaceae and Euphorbiaceae*. The most cited were *A. oleracea (50), S. aromaticum (30), N. tabacum (20).*The predominant means of preparation was decoction (42.86%); while the main means of administration was as mouthwash (61.04%). The most used parts were the leaves (49.35%). Gingivitis (41.55%) was the primary pathology. We identified distinct pharmacognostic traits consistent with findings in literature. Phytochemical screening revealed alkaloids, flavonoids, polyphenols, sterols/steroids/terpenes, resins (+) in all; coumarins (+) only in M. arvensis; saponins (+) in A. oleracea and M. arvensis. This study validates urban Cameroonian ethnobotanical practices for oral health, revealing bioactive-rich plants with potential antimicrobial/anti-inflammatory effects. Findings support evidence-based integration into healthcare, urging further in vitro activity, toxicity, and sustainable development research to address gaps and enhance primary care.

Keywords:
Medicinal plants, Ethnobotany, Phytochemistry, Oral diseases.

Résumé

Les maladies bucco-dentaires représentent un problème majeur de santé publique en Afrique subsaharienne, notamment au Cameroun, où les barrières socio-économiques et l'accès limité aux soins dentaires modernes affectent des milliers de personnes. Dans les zones urbaines comme Douala, l'automédication et les remèdes traditionnels prédominent, 70 à 80 % de la population ayant recours aux connaissances ethnobotaniques pour ses soins de santé primaires. Des études antérieures menées en milieu rural au Cameroun ont recensé entre 30 et 289 espèces végétales pour le traitement des affections bucco-dentaires, mettant en évidence leurs propriétés analgésiques et antimicrobiennes. Cependant, de telles études n'ont pas été réalisées en milieu urbain côtier comme Douala. Cette étude visait à identifier les plantes utilisées pour traiter les maladies bucco-dentaires et à fournir une base scientifique à leur utilisation. Nous avons mené une étude descriptive transversale de mai à novembre 2025 à Douala, au Cameroun. Pour les enquêtes ethnobotaniques, nous avons utilisé des questionnaires semi-structurés auprès de guérisseurs sur les principaux marchés (Marché Central, Mboppi, Nkoloulou) et sur leurs lieux de travail. Des analyses en laboratoire ont été effectuées sur les espèces végétales prioritaires. Nous avons étudié leurs propriétés physico-chimiques, leur profil pharmacognostique et leur composition phytochimique. Une analyse descriptive des données a été utilisée. Le sex-ratio de nos informateurs était de 0,54 % en faveur des hommes pour 0,46 %. L'âge moyen était de 43,5 ans, et 56 % d'entre eux avaient atteint le niveau d'études secondaires. Nous avons identifié 78 espèces appartenant à 38 familles, principalement les Lamiacées et les Euphorbiacées. Les espèces les plus citées étaient *A. oleracea* (50), *S. aromaticum* (30) et *N. tabacum* (20). Le mode de préparation prédominant était la décoction (42,86 %), tandis que le principal mode d'administration était le bain de bouche (61,04 %). Les parties les plus utilisées étaient les feuilles (49,35 %). La gingivite (41,55 %) était la pathologie la plus fréquente. Nous avons identifié des caractéristiques pharmacognostiques distinctes, concordantes avec les données de la littérature. L'analyse phytochimique a révélé la présence d'alcaloïdes, de flavonoïdes, de polyphénols, de stérols/stéroïdes/terpènes et de résines chez toutes les espèces, et de coumarines uniquement chez *M. arvensis*. La présence de saponines (+) dans A. oleracea et M. arvensis confirme la validité des pratiques ethnobotaniques urbaines camerounaises en matière de santé bucco-dentaire, en révélant des plantes riches en composés bioactifs aux effets antimicrobiens et anti-inflammatoires potentiels. Ces résultats plaident en faveur d'une intégration fondée sur des données probantes dans les soins de santé et incitent à poursuivre les recherches in vitro sur l'activité, la toxicité et le développement durable afin de combler les lacunes et d'améliorer les soins primaires.

Keywords:
Plantes médicinales, ethnobotanique, phytochimie, maladies buccales.

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1. Introduction

Oral health diseases represent a significant global public he alth burden, affecting billions of individuals and contributing to morbidity, particularly in low and middle-income countries where access to modern dental care is limited.(Petersen et al., 2005). In Cameroon, these challenges are amplified by socioeconomic factors, poor hygiene practices, and high prevalence of infectious diseases, because the populations rely so much on self-medication and traditional remedies (A. M. Agbor & Naidoo, 2011).

Ethnopharmacological studies in Cameroon have shown that plants are extensively used to treat many pathologies, includin g those of the oral cavity. Surveys in the Mount Cameroon region have identified over 30 plant species used by traditional healers for treating toothache, gum diseases, and oral ulcers, because of their analgesic and antimicrobial properties (Ndenecho, 2020). Other ethnobotanical studies in the Littoral and South-West regions identified over 289 plants from 89 families, many of which address digestive and infectious disorders that are linked to oral oral diseases, such as dysentery and mouth sores (Jiofack et al., n.d.). Research on self-medication practices in urban areas like Yaounde, Bamenda, and Buea indicates a 67.8% prevalence of self treat ment for oral problems, predominantly toothache (54.7%), using pharmaceutical products alongside traditional herbs go tten from markets or herbalists (M. A. Agbor & Azodo, 2011). Furthermore, traditional practices like tooth extraction by herbalists in rural areas, such as Lekie division, using plants for anesthesia, highlight the importance of ethnobotany in oral care (A. M. Agbor et al., 2011).

Despite all this, there is a big gap in the literature about plants for oral diseases in urban areas like Douala. While surveys have been carried out in rural and highland areas, such as Aguambu-Bamumbu in the Southwest Region where 106 medicinal plants are documented, (A. M. Agbor & Naidoo, 2011; Focho et al., 2009) comprehensive studies on Douala's ethnopharmacological profile are lacking. Also, some contradictions arise in reported efficacies and phytochemical validation. (A. M. Agbor, 2015; Vougat et al., 2015) Additionally, pharmacognostic studies remain underexplored for oral-specific uses, potentially leading to lack awareness of risks like herb-drug interactions in commercial exploitation (A. M. Agbor & Naidoo, 2011).

This study addresses these gaps through an ethnobotanic survey, phytochemical, and pharmacognostic investigation of plants used to treat mouth diseases in Douala. The aim is to join traditional knowledge with scientific validation. By documenting local plant species used, screening for bioactive compounds (e.g., phenols, alkaloids), and checking other properties, the research justifies the need for evidence based integration of traditional remedies into Cameroon's health system, as advocated by WHO guidelines (World Health Organization, 2004).

2. Materials and Methods

2.1. Ethnobotanical survey

A descriptive cross-sectional study was conducted in Douala, precisely in the major markets, Marché Central, Marché Mboppi, and Marché Nkoulouloun, and at the workplaces of traditional healers within urban and peri-urban neighbourhoods of the city. The study was carried out over a period of 7 months from May to November 2025. Participants included market herbal vendors and traditional healers practicing in Douala.

Participants were included if they met the following:

- Practicing traditional herbal medicine in Douala, Littoral Region, Cameroon for at least a year.
- Actively using 3 or more different medicinal plants for treatments at workplaces.
- Available for short semi-structured interviews (15–30 min) and able to demonstrate and describe plant uses.

2.2. Non-inclusioni criteria

- Practicing for less than a year.
- Using less than 3 medicinal plants regularly.
- Operating outside Douala.

2.3. Sampling

We used non-probability purposive sampling combined with snowball sampling. This helped us to recruit traditional healers and herbalists in Douala. Informants were gotten from major markets (Marché Central, Marché Nkoulouloun) and healer workplaces based on inclusion criteria. Additional participants were recruited through referrals from initial informants.

For the laboratory analysis, we chose the most cited plant, and another from its family, and 2 plants from the most cited family.

We chose our sample size based on a "saturation" method using an iterative approach, and defined saturation as the point at which no new medicinal plant species, uses, or preparation

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methods were recorded in three consecutive interviews with a healer. If three such interviews consecutively returned no new herbals, we would stop interviewing.

2.4. Variables studied

On the survey form, we gathered variables on sociodemographic data, characteristics of the medicinal plant, knowledge of the dental diseases treated, preparation and administration of the drug, efficacy, safety and cultural aspects.

We studied mainly organoleptic, pharmacognosic and phytochemical characteristics.

2.5. Procedure

2.5.1. Technical procedures

- **Monographic study**

Materials

Technical Equipment: This includes the materials required for harvesting and purchasing the drugs. It consists of a shovel, bags for transporting the harvested or purchased drugs, a ruler, and a digital camera.

Laboratory Apparatus and Consumables: The equipment used includes a Canon-type optical microscope coupled with a camera, a knife, a mill, a stopwatch, pencils, slides, coverslips, watch glasses, razor blades

Reagents and Solvents: The anatomo-histological and histochemical study of the drugs required the use of water and various reagents: sodium hypochlorite solution (bleach), acetic acid, methyl blue, ferric chloride, soda (sodium hydroxide), and ammonia.

Plant Material: The study focussed on four species: *Acmella oleracea, Mentha avernsis, Vernonia amygdalina, Thymus vulgaris*. The plant material was collected and stored according to recommendations from WHO quality control methods for medicinal plant materials (*Quality Control Methods for Medicinal Plant Materials*, 1998).

Methods

Monographic study: We selected the four most cited plants. The selected plants were described morphologically, and their taxonomic and ecological positions were specified before harvesting.

A herbarium specimen of each drug was prepared and stored at the Faculty of Medicine and Pharmaceutical Sciences of Douala. The drugs were cleaned and then dried at room temperature, away from sunlight. The dry plant material was coarsely pulverized using a mill. Fresh organs were used for the anatomo-histological and histochemical study (*Quality Control Methods for Medicinal Plant Materials*, 1998).

Pharmacognosic study (*Quality Control Methods for Medicinal Plant Materials*, 1998; Wasiullah et al., 2023)

- **Macroscopic tests**

Organoleptic Characteristics : The characteristics evaluated were color, shape, size, odor, and taste.

Odor Test: 1 mg of pulverized drug was taken between the thumb and forefinger or in the palm of the hand. The released odoriferous constituents were tested slowly and repeatedly. Odor intensity was first assessed using the parameters: "None, Weak, Marked, Strong." The type of odor was then determined: "Aromatic, Fruity, Characteristic, earthy".

Taste Test: One to two grams of drug were placed on the tongue and held in the mouth, without swallowing, for ten to thirty seconds. After spitting out the sample, the mouth was rinsed, and the taste was evaluated: "Pungent, Insipid, Sour, Bitter, Sweet, Salty, Hot".

- **Microscopic tests (Quality Control Methods for Medicinal Plant Materials, 1998**

Anatomo-Histological: Study To identify the different tissues, transverse sections of fresh leaves and flowers of the various plants were made. The sections were soaked in bleach for 15 to 20 minutes (to destroy cell contents), then rinsed three times with distilled water. They were macerated in 20% acetic acid for 5 minutes to remove bleach residue, which would otherwise destroy methyl blue. After rinsing, the sections were soaked in methyl blue (5 min), rinsed with distilled water, and then observed between slide and coverslip in a drop of glycerin under ×4 and ×10 objectives. Cells with pectocellulosic walls were stained pink (light pink for parenchyma, bright pink for phloem, purplish pink for collenchyma); cells with lignified walls were stained green (green for xylem, blue-green for sclerenchyma, yellowish-green for epidermis and cork).

- **Micrographic study**

A small quantity of fine powder was mixed with a few drops of 5% alcoholic potash on a slide and covered with a

coverslip. Observation was performed under an optical microscope with a ×10 objective. The characteristic elements of each drug powder were noted and photographed (Quality Control Methods for Medicinal Plant Materials, 1998).

Phytochemical screening

- **Materials**

Technical Equipment: This material is identical to that used in the pharmacognostic study.

Laboratory Apparatus and Consumables: The equipment used includes separating funnels, a sand bath, a water bath, an analytical balance, beakers, a mortar and pestle, a stopwatch, hydrophilic cotton, a pencil, silica crucibles, a chromatography tank with lid, a desiccator, a funnel, a graduated test tube, Erlenmeyer flasks, an oven adjustable, a rotary evaporator, flasks, a lyophilizer, micropipettes, Whatman filter paper, a pH meter, tongs, pipettes of various graduations, chromatography plates, a pro-pipette, a refrigerator, a ruler, an electric dryer, an ultrasonic sonicator, spatulas, a spectrophotometer, test tubes, and a vortex.

Reagents and Solvents: The phytochemical study of the drugs required various solvents for extractions and reagents to reveal different chemical groups: distilled water, methanol, petroleum ether, chloroform, ethyl acetate, butanol, sodium acetate, acetic acid, hydrochloric acid, formic acid, picric acid, sulfuric acid, hydrochloric alcohol, isoamyl alcohol, ammonia, acetic anhydride, anisaldehyde, calcium chloride, ferric chloride, magnesium shavings, DPPH (2,2-diphenyl-1-picrylhydrazyl), ethanol, glibenclamide, Godin reagent, helium, metformin, methyl ethyl ketone, methyl ester (Sigma, St. Louis, USA), soda, DRAGENDORFF reagent (potassium iodobismuthate solution), Folin-Ciocalteu reagent (FCR), STIASNY reagent (10 mL of 40% formalin and 5 mL concentrated HCl), VALSER-MAYER reagent (potassium iodomercurate), and aluminum trichloride.

Plant Material: The plant material is the same as that described for the pharmacognostic study.

Materials

- **Extractions**

Extractions Using Traditional Methods : The traditional extraction methods were maceration, infusion, and decoction. The solvent used was water, applied to each drug at a 10% ratio. The drugs were coarsely pulverized before extraction (Odoh et al., 2025; *Quality Control Methods for Medicinal Plant Materials*, 1998).

Maceration: In a 1-liter Erlenmeyer flask, 50 g of coarsely pulverized plant (leaves and stems) were mixed with 500 mL of distilled water. The mixture was not subjected to magnetic stirring. After 24 hours at laboratory temperature, it was stirred, shaken, and filtered. This extraction was repeated three times. The filtered macerate from is the extemporaneous extract denoted.

Infusion: In a 1-liter Erlenmeyer flask, 50 g of coarsely pulverized plant leaf powder were mixed with 500 mL of boiling water. This extraction, lasting three hours, was repeated three times. The extract was then filtered. The infusion is the extemporaneous extract and denoted.

Decoction: The fruits and the leaves plants were coarsely pulverized separately, were each placed in a 1-liter flask. To 50 g of each drug powder, 500 mL of distilled water were added, and the mixture was boiled for 15 minutes. The decoction of each drug was filtered. These decoctions are denoted and constitute the extemporaneous extracts of these drugs.

Dry Extracts: The filtered extemporaneous aqueous extracts obtained (macerate, infusion, and decoction) were aliquoted for each extract. One aliquot was used for phytochemical screening. The other portion, after concentration in a rotary evaporator under reduced pressure, was distributed in small quantities into small glass flasks and frozen. Each frozen extract was lyophilized. This method allows transition from the frozen state to the dry state (ES), free of water. These dry extracts were quantified and stored in the refrigerator at 4 °C before use in various analytical tests, assays, and activities .

Phytochemical screening

Color reactions were used to detect constituents, mainly secondary metabolites (Odoh et al., 2025; *Quality Control Methods for Medicinal Plant Materials*, 1998).

Tube Characterization Tests: The search for chemical groups was performed by tube reactions. Results were classified as:

- Positive reaction: +;
- Negative: –.

The methods used for characterization tests are limited to detecting a few chemical groups with general reactions sufficiently sensitive to require only a small quantity of drug. They are only indicative.

Polyphenol Detection with Ferric Chloride Test ($FeCl_3$)

Principle: Polyphenols possess multiple phenolic groups. Phenol colorimetry reveals the formation of selective

complexes with ferric ions. The complexed ion coloration is greenish, blue-black, or brown-black.

Procedure: From each aliquot, 2 mL were taken, and one drop of 2% alcoholic ferric chloride solution was added. Ferric chloride, in the presence of polyphenolic derivatives, produces a greenish, blue-black, or brown-black coloration.

Tannin Detection with STIASNY Test

Principle: Tannins consist of two subgroups: gallic tannins (derived from gallic acid and combined as hydrolyzable heterosides) and catechic tannins (non-heterosidic, formed from condensed catechol polymers). Characterization uses STIASNY reagent (mixture of formalin and concentrated hydrochloric acid). Catechic tannins (condensed, non-hydrolyzable) precipitate as brown flakes upon heating and cooling, while gallic tannins (hydrolyzable heterosides) are hydrolyzed after adding sodium acetate. Adding a few drops of 3% $FeCl_3$ produces a greenish or blue-black coloration specific to polyphenols, indicating gallic tannins.

Procedure: Catechic Tannins (STIASNY Reaction): Evaporate 5 mL of each extract to dryness in a capsule. Add 15 mL of STIASNY reagent to the residue. Maintain the mixture in a water bath at 80 °C for 30 min. Allow to cool. The observation of large flaky precipitates in the solution characterizes catechic tannins (non-hydrolyzable).

Gallic Tannins: Filter each previous solution. Collect the filtrate and saturate with sodium acetate. Adding 3 drops of 3% ferric chloride produces an intense blue-black coloration, indicating the presence of gallic tannins (hydrolyzable) not precipitated by STIASNY reagent.

Flavonoid Detection with Shibata Reaction [57]

Principle: Flavonoids are widespread yellow pigments in the plant kingdom, existing as heterosides with a genin derived from the benzogammapyrone nucleus. Characterization occurs after hydrolysis with hydrochloric alcohol. Magnesium ions on the genin form cyanidin chloride, which is pink-orange or red-purple.

Procedure: Evaporate 2 mL of each solution to dryness in a capsule. After cooling, dissolve the residue in 5 mL of hydrochloric alcohol (1:1 v/v). Pour the solution into a test tube and add 2–3 magnesium shavings (flavonoid complexing agent). A pink-orange or purple coloration indicates flavonoids. Adding 3 drops of isoamyl alcohol intensifies this coloration.

Free or Combined Quinonic Substances Detection with BORNTRAËGER Reaction

Principle: Quinonic substances produce a cherry-red coloration under alkaline lye (ammonia, soda, lime water). The test involves immediate hydrolysis of genins to characterize total quinonic substances.

Procedure: In a capsule, evaporate 2 mL of each aliquot to dryness. Triturate the residue in 5 mL of 1/5 hydrochloric acid. In a test tube, heat the solution in a boiling water bath for half an hour. After cooling under cold running water, extract the hydrolysate with 20 mL of chloroform in a test tube. Collect the chloroform phase in a test tube and add 0.5 mL of BORNTRAËGER reagent (ammonia diluted 1/2). A coloration ranging from red to purple indicates quinones.

Sterols, Steroids, and Terpenes Detection with LIEBERMANN Reaction

Principle: In the presence of concentrated sulfuric acid or LIEBERMANN reagent, sterols and terpenes produce a red-brown coloration.

Procedure: The hot dry aliquot extract was dissolved in 1 mL of acetic anhydride-chloroform (1:1 v/v). This solution was divided between two numbered test tubes. In tube 2, 0.5 mL of concentrated sulfuric acid was carefully poured along the tube wall. The appearance of a purple or violet ring at the interface indicates a positive reaction.

Saponoside Detection

Principle: Saponosides dissolve in water, forming a persistent foamy solution upon shaking. This property is used to detect them and determine their foam index.

Procedure: In a series of 10 test tubes, numbered 1 to 10, aliquots were successively distributed from 1 to 10 mL. Volumes were adjusted to 10 mL in each tube with distilled water. Each tube was shaken lengthwise for 15 seconds at 2 shakes per second (30 shakes). After 15 minutes, foam height was measured in each tube. The tube with persistent foam height equal to 1 cm indicates the foam index value according to the ratio, with n° being the tube number: [Formula for foam index not fully provided in the text; typically calculated as 1000/n° where n° is the volume in the tube with 1 cm persistent foam.

Alkaloid Detection

Principle: Alkaloids combine with heavy metals (iodine, bismuth, mercury) and precipitate as colored heavy salts.

DRAGENDORFF reagent (potassium iodobismuthate) was used for characterization.

Procedure: In a capsule, 6 mL of each solution were evaporated to dryness. The residue was dissolved in 6 mL of 60 °C alcohol in a test tube. In the presence of 2 drops of DRAGENDORFF reagent, a precipitate or orange-red coloration appears.

2.5.2. Other characterizations

Moisture content

Principle of the Gravimetric Method: Moisture is obtained after desiccation at 105 °C ± 3 °C for 24 hours according to WHO recommendations (*Quality Control Methods for Medicinal Plant Materials*, 1998).

Method: A 5 g sample is placed in tared capsules and dried in an oven at 105 °C ± 3 °C for 24 hours. After cooling in a desiccator, capsules are reweighed, and moisture content is determined by the formula: [Moisture % = ((P1 – P2) / P0) × 100] P0: Sample weight P1: Weight of sample and crucible before oven P2: Weight of sample and crucible after oven.

Ash content (Quality Control Methods for Medicinal Plant Materials, 1998)

Principle of the Gravimetric Method: Ash is obtained after burning at 550 °C ± 3 °C for 6 hours according to WHO recommendations (*Quality Control Methods for Medicinal Plant Materials*, 1998).

Method: A 5 g sample is placed in tared capsules and dried in an oven at 105 °C ± 3 °C for 24 hours. After cooling in a desiccator, capsules are reweighed, and moisture content is determined by the formula: [Moisture % = ((P1 – P2) / P0) × 100] P0: Sample weight P1: Weight of sample and crucible before oven P2: Weight of sample and crucible after oven

Determination of pH

pH was determined using a pH meter with the pH counter electrode (*Quality Control Methods for Medicinal Plant Materials*, 1998).

Method: Ten grams of pulverized drug are macerated for 30 minutes in 75 mL of distilled water. The filtrate is analyzed using the pH meter. The value is displayed directly on the pH meter screen.

Determination of Total AcidityAcidity

The method is a colorimetric assay to determine the natural acid content of a product (*Quality Control Methods for Medicinal Plant Materials*, 1998).

Method: Determination uses a 0.4% (0.1 N) aqueous sodium hydroxide solution in the presence of a colored indicator (phenolphthalein). Acidity is calculated by: [Acidity = (N × V × 100) / (n × v)] N = Normality of the sampled solution V = Volume of the sampled solution n = Normality of soda v = Volume of soda

2.6. Statistical analysis

Ethnobotanical data was analyzed using descriptive statistics (frequencies, percentages) in Microsoft Excel 2016 and quantitative indices.

2.7. Ethical clearance

Ethical clearance was obtained from the Institutional Ethics Committee of the University of Douala

3. Results

3.1. Sociodemographic data of informants

A total of 39 informants composed of 18 females (46%) and 21 males (54%) aged between 22 and 64 years were interviewed. Majority of them were between 41–50 (25%)

Table 1 Demographic data on informants

Demographic data	% composition
Gender	
Female	46%
Male	54%
Age group in years	
< 30	5%
31–40	20%
41–50	25%
51–60	25%
61–70	20%
> 70	5%
Level of education	
No formal education	23%
Primary education	13%
Secondary education	56%
College education	0%
University education	8%

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and 51–60 (25%) years, while only 5% were aged below 30. In terms of education, majority of the informants (56%) had attained secondary school education, 8% had attained university education, while 23% had no formal education (Table below). The mean age for all informants was (43.5); the mean for females was 46.3 while that of males 52.1.

Medicinal plants, recipes and pathologies

Overall, 78 species were identified, of which eight (08) were the most cited: *Acmella oleracea*, *Syzygium aromaticum*, *Nicotiana tabacum*, *Psidium guajava*, *Azadirachta indica*, *Carica papaya*, *Citrus sinensis*, and *Allium cepa* (Table below).

These species belong to 38 botanical families, the most cited of which are: Lamiaceae (9 species); Euphorbiaceae (5 species); Solanaceae, Zingiberaceae, Apiaceae (4 species each); and finally Fabaceae, Asteraceae, Myrtaceae (3 species each), (Figure below). The most cited plants were *Acmella oleracea, Nicotiana tabacum, Syzygium aromaticum, Psidium gujava.*

Table 2. Plants identified

Common name	Scientific name	Family	NC
Deux côtés	*Eremomastax speciosa* (Hochst.) Cufod.	Acanthaceae	4
Alligator weed	*Alternanthera sessilis* (L.) R.Br. ex DC.	Amaranthaceae	1
Oignon	*Allium cepa* L.	Amaryllidaceae	10
Ail	*Allium sativum* L.	Amaryllidaceae	5
Manguier	*Mangifera indica* L.	Anacardiaceae	2
Rondelles	*Monodora myristica* (Gaertn.) Dunal	Annonaceae	1
Persil	*Petroselinum crispum* (Mill.) Fuss	Apiaceae	3
Anis vert	*Pimpinella anisum* L.	Apiaceae	1
Céleri	*Apium graveolens* L.	Apiaceae	1
Coriandre	*Coriandrum sativum* L.	Apiaceae	1
Ginseng	*Panax ginseng* C.A.Mey.	Araliaceae	7
Palmier à huile	*Elaeis guineensis* Jacq.	Arecaceae	1
Kande	*Aloe vera* (L.) Burm.f.	Asphodelaceae	1
Aloe vera	*Aloe vera* (L.) Burm.f.	Asphodelaceae	3
Fleur jalousie	*Arnica montana* L.	Asteraceae	1
Œil de la poule	*Acmella oleracea* (L.) R.K.Jansen	Asteraceae	50
Ndolè	*Gymnanthemum amygdalinum* (Delile) Sch.Bip.	Asteraceae	5
Ananas	*Ananas comosus* (L.) Merr.	Bromeliaceae	1
Papayer	*Carica papaya* L.	Caricaceae	13
Bitter cola	*Garcinia kola* Heckel	Clusiaceae	2
Kinkeliba	*Combretum micranthum* G.Don	Combretaceae	5
Canne des jumeaux	*Costus afer* Ker Gawl.	Costaceae	2
Miracle leaf	*Kalanchoe pinnata* (Lam.) Pers.	Crassulaceae	4
Concombre	*Cucumis sativus* L.	Cucurbitaceae	1
Dartrier	*Hopea odorata* Roxb.	Dipterocarpaceae	1
Les feuilles de Djeka	*Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg.	Euphorbiaceae	4
Kpwem	*Manihot esculenta* Crantz	Euphorbiaceae	1
Dibobonji	*Alchornea cordifolia* (Schumach. & Thonn.) Müll.Arg.	Euphorbiaceae	1
Njansang	*Ricinodendron heudelotii* (Baill.) Pierre ex Heckel	Euphorbiaceae	1
Chaya	*Cnidoscolus aconitifolius* (Mill.) I.M.Johnst.	Euphorbiaceae	1
Feuilles de makembe	*Aeschynomene indica* L.	Fabaceae	1
Bébé dort	*Mimosa pudica* L.	Fabaceae	2
Rattle	*Albizia lebbeck* (L.) Benth.	Fabaceae	1
Messep	*Ocimum gratissimum* L.	Lamiaceae	3
Pomme du singe	*Coleus monostachyus* (P.Beauv.) A.J.Paton	Lamiaceae	1
Basilic	*Ocimum gratissimum* L.	Lamiaceae	2
Basilic sacré	*Ocimum tenuiflorum* L.	Lamiaceae	1
Sauge	*Salvia officinalis* L.	Lamiaceae	1
Thym	*Thymus vulgaris* L.	Lamiaceae	3
Origan	*Origanum vulgare* L.	Lamiaceae	3
Menthe sauvage	*Mentha arvensis* L.	Lamiaceae	7
Avocatier	*Persea americana* Mill.	Lauraceae	8
Feuilles de laurier	*Laurus nobilis* L.	Lauraceae	3
Cannelle	*Cinnamomum verum* J.Presl	Lauraceae	4
Graines de lin	*Linum usitatissimum* L.	Linaceae	1
Fromager	*Ceiba pentandra* (L.) Gaertn.	Malvaceae	1
Neem	*Azadirachta indica* A.Juss.	Meliaceae	14
Feuilles mortes	*Ficus umbellata* Vahl	Moraceae	1
Bananier	*Musa* × paradisiaca L.	Musaceae	4
Noix de muscade	*Myristica fragrans* Houtt.	Myristicaceae	1
Goyavier	*Psidium guajava* L.	Myrtaceae	15
Clou de girofle	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	Myrtaceae	30

Kossipo / arbre à fièvre	*Eucalyptus globulus* Labill.	Myrtaceae	1
Sapin	*Abies alba* Mill.	Pinaceae	1
Poivre noir	*Piper nigrum* L.	Piperaceae	3
Citronnelle	*Cymbopogon citratus* (DC.) Stapf	Poaceae	9
Écorce à savon	*Quillaja saponaria* Molina	Quillajaceae	1
Orangier	*Citrus sinensis* (L.) Osbeck	Rutaceae	11
Citronnier / Asom	*Citrus limon* (L.) Osbeck	Rutaceae	2
Mapouè	*Populus heterophylla* L.	Salicaceae	1
Jujube en herbe	*Scoparia dulcis* L.	Scrophulariaceae	1
Ngono'o	*Solanum melongena* L.	Solanaceae	1
Tabac	*Nicotiana tabacum* L.	Solanaceae	20
Aubergine sauvage	*Solanum torvum* Sw.	Solanaceae	5
Piment	*Capsicum annuum* L.	Solanaceae	1
Herbe queue-de-rat	*Stachytarpheta cayennensis* (Rich.) Vahl	Verbenaceae	1
Gingembre	*Zingiber officinale* Roscoe	Zingiberaceae	6
Jujube sec / graine à paix	*Aframomum daniellii* (Hook.f.) K.Schum.	Zingiberaceae	5
Curcuma	*Curcuma longa* L.	Zingiberaceae	2

Table 2 presents the diversity of medicinal plants reported by the respondents, along with their frequency of citation (NC). Overall, 56 citations corresponding to 54 plant taxa belonging to 33 botanical families were recorded. This floristic richness highlights the importance of herbal medicine in the management of the conditions under investigation and reflects the extensive ethnobotanical knowledge held by the local communities.

The most represented families were Lamiaceae (9 species), followed by Apiaceae (4 species), Euphorbiaceae (5 citations corresponding to 4 species), and Solanaceae (4 species). The predominance of Lamiaceae may be attributed to their richness in essential oils and biologically active secondary metabolites, which justifies their widespread use in traditional medicine. Analysis of citation frequencies showed that certain species occupy a central place in local therapeutic practices. Acmella oleracea ("Eyeball plant") was the most frequently mentioned species (NC = 50), suggesting a strong recognition of its medicinal value among respondents. This species is particularly renowned for its analgesic, anti-inflammatory, and local anesthetic properties, especially in the treatment of oral and dental disorders. It was followed by *Syzygium aromaticum* (clove), with 30 citations, reflecting its extensive use due to its antiseptic, antimicrobial, and analgesic properties. *Nicotiana tabacum* (tobacco) ranked third (NC = 20), indicating its considerable use in local practices despite the well-documented health risks associated with its application. Other species with relatively high citation frequencies included *Psidium guajava* (15 citations), *Azadirachta indica* (14 citations), *Carica papaya* (13 citations), *Citrus sinensis* (11 citations), and *Allium cepa* (10 citations). These species may therefore be considered among the principal traditional remedies used by the study population. Conversely, several plants were mentioned only once, including *Hopea odorata*, *Quillaja saponaria*, *Arnica montana*, *Populus heterophylla*, and *Abies alba*. Such low citation frequencies may reflect either more specialized uses or limited local availability of these plant resources. The coexistence of indigenous African species, such as *Vernonia amygdalina*, *Alchornea cordifolia*, *Eremomastax speciosa*, and *Ricinodendron heudelotii*, with widely introduced exotic species, including *Panax ginseng*, *Salvia officinalis*, *Thymus vulgaris*, *Origanum vulgare*, and *Pimpinella anisum*, illustrates a dynamic pharmacopoeia that integrates both indigenous knowledge and external influences. Overall, this table reveals a high ethnobotanical diversity dominated by a few key species that enjoy broad consensus among respondents, while numerous other plants are used more occasionally. The most frequently cited species deserve particular attention in future phytochemical, pharmacological, and toxicological investigations to scientifically validate their traditional uses and identify potential bioactive compounds of therapeutic interest.

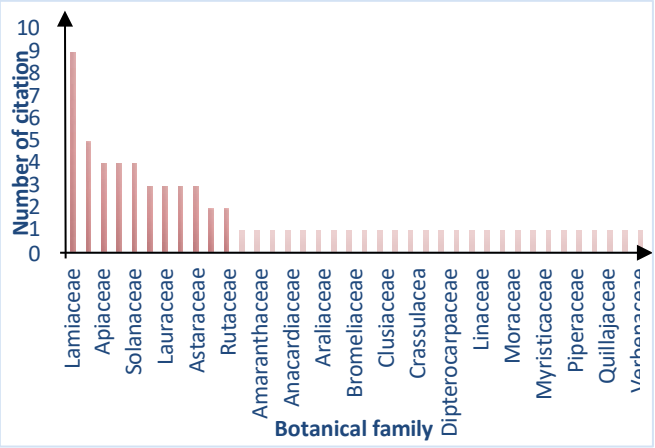

Figure 1. Number of citations of botanical families

Each of the cited plants has a preparation method that facilitates the release of its chemical compounds, and the most frequently mentioned method is decoction (42.86%) (Figure below).

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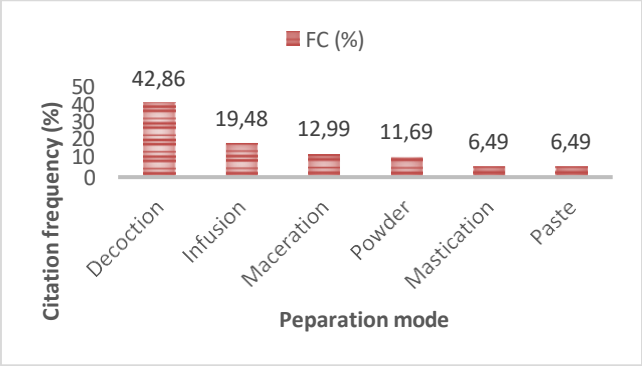

Figure 2. Method of preparation

The predominant mode of administration is mouthwash (61.04%) (Figure below).

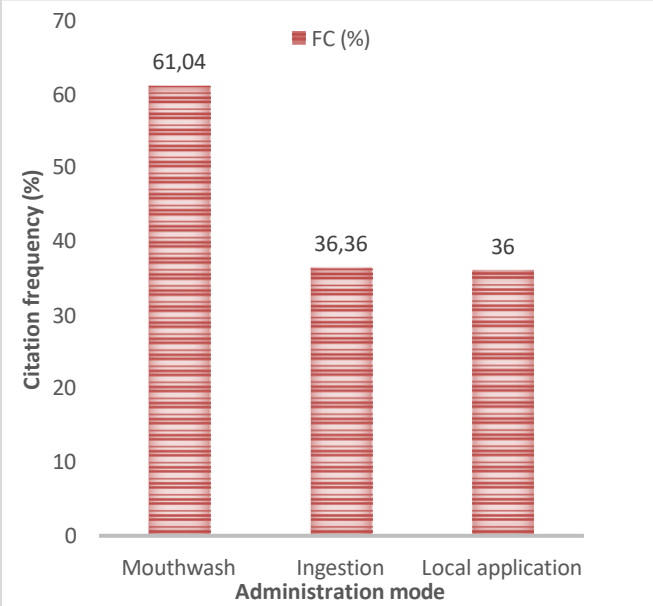

Figure 3. Mode of administration

The part of the plant most used, according to respondents, is the leaf (49.35%) (Figure below).

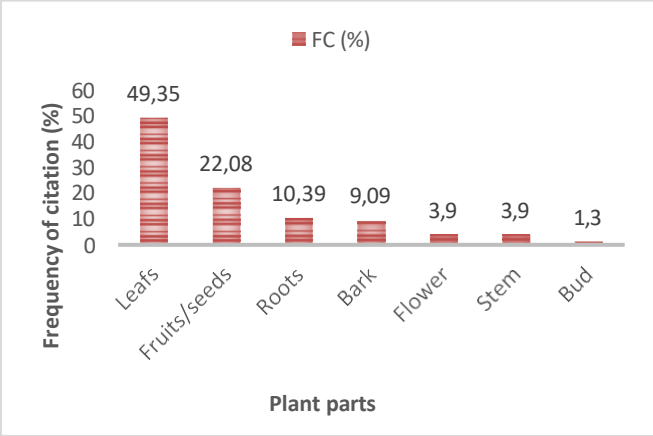

Figure 4. Frequency of citation of plant parts

Data collection showed that the oral pathology most targeted by these plants is gingivitis (41.55%), with the predominant /evaluation criterion being "good efficacy" (38.96%) (Figure 17), for a predominant treatment duration of 5–7 days (45.45%) (Figure 18).

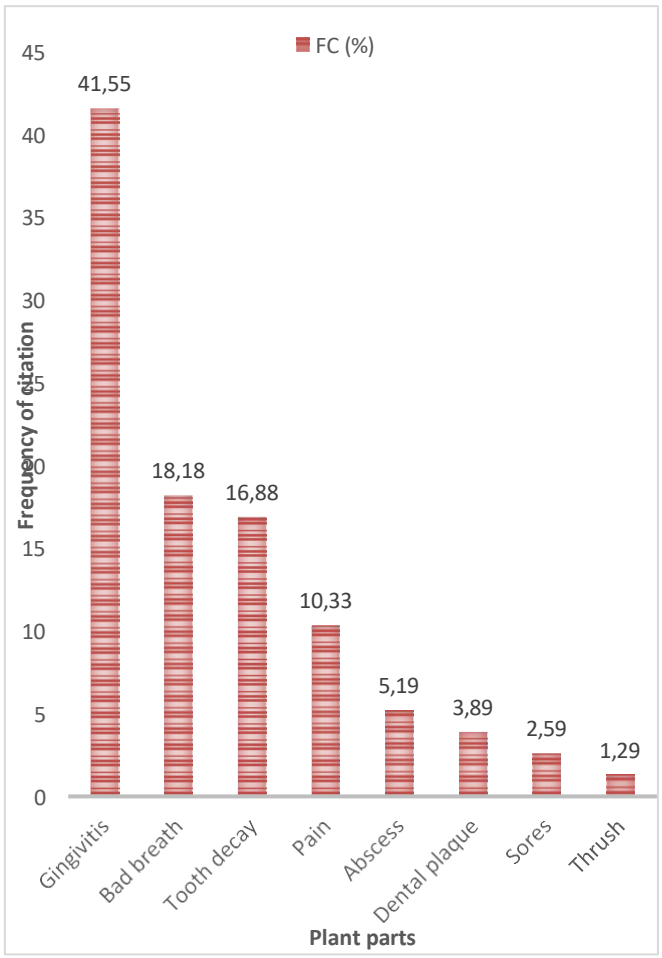

Figure 5. Frequency of citation of pathologies

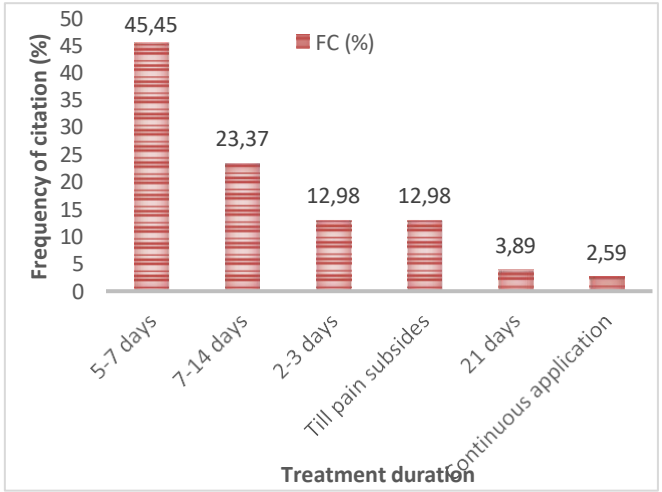

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Figure 6. Number of citations of treatment duration

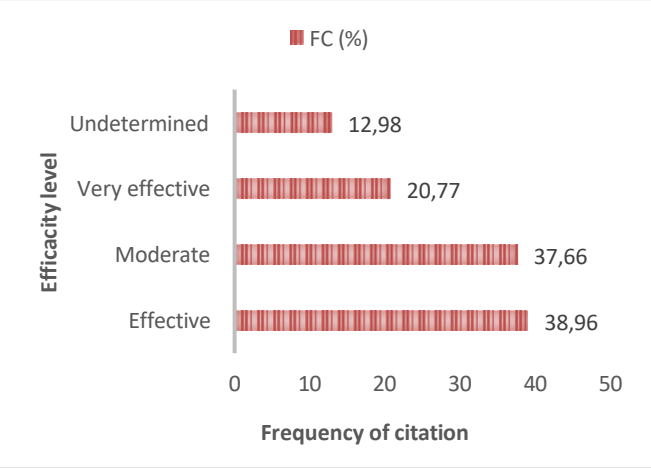


Figure 7. Frequency of citations of efficacy level of plant

Pharmacognostic study

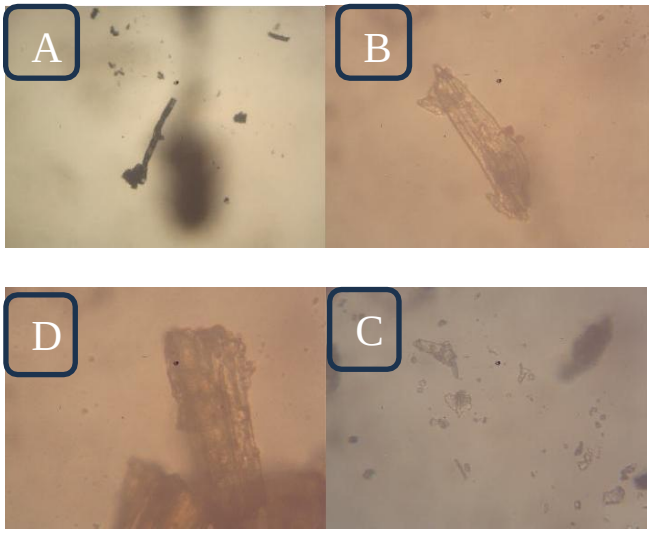
- **Acmella oleracea**

Macroscopic characteristics: The plant is an erect herb up to 40-60 cm tall, with glabrous to sparsely pilose stems that are green to reddish, 2.5-7.5 mm thick. Leaves are opposite, simple, ovate to deltate, 3-6 cm long and 2-4 cm wide, with dentate margins, truncate base, and acuminate apex; petioles winged, 2-6.5 cm long. Capitula are discoid and conical, 1-2 cm in diameter, yellow with reddish disk florets, on peduncles 3.5-12.5 cm long.

Figure 8. Image of *Acmella oleracea*, plant and powder (Forgwei *et al*., 2025)

Organoleptic characters: The powder is green to brown, yellow in color, with a strong characteristic herbal odor and a, burning taste accompanied by a tingling and numbing sensation.

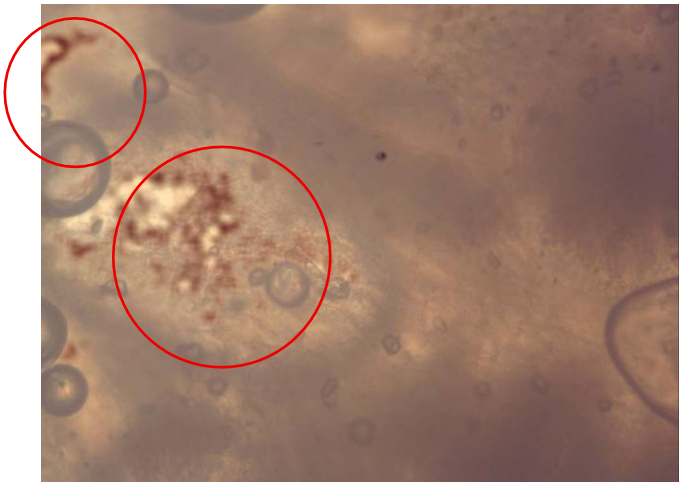
Microscopic characteristics: Observation of the powder of *Acmella oleracea* using the light microscope, magnification X10 and X40 permitted us to observe the following:



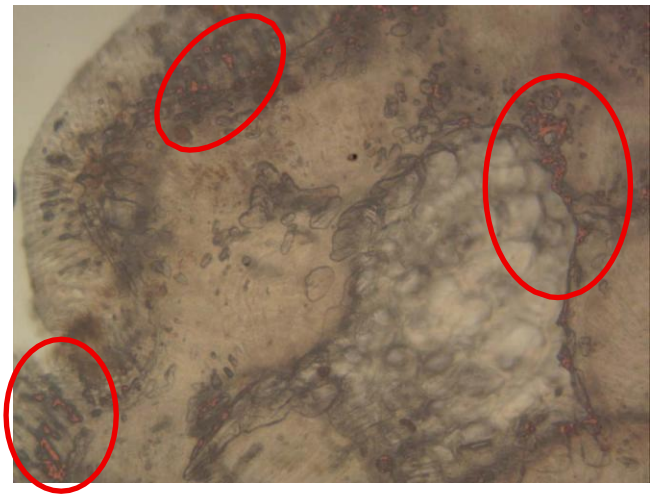
A: Trichome B, C: Sclereids D: Calcium oxalate crystals

- **Histochemistry**

Preliminary histochemistry revealed the presences of groups of secondary metabolites. Polyphenols was not conclusive.



Anthracenosides



Flavonoids

Thymus vulgaris

- *Macroscopic characteristics*

The plant is a bushy evergreen subshrub, 15-30 cm tall, with woody-based stems that are quadrangular when young and round when mature, green to brownish. Leaves are opposite, linear to elliptic, 5-10 mm long and 2-4 mm wide, with entire revolute margins, grey-green color, and acute apex; sessile or shortly petiolate. Inflorescences are terminal whorls of small lilac to purple flowers, 4-6 mm long.

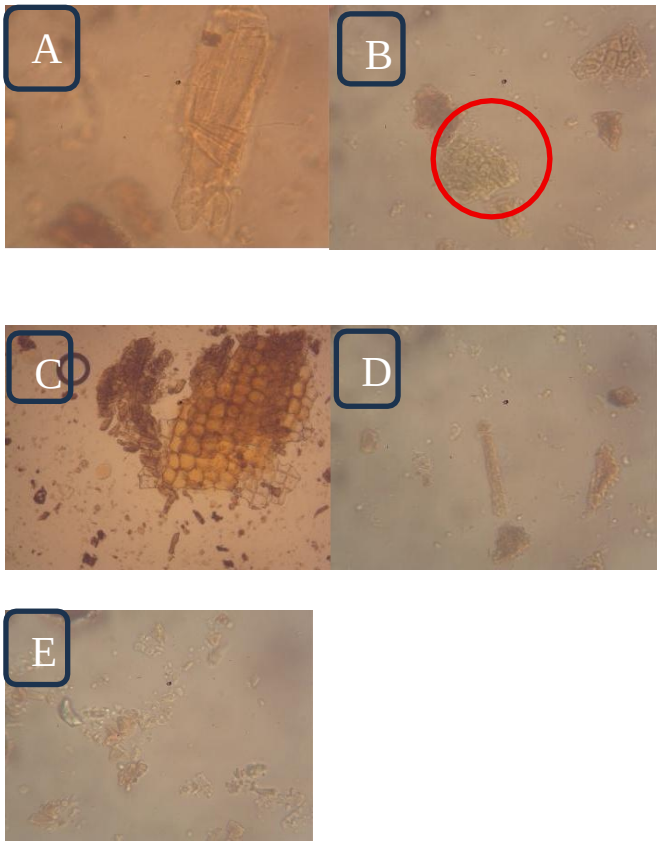
Figure 9. Thymus vulgaris plant and powder

- **Organoleptic characters**

The leaf powder is grey-green, with an aromatic herbal odor and a slightly warm and bitter taste.

- **Microscopic characteristics**

Observation of the powder using the light microscope, magnification X10 and X40 permitted us to observe the following:



A: Cork cells B: Cell fragments C: Epidermal cells D: Multicellular trichome E: Calcium oxalate crystals

Mentha avernsis

- **Macroscopic characteristics**

The plant is an erect herbaceous perennial 20-80 cm tall, with quadrangular, hairy stems that are green to reddish-brown. Leaves are opposite, ovate to lanceolate, 2-5 cm long and 1-2

cm wide, with serrate margins, cuneate base, and acute apex; petioles short, 2-5 mm long. Inflorescences are dense whorls of small lilac flowers in leaf axils.

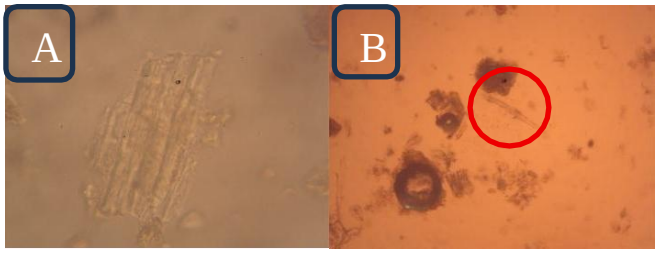
Figure 10. Image of *Mentha avernsis* plant and powder

- **Organoleptic characters:**

The leaf powder is light brown, with a strong minty aromatic odor and a cooling, slightly pungent taste.

- **Microscopic characteristics**

Observation of the powder using the light microscope, magnification X10 and X40 permitted us to observe the following:



A:Cork cells B: Trichome

- **Anatomo-histological studies**

This permitted us to observe some anatomical and histological structures.

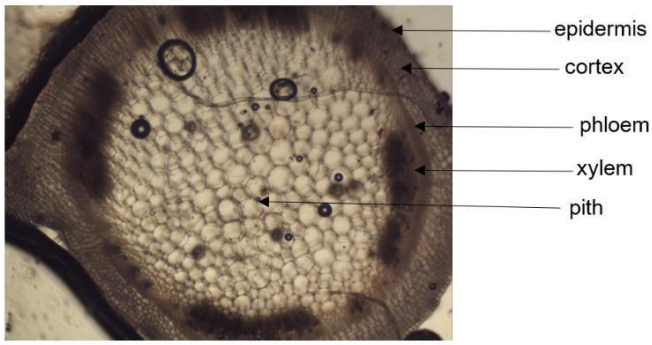
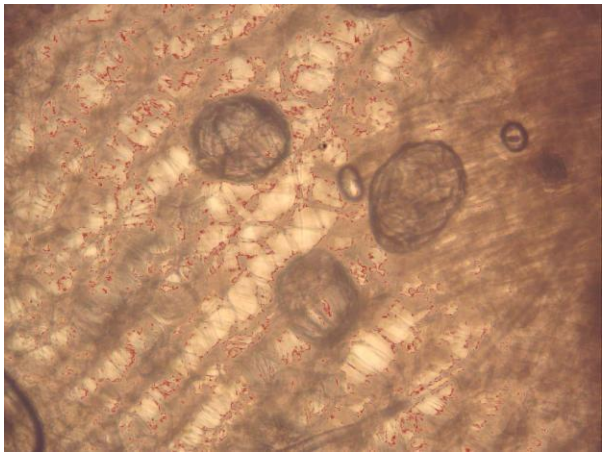


Figure 11. Cross section of Mentha stem, X40

- **Histochemistry**

Preliminary histochemistry revealed the presences of groups of secondary metabolites.



Anthracenosides (small red dots)

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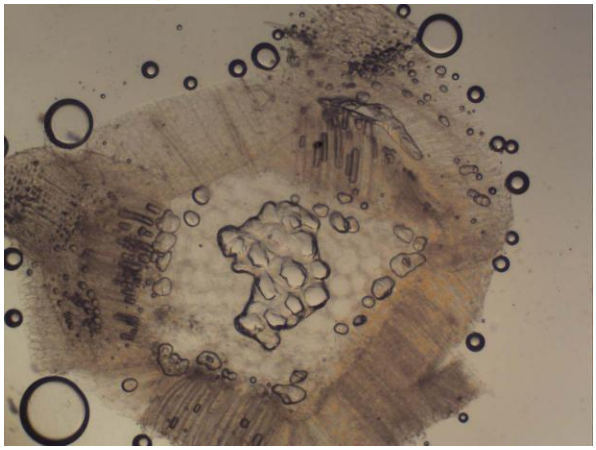

Flavonoids

Vernonia amygdalina

- **Macroscopic characteristics**

The plant is a shrub or small tree, 2-5 m tall (up to 10 m), with rough bark and dense black striations. Leaves are opposite, simple, elliptic to lanceolate, 6-20 cm long and 3-8 cm wide, with petioles 1-5 cm, finely toothed margins, acuminate apex, and cuneate base. Inflorescences are paniculate heads with white to pale mauve flowers.

Figure 12. Image of Vernonia amygdalina plant and powder (Forgwei *et al*., 2025)

- **Organoleptic characters**

The leaf powder is green to dark green, with a characteristic herbal odor and an intensely bitter taste.

- **Microscopic characteristics**

Observation of the powder using the light microscope, magnification X10 and X40 permitted us to observe the following:

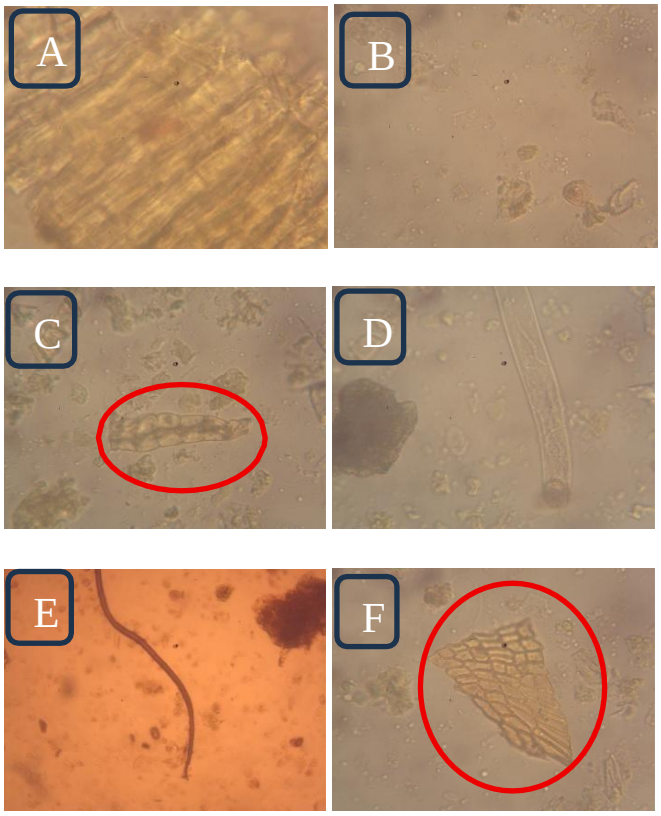

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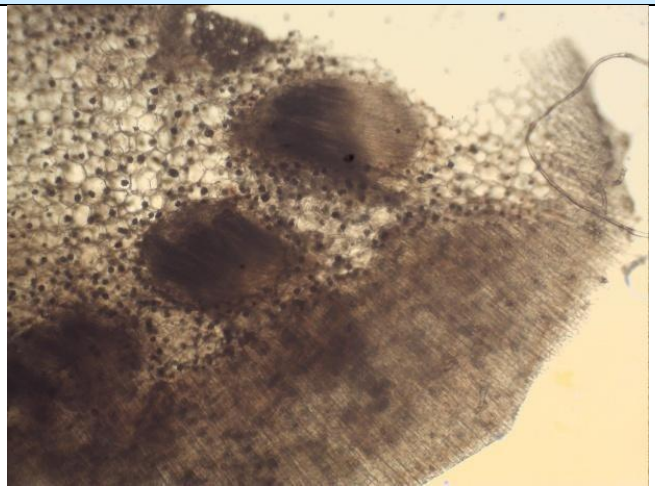
Table 3. Moisture, ash, pH and total acidity of plants

	Acmella Oleracea	*Thymus vulgaris*	*Mentha avernsis*	*Vernonia amygdalina*
Moisture	2.66	0.83	8.81	5.50
Ash	7.55	7.00	8.40	8.98
Ph	5.87	5.98	6.30	6.60
Total acidity	0.58	0.07	0.71	0.29

A:Cork cells B: Calcium oxalate crystals C: Sclereids D: Trichome E: Fibre F: Epidermal cells



- **Histochemistry**

Preliminary histochemistry revealed the presences of groups of secondary metabolites.

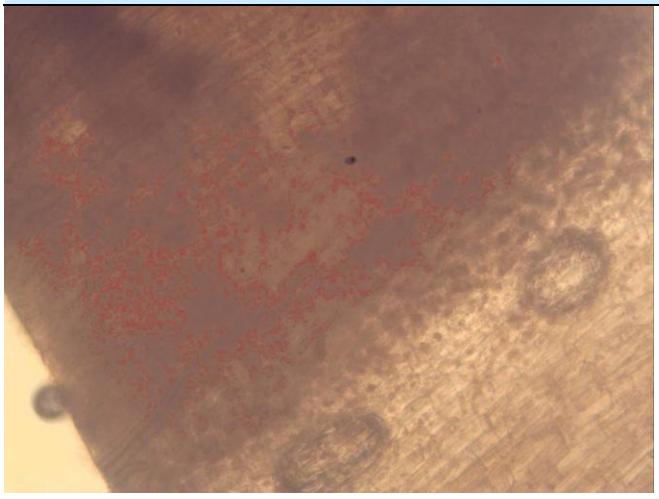
Table 4. Phytochemical profile of plants

	Acmella Oleracea	*Thymus vulgaris*	*Mentha avernsis*	*Vernonia amygdalina*
Alkaloids	++	-	++	+++
Flavonoids	++	+	++	++
Polyphenols	+++	++	++	++
Sterols, steroids, terpenes	++	+	+++	++
Resins	++	++	+	++
Coumarins	_	_	+	_
Saponins	+	_	+	_

Flavonoids

Table 2. Organoleptic characteristics of studied plant parts

	Colour of powder	Odor	Taste
Acmella oleracea	Brown, yellow	Strong, characteristic herbal	Burning, tingling and numbing sensation
Thymus vulgaris	Dark green to brown	Aromatic herbal	Warm, slightly bitter
Mentha avernsis	Light brown	Strong, minty, aromatic	
Vernonia amygdalina	Dark green	Characteristic herbal	Intensely bitter



Anthracenosides

3.2. Physicochemical characteristics

The moisture content is less than 12% in all 4 samples as recommended by WHO expert committee on specifications for pharmaceutical preparations (WHO Expert Committee on Specifications for Pharmaceutical Preparations & World Health Organization, 2018), which helps prevent the growth of mold, fermentation reactions, and oxidation that can alter the plant's quality and thus its active principle, thereby impacting the efficacy and safety of the medicine during long-term storage.

Determination of ash value helps in knowing absence of mineral matter that is accidentally introduced from earth, sand, floor sweepings, absence of other parts of plant, absence of adulterated and exhausted drug (World Health Organization, 1999). The range varies between species.

The pH value in the herbal extracts helps maintain the stability of bioactive compounds, prevents excessive microbial proliferation, and ensures compatibility with oral administration by avoiding irritation to mucous membranes, thereby preserving the efficacy and safety of the herbal medicine over extended storage periods.

Total acidity, measured as titratable acidity (typically expressed as % citric acid equivalent), represents the content of organic acids contributing to preservation, flavor, and antioxidant properties. The values of moisture content, total ash, pH and total acidity are presented in Table 11 below.

3.3. Phytochemical screening

Qualitative phytochemical screening was realized in test tube and showed the presence of many phytochemicals in different plants.

Alkaloids, flavonoids, polyphenols, sterols, steroids and resins were present in all plants. Coumarins were present only in *Mentha avernsis*, while saponins were present in *Acmella oleracea and Mentha avernsis* as show in table 12 below.

Results: + (present), ++ (abundant), +++ (very abundant), – (negative).

4. Discussion

The sociodemographic data indicated that there were more men than women. Mpondo *et al*., (Mpondo et al., 2012) found similar results in their work on phenolic plants used by the populations of the city of Douala. The male predominance observed in the possession of this knowledge may be linked to the priority given to men in African societies regarding inheritance, property rights, and succession within the heritage. The majority of these traditional healers were over forty (40) years old and belong to the adult class, who have greater experience in the practice of plant-based pharmacopoeia compared to the young. They can recognize most plant species through simple visual contact. The young are mostly educated and lose interest in traditional medicine in favor of various leisure activities. These results were similar to those found by Dibong *et al*., (S. Dibong et al., 2020) in their work on medicinal plants of the digestive apparatus. Majority of our participants had reached at least secondary school education. This differs from studies carried out by Bayaga *et al*.,(Bayaga et al., 2021) and Agbor *et al.*,(A. M. Agbor & Naidoo, 2011) who instead found most participants to either have no formal education or ended at primary education. This difference may be due to the setting, as Douala is an urban area, and access to education is more available. For most of the people surveyed, knowledge about traditional plants comes from the family; this transmission ensures the succession and preservation of family knowledge, as cited by *Etame et al*.,(Etamé Loé et al., 2018) and Jazy *et al*.,(Jazy et al., 2017) hence the importance of transmitting knowledge to relatives.

We identified 78 plant species across 38 families, confirming the floristic richness of the littoral region as already reported by Tchatat *et al*. (2006), and Dibong *et al*. (2016) (S. D. Dibong et al., 2016; Tchatat & Ndoye, 2006). The most represented families were the *Lamiaceae, Euphorbiaceae, Apiaceae, Zingliberaceae* and *Solanaceae*. A review by Cock *et al.* (2023) on south African medicinal plants (Cock et al., 2018) found *Solanaceae* to be most dominant, differing from the Lamiaceae prominence here. Camara *et al*. (2023) (Camara et al., 2023) carried out a similar study on the use of medicinal plants to treat mouth affections in Guinea and found *Anonaceae* to be the most dominant family. This divergence likely stems from biogeographical variations, as well as differences in social and cultural beliefs amongst populations. *Acmella oleracea*, *Syzygium aromaticum*, and *Nicotiana tabacum* the most cited. The leafs were the most common part of the plants used. This was in accordance with earlier studies by Bene *et al*. (2016) and Rahmatullah *et al*. (2012) who reported that they were the part of the plant most used in traditional medicine. This could be explained by the ease and speed of harvesting. Furthermore, regular leaf harvesting poses no threat to the survival of individual plant and encourages the frequent and safe use of the leaves in herbal preparations. Decoction was the preferred method of preparation. This could be because decoction allows for a more complete extraction of the active molecules from a plant, during the boiling of the mixture. This was similar to results found by Dibong *et al*. (2020), Jazy *et al*. (2012), and Camara *et al*. (2023) (Camara et al., 2023; S. Dibong et al., 2020; Jazy et al., 2017). The dominant means of administration was mouthwash, which is very common in oral ethnomedicine. This aligns with studies by Agbor *et al*. (2015), Cock *et al.* (2018) and Camara *et al* (2023) (A. M. Agbor et al., 2011; Camara et al., 2023; Cock et al., 2018), and could be explained by the ease of access to the site of affection.

Gingivitis was the most cited pathology here, accompanied by pain, swelling and bleeding from the gum. This differs from studies by Agbor *et al.*(M. A. Agbor & Azodo, 2011) on Self-medication for oral health problems in Cameroon, who had Toothache as the most common use. Camara *et al*. (2023)

(Camara et al., 2023) conducted a similar study in Guinea, and instead found dental caries as the most common pathology. These differences could be attributed to different realities amongst people in different places. Also, Douala being an urbanized area, the population has better knowledge and access to primary health care in case of tooth decay. The differences between studies can be attributed to different demographics of participants. The dominant duration of treatment was 5–7 days, and good efficacy was most often gotten.

All samples exhibited macroscopic, organoleptic, and microscopic traits largely matching descriptions in literature. Specifically, *Acmella oleracea* aligns with *Aktar et al.* characterization (Aktar et al., 2024), while *Vernonia amygdalina's* traits resemble those by Ijeh *et al*. (Ijeh & Ejike, 2011). *Thymus vulgaris* powder match Kuete *et al*. (Kuete, 2017), and *Mentha arvensis*, similar to Nazim *et al*(Nazim et al., 2020).

Moisture and total ash contents are vital for herbal drug quality, stability, and purity. High moisture promotes microbial and enzymatic growth, shortening shelf life, while elevated ash indicates presence of natural minerals. Low ash suggests low mineral content or inorganic impurities. All our samples are within the range recommended by African pharmacopoeia(AFRICAN UNION SCIENTIFIC, TECHNICAL & RESEARCH COMMISSION, 2014) with for total ash to be between 6.5% and 23%, moisture content between 4.2 and 10.5%. The pH of our samples was in line with what Felle *et al*. (Felle, 2005) found to optimal pH range for plant growth and maintenance of bioactive stability. Total acidity aids preservation and antioxidants.

Phytochemical screening revealed flavonoids, polyphenols, sterols/steroids/terpenes, and resins in all plants, with coumarins in *Mentha arvensis* only and saponins in *Acmella oleracea* and *Mentha arvensis*. These affirm Upthala *et al*'s results for *Acmella oleracea* (Uthpala & Navaratne, 2021), indicating the presence of the above mentioned phytochemicals in acmella. With respect to *Thymus vulgaris*, Saleem *et al*. (Saleem et al., 2022) found phenols, flavonoids, terpenoids and steroids, while alkaloids, saponins and tanins were absent. Singh *et al*. (Singh, 2023) found the same constituents in *Mentha avernsis*, while Edo *et al*. (Edo et al., 2023) had similar results for *Vernonia amygdalina*, with the only difference being the presence of coumarins, which we didn't find. These phytochemicals have numerous properties including their anti-inflammatory, antioxidant, and hormonal effects, justifying oral pathology use. Shared metabolites (polyphenols, alkaloids, anthraquinones) suggest treatment of oral pathologies via anti-inflammatory and antimicrobial actions, as Camara *et al*.(Camara et al., 2023) propose for similar pathologies in Guinea. The differences in phytoconstituents between our results and others can be due to different geographical zones, as well as different methods of extraction, and different solvents.

A broad review indicates these plants are used across sub-Saharan Africa and Cameroon for oral and infectious diseases. Ethnobotanical surveys in western Cameroon villages for oral issues report overlaps, with species here matching results from other studies by Telefo *et al*. (Telefo et al., 2011) in the baham community, Dibong *et al*. (S. Dibong et al., 2020) in Bamoun, Mpondo *et al*. (Mpondo Mpondo et al., 2017) in the Haut Nyong, and Etame *et al*. (Etamé Loé et al., 2018) in Lom et Djerem. These findings could aid monographs for botanical and biological identity, detecting adulteration and ensuring safety and efficacy in treatment of oral pathologies. Further studies are essential to validate and expand this data.

5. Conclusion

This study documented the ethnobotanical knowledge, pharmacognosic properties, and phytochemical constituents of medicinal plants used for managing oral diseases in Douala, Cameroon. A cross-sectional survey involving traditional healers identified 78 plant species from 38 botanical families, with Lamiaceae, Euphorbiaceae, and others being prominent. The most frequently cited species included *Acmella oleracea*, *Syzygium aromaticum*, *Nicotiana tabacum*, *Psidium guajava*, *Azadirachta indica*, and *Carica papaya*, primarily for treating gingivitis through decoction and mouthwash administration, using leaves as the predominant plant part. Treatment durations typically ranged from 5–7 days, with healers reporting good efficacy as the primary evaluation criterion.

Pharmacognosic evaluation of prioritized species, *Acmella oleracea*, *Thymus vulgaris*, *Mentha arvensis*, *and Vernonia amygdalina* revealed distinct macroscopic, organoleptic, and physicochemical traits, including low moisture content, total ash, neutral to slightly acidic pH, and titratable acidity, all aligning with standards for quality, stability, and safety in herbal preparations. Phytochemical screening confirmed the presence of flavonoids, polyphenols, sterols/steroids/terpenes, and resins across all four species, with coumarins exclusive to *Mentha arvensis* and saponins in *Acmella oleracea* and *Mentha arvensis*, highlighting their potential anti-inflammatory, antimicrobial, and therapeutic effects against oral pathologies.

These findings highlight the integral role of traditional herbal practices in urban oral healthcare, validating cultural

knowledge through scientific analysis while emphasizing sustainable resource use. To advance integration into Cameroon's healthcare framework, future studies should prioritize clinical trials, toxicity assessments, and formulation development for these remedies, thereby improving accessibility, efficacy, and safety for underserved communities

References

1. AFRICAN UNION SCIENTIFIC, TECHNICAL & RESEARCH COMMISSION. (2014). *African Pharmacopoeia* (2nd ed., Vol. 1). Afrian Union.

2. Agbor, A. M. (2015). Methanol Extracts of Medicinal Plants Used for Oral Healthcare in Cameroon. *Biochemistry & Pharmacology: Open Access*, *04*(02). https://doi.org/10.4172/2167-0501.1000164

3. Agbor, A. M., & Naidoo, S. (2011). Knowledge and practice of traditional healers in oral health in the Bui Division, Cameroon. *Journal of Ethnobiology and Ethnomedicine*, *7*, 6. https://doi.org/10.1186/1746-4269-7-6

4. Agbor, A. M., Naidoo, S., & Mbia, A. M. (2011). The role of traditional healers in tooth extractions in Lekie Division, Cameroon. *Journal of Ethnobiology and Ethnomedicine*, *7*(1), 15. https://doi.org/10.1186/1746-4269-7-15

5. Agbor, M. A., & Azodo, C. C. (2011). Self medication for oral health problems in Cameroon. *International Dental Journal*, *61*(4), 204–209. https://doi.org/10.1111/j.1875-595X.2011.00058.x

6. Aktar, Mst. A., Bhuia, Md. S., Molla, S., Chowdhury, R., Sarkar, C., Al Shahariar, Md., Roy, P., Reiner, Ž., Sharifi-Rad, J., Calina, D., Shakil, Md. A. K., & Islam, M. T. (2024). Pharmacological and phytochemical review of Acmella oleracea: A comprehensive analysis of its therapeutic potential. *Discover Applied Sciences*, *6*(8), 412. https://doi.org/10.1007/s42452-024-06108-5

7. Bayaga, H., Marie, N., Béatrice, M., & Bathélémy, N. (2021). Ethno Pharmacological Knowledge of Common Medicinal Plants Used For the Traditional Treatment of Oral Pathologies in the Mayo-Kani Division, (Cameroon). *Saudi Journal of Medicine and Medical Sciences*, *7*, 508–516. https://doi.org/10.36348/sjmps.2021.v07i10.008

8. Camara, A. K., Keita, T., Camara, A. A., Tonguino, T. G., Kourouma, A., Kolie, A., Soumah, A., Traore, N., & Traore, M. S. (2023). Enquête ethnobotanique sur l'utilisation des plantes médicinales dans le traitement des affections bucco-dentaires dans la commune de Kindia en République de Guinée. *Pharmacopée et médecine traditionnelle africaine*, *21*(2), 107–115.

9. Cock, I. E., Selesho, M. I., & Van Vuuren, S. F. (2018). A review of the traditional use of southern African medicinal plants for the treatment of selected parasite infections affecting humans. *Journal of Ethnopharmacology*, *220*, 250–264. https://doi.org/10.1016/j.jep.2018.04.001

10. Dibong, S. D., Mvogo Ottou, P. B., Vandi, D., Ndjib, R. C., Monkam Tchamaha, F., & Mpondo Mpondo, E. (2016). Ethnobotanique des plantes médicinales anti hémorroïdaires des marchés et villages du Centre et du Littoral Cameroun. *Journal of Applied Biosciences*, *96*(1), 9072. https://doi.org/10.4314/jab.v96i1.5

11. Dibong, S., Etamé Loé, G., Okalla Ebongue, C., Ngaba, G., Boudjeka, V., Yinyang, J., Nga, E., & Mpondo, E. (2020). *Contribution à l'étude ethnobotanique des plantes médicinales traitant les maladies de l'appareil digestif des peuples Bamouns au Cameroun*.

12. Edo, G. I., Samuel, P. O., Jikah, A. N., Onoharigho, F. O., Idu, L. I., Obasohan, P., Opiti, A. R., Electric, J., Ikpekoro, V. O., Otunuya, C. F., Ugbuwe, E., Ongulu, J., Ijide, M., Nwaose, I. D., Ajakaye, S. R., & Owigho, J. E. (2023). Biological and bioactive components of bitter leaf (Vernonia amygdalina leaf): Insight on health and nutritional benefits. A review. *Food Chemistry Advances*, *3*, 100488. https://doi.org/10.1016/j.focha.2023.100488

13. Etamé Loé, G., Ngoule, C., Mbome, B., Pouka, C., Ngene, J.-P., Yinyang, J., Okalla Ebongue, C., Ngaba, G., & Dibong, S. (2018). Contribution a l'étude des plantes médicinales et leurs utilisations traditionnelles dans le département du Lom et Djerem (Est, Cameroun). *Journal of Animal and Plant Sciences*, *35*.

14. Felle, H. H. (2005). pH Regulation in Anoxic Plants. *Annals of Botany*, *96*(4), 519–532.

https://doi.org/10.1093/aob/mci207

15. Focho, D. A., Newu, M. C., Anjah, M. G., Nwana, F. A., & Ambo, F. B. (2009). Ethnobotanical survey of trees in Fundong, Northwest Region, Cameroon. *Journal of Ethnobiology and Ethnomedicine*, *5*(1), 17. https://doi.org/10.1186/1746-4269-5-17

16. Ijeh, I., & Ejike, C. (2011). Current perspectives on the medicinal potentials of Vernonia amygdalina Del. *Journal of Medicinal Plants Research*, *5*.

17. Jazy, M. A., Karim, S., Morou, B., Sanogo, R., & Mahamane, S. (2017). Enquête Ethnobotanique Auprès Des Tradipraticiens De Santé Des Régions De Niamey Et Tillabéri Au Niger: Données 2012-2017. *European Scientific Journal, ESJ*, *13*(33), 276. https://doi.org/10.19044/esj.2017.v13n33p276

18. Jiofack, T., Fokunang, C., Guedje, N., Kemeuze, V., Fongnzossie, E., Nkongmeneck, B. A., Mapongmetsem, P. M., & Tsabang, N. (n.d.). *Ethnobotanical uses of medicinal plants of two ethnoecological regions of Cameroon*.

19. Kuete, V. (2017). Thymus vulgaris. In *Medicinal Spices and Vegetables from Africa* (pp. 599–609). Elsevier. https://doi.org/10.1016/B978-0-12-809286-6.00028-5

20. Mpondo, E., Dibong, S., Ladoh Yemeda, C. F., Priso, R., & Ngoye, A. (2012). Les plantes à phénols utilisées par les populations de la ville de Douala. *Journal of Animal and Plant Sciences*, *15*, 2083–2098.

21. Mpondo Mpondo, E., Ngene, J. P., Mpounze Som, L., Etame Loe, G., Ngo Boumsong, P. C., Yinyang, J., & Dibong, S. D. (2017). Connaissances et usages traditionnels des plantes médicinales du département du haut Nyong. *Journal of Applied Biosciences*, *113*(1), 11229. https://doi.org/10.4314/jab.v113i1.12

22. Nazim, M., Sadiq, Q.-U.-A., Nawaz, A., Anjum, S., Ali, M., & Maryam, H. (2020). Mentha arvensis, a medicinal and aromatic plant, has high nutritional value and several-uses: A review. *Buletin Agroteknologi*, *1*(2), 37. https://doi.org/10.32663/ba.v1i2.1180

23. Ndenecho, E. N. (2020). Herbalism and resources for the development of ethnopharmacology in Mount Cameroon region. *International Journal of Medicinal Plants Research*, *9*(7), 1–9.

24. Odoh, U. E., Gurav, S. S., & Chukwuma, M. O. (Eds.). (2025). *Pharmacognosy and Phytochemistry: Principles, Techniques, and Clinical Applications* (1st ed.). Wiley. https://doi.org/10.1002/9781394203680

25. Petersen, P. E., Bourgeois, D., Ogawa, H., Estupinan-Day, S., & Ndiaye, C. (2005). The global burden of oral diseases and risks to oral health. *Bulletin of the World Health Organization*, *83*(9), 661–669.

26. *Quality control methods for medicinal plant materials*. (1998). World Health Organization.

27. Saleem, A., Afzal, M., Naveed, M., Makhdoom, S. I., Mazhar, M., Aziz, T., Khan, A. A., Kamal, Z., Shahzad, M., Alharbi, M., & Alshammari, A. (2022). HPLC, FTIR and GC-MS Analyses of Thymus vulgaris Phytochemicals Executing In Vitro and In Vivo Biological Activities and Effects on COX-1, COX-2 and Gastric Cancer Genes Computationally. *Molecules*, *27*(23), 8512. https://doi.org/10.3390/molecules27238512

28. Singh, S. (2023). A REVIEW ON SOME MEDICINAL PLANT SPECIES WITH THE MOST TRADITIONAL MEDICINAL USAGE IN INDIA. *International Journal of Biological Innovations*, *05*(01), 52–62. https://doi.org/10.46505/IJBI.2023.5103

29. Tchatat, M., & Ndoye, O. (2006). Etude des produits forestiers non ligneux d'Afrique centrale: Réalités et perspectives. *Bois Forêts Trop*, *288*, 27–39.

30. Telefo, P. B., Lienou, L. L., Yemele, M. D., Lemfack, M. C., Mouokeu, C., Goka, C. S., Tagne, S. R., & Moundipa, F. P. (2011). Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon. *Journal of Ethnopharmacology*, *136*(1), 178–187. https://doi.org/10.1016/j.jep.2011.04.036

31. Uthpala, T. G. G., & Navaratne, S. B. (2021). *Acmella oleracea* Plant; Identification, Applications and Use as an Emerging Food Source – Review. *Food Reviews International*, *37*(4), 399–414. https://doi.org/10.1080/87559129.2019.1709201

32. Vougat, R., Foyet, H., Garabed, R., & Ziebe, R. (2015). Antioxidant activity and phytochemical constituent of two plants used to manage foot and mouth disease in the Far North Region of Cameroon. *Journal of Intercultural Ethnopharmacology*, *4*(1), 40. https://doi.org/10.5455/jice.20141020064838

33. Wasiullah, M., Yadav, P., & Yadav, S. (2023). *Who Guidelines on Quality Control and Standardization of Herbal Medicines*. *8*(3).

34. WHO Expert Committee on Specifications for Pharmaceutical Preparations & World Health Organization (Eds.). (2018). *WHO Expert Committee on Specifications for Pharmaceutical Preparations: Fifty-second report*. World Health Organization.

35. World Health Organization. (1999). *WHO monographs on selected medicinal plants. Volume 1*. World Health Organization.

36. World Health Organization (Ed.). (2004). *WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems*. World Health Organization.