Scholars Academic Journal of Biosciences
Abbreviated Key Title: Sch Acad J Biosci
ISSN 2347-9515 (Print) | ISSN 2321-6883 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Environment Management

Ethnobotany of Medicinal Plants used by the Populations of the Plateaux Department (Republic of Congo)

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DOI: 10.36347/sajb.2022.v10i12.005 | **Received:** 04.11.2022 | **Accepted:** 13.12.2022 | **Published:** 24.12.2022

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Abstract | **Original Research Article**

This study was carried out in the Plateaux Department. It consisted in improving the knowledge of the use of medicinal plants by the populations of the said Department. A series of ethnobotanical surveys were conducted using a questionnaire and 300 informants were interviewed. The results show that 98 medicinal species divided into 84 genera and 56 families were inventoried. Rubiaceae (8.91%) followed by Asteraceae (7.80%), Fabaceae (7.05%) and Zingiberaceae (4%) are the most representative families. Among these species, spontaneous species are widely used. Leaves (46.53%) followed by barks (13.56%) and roots (13.32%) are the most commonly used parts and decoction (47.79%) is the most common method of preparation. Concerning the diseases treated, malaria (16.39%), stomach ache (8.47%), cough (8.44%), fever (6.57%), haemorrhoids (6.31%) and diarrhoea (5.80%) are the most treated diseases. *Nauclea latifolia* Sm., *Morinda morindoides* (Baker) Milne-Redh, *Mangifera indica* L., *Chromolaena odorata* (L.) King & H. Rob. are the plants most involved in the constitution of the recipes. This study will allow the establishment of a Congolese pharmacopoeia in the future and will constitute a source of information for scientific research in the fields of phytochemistry and pharmacology.

Keywords: Ancestral knowledge, therapeutic uses, local communities, traditional medicine, endogenous knowledge.

INTRODUCTION

Ethnobotany studies the reciprocal relations between humans and plants, the use that humans have made of the plants that surround them since the dawn of time (Bouroubou, 2013). Indeed, plants occupy a vital place in almost every aspect of man's daily life; they provide him with food, fiber, fuel, shelter, clothing, traditional and synthetic medicines. In addition, through traditional medicine, they play an essential role in primary health care. It is estimated that 60% of the world's population uses traditional medicines and in some countries these medicines are an integral part of the public health system (Natura, 2000). Thus, given their cultural, social and economic importance, several studies have been conducted worldwide (Baran, 2000; Chabrier, 2010) and in Africa (Sofowora, 1993; Bourobou, 2013). Similarly, several studies have been undertaken in Congo, the most recent of which are those of Louméto (2010), Kimpouni and Motom (2012), Bokatola (2013), Kimpouni *et al*., (2014), Mamboueni (2016) and Mboussy (2016). Unfortunately, the results of these studies have not been statistically processed. The present study fills this gap in the processing of the results. In general, work on the vegetation of the Plateaux Department and the TéKé and Mbochi ethnic-linguistic group in the localities of Ngo, Nsa, Lékana, Ollombo, Ongogni and Abala remains insufficient, even limited, at present.

Nowadays, it has been observed that knowledge on the use of medicinal plants is disappearing due to illiteracy and modernism (Tshidibi, 2012; Ilumbe, 2014). It is important to valorise this traditional knowledge, to safeguard the cultural knowledge on the use of the floral biodiversity of natural formations, in order to fight against the erosion of endogenous knowledge.

The general objective of the study is to improve the knowledge on medicinal plants used in the Plateaux

Department. Specifically, this study aims to: (i) identify the medicinal plants used by the populations of the Plateaux Department; (ii) determine the pathologies treated by medicinal plants in these localities.

MATERIALS AND METHODS

Study environment

Located in the center of the country between latitude 2°32'09" South and longitude 14°45'09" East, the Department of the Plateaux is bordered by the Department of Cuvette and Cuvette Ouest to the north, the Department of Pool to the south, Democratic Republic of Congo to the east, the Department of Lékoumou and Gabon to the west. It has a surface area of 38400 km^2 or 11% of the country's surface area. This Department comprises eleven (11) Districts including Ngo, Nsa, Lékana, Ongogni, Ollombo and Abala which were selected as study sites.

The climate is equatorial and is predominantly influenced by intertropical low pressure from October to May and southern subtropical high pressure from June to September. Average annual temperatures range from 23°C on the Batéké highlands to 26°C on the lowlands and the Congolese basin. Approximately 1,400 to 2,500 mm of water fall per year. The soil is made up of tertiary geological formations of the Batéké Plateaux series, essentially consisting of sandylimons and polymorphous sandstones (Descoings, 1975). The vegetation consists of savannahs with *Loudetia simplex* (Nees) C.E. Hubb., *Loudetia demeusei* (De Wild.) and *Hymenocardia acida* Tul., *Hyparrhenia diplandra* (Hack.) Stapf. and *Bridelia ferruginea* Benth. (Makany, 1976), followed by forest fragments formed by the sacred forests of the old villages. Agriculture is the main activity. The main crops are cassava and groundnuts (Kila Elenga, 2009). Fishing, hunting, gathering and livestock breeding are also practised.

Methods

Data Collection

Data were collected through a series of ethnobotanical surveys using semi-structured interviews based on a pre-designed questionnaire. The collection of information in the field is based on personal interviews and non-standard interviews based on a pre-designed questionnaire involving both genders. Together with a guide who also acts as an interpreter, the information gathering consisted of door-to-door interviews. These interviews are conducted in the local language with 300 informants. These methods were also used by Camara-Leret *et al.*, (2012). In this study, the ethnobotanical approach consisted of identifying the resource and knowing the method of preparation, the route of administration and then the pathology treated. Finally, it is punctuated by the collection of specimens in the forests, savannahs, fields and around houses. Species found in the field were packed in boxes with newspaper for identification at the laboratory. The surveys took place from September 2020 to September 2021.

Laboratory work

Plant identification

The species collected were identified at the Herbarium of the Institut National de Recherche en Sciences exactes et Naturelles (IRSEN). The identification of the species collected was done by comparison with the participation of Moutsamboté, in his capacity as botanist. This allowed us to know the taxonomic position of each species collected.

Determination of morphological and biological types, phytogeographical distribution and habitat

The determination of morphological, biological, phytogeographical distribution and habitat types was done by consulting the works of Lubini *et al.*, (1994) and Moutsamboté (2012).

Data Processing

The collected data were entered and processed using Microsoft Excel 2013 and Ri386 4.1.0 software.

The LSD test is used to determine statistically significant differences ($p < 0.05$), indicated by letters (a, b, c, d, e), between species. The data obtained were coded. The histograms were made from the pivot tables. The species cited in the different recipes were characterized by their morphological, biological, phytogeographical, habitat type and origin. The frequency of citation (Fc) of plants was calculated according to the formula:

$$FC = (\frac{S}{NI}) \times 100$$

FC=(S/NI)×100

With S: number of times the species is cited, N: total number of citations of all listed species.

RESULTS

Diversity of taxa listed

The surveys carried out in the six (6) localities made it possible to list 98 medicinal species divided into 84 genera and 56 families of which the most representative are Rubiaceae (8.91%), Asteraceae (7.80%), Fabaceae (7.05%) followed by Zingiberaceae (4%) as shown in table n°1. Regarding the habitat of the plants recorded, savannah (42.21%) prevails over cultivated (40.58%) and forest (17.21%) (Figure 1). In terms of morphological types, perennial grasses (37.04%) followed by shrubs (33.80%), trees (19.06%) and lianas (5.03%) are the dominant types (Figure 2). Regarding the origin of the species, the study revealed three types of specimens in the proportions of (57.97%) for spontaneous species, (37.60%) for cultivated species and (4.42%) for spontaneous/cultivated species (Figure 3). According to biological type, microphanerophytes (26.66%), mesophanerophytes (26.65%), followed by chamephytes (19.27%) and geophytes (10.71%) are the most represented (Figure 4). With regard to the phytogeographical type, the identification reveals that

pantropicals (61.43%) followed by Guinean-Congolese (15.96%) and Cosmopolitans (12.46%) are in the majority compared to the other types (Figure 5).

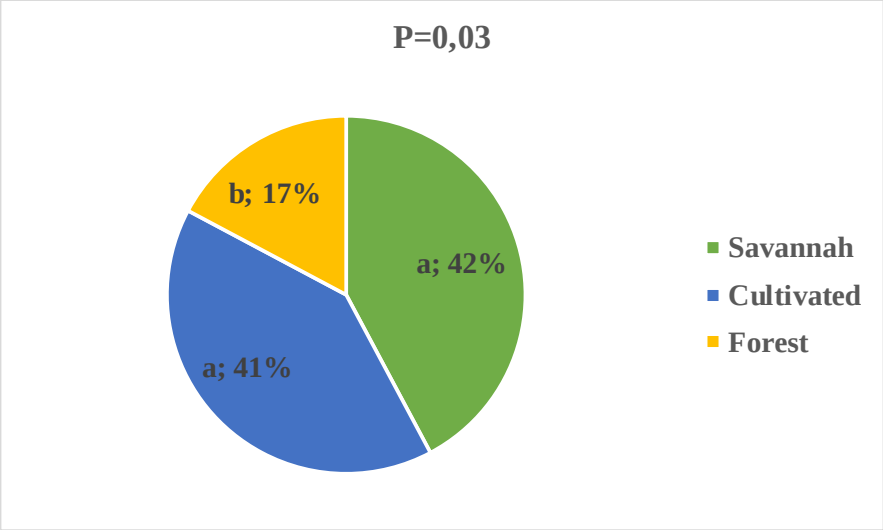

Figure 1: Distribution of medicinal plants by habitat

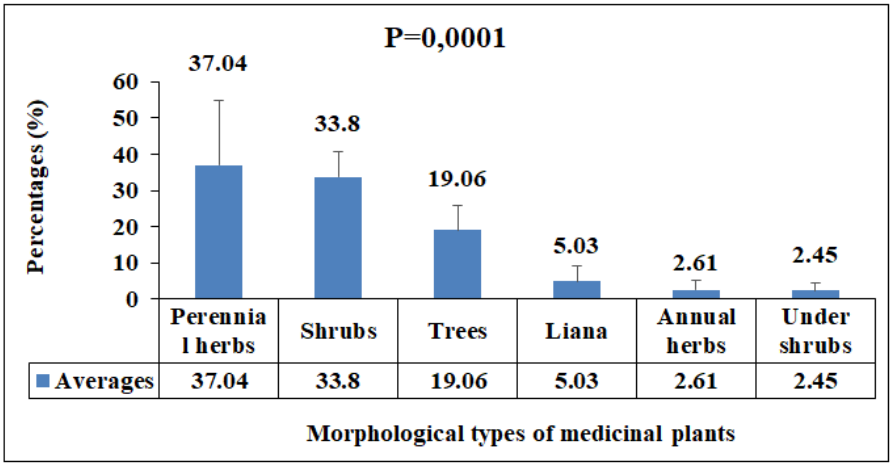

Figure 2: Morphological spectrum of medicinal plants identified

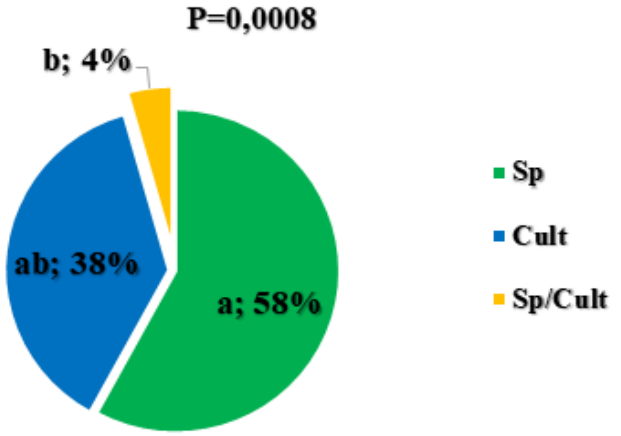

Figure 3: Distribution of medicinal plants according to their origin
Legend: Spontaneous (Sp.); Cultivated (Cult.); spontaneous/cultivated (Spcult.).

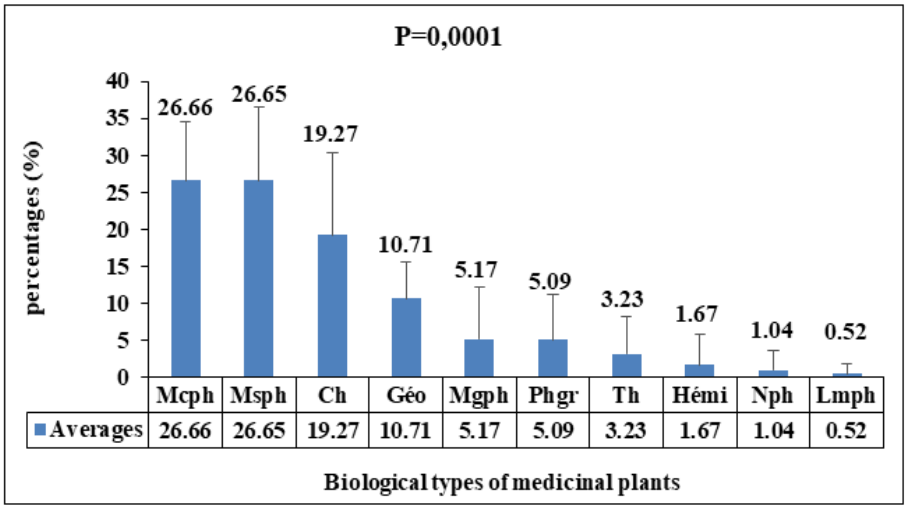

Figure 4: Biological spectrum of medicinal plants

Legend: Microphanerophyte (Mcph); Mesophanerophyte (Msph); Chamephyte (Ch); Geophyte (Geo); Megaphanerophyte (Mgph); Climbing phanerophyte (phg); Therophyte (Th); Hemiphanerophyte (Hemi); nanophanerophyte (nph); microphanerophyte liana (Lmph).

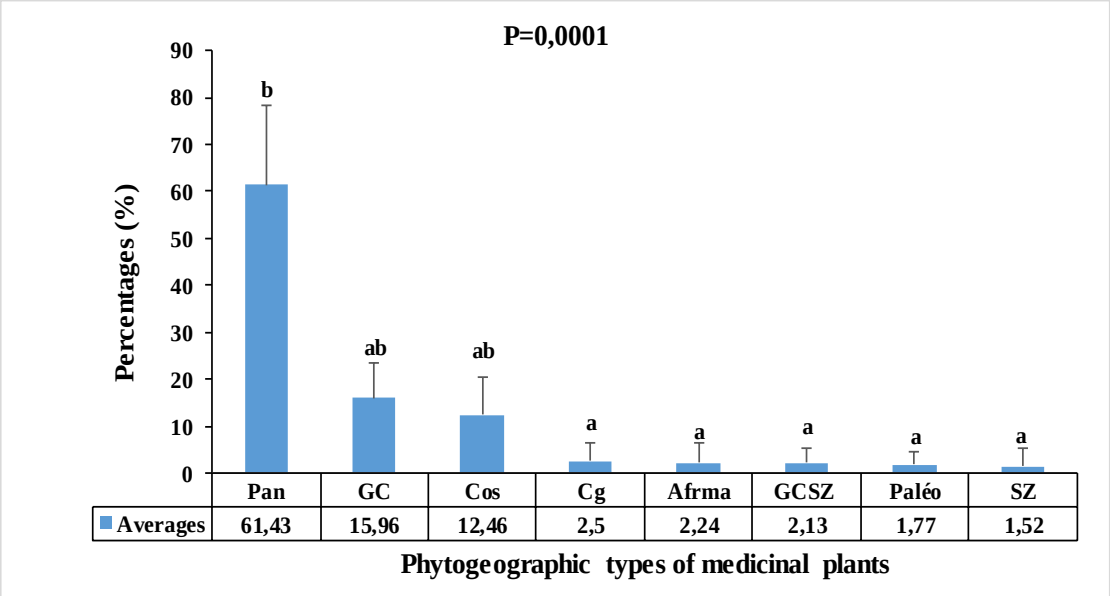

Figure 5: Listed phytogeographical types of medicinal plants.

Legend: Pantropical (Pant); Guinean-Congolese (GC); Cosmopolitan (Cos); Central Guinean (Cg); Afro-Malagasy (Afrma); Guinean-Congolese-Sudano-Zambezien (GCSZ); Paleotropical (Paleo); Sudano-zambezien (SZ).

Ethnobotanical data

Mode of preparation

The survey revealed that decoction (47.79%) is the most commonly used method, followed by trituration (19.29%), then mastication (10.28%) and maceration (9.48%), compared to crushing (6.86%) Figure 6.

Routes of administration

Several routes of administration of the drug were prescribed. The oral route (68.54%) is the most commonly used (Figure 7).

Organs used in herbal medicine

Leaves (46.53%) occupy the first place followed by bark (13.56%) and then root (13.32%) in the preparation of recipes (Figure 8).

Diseases treated

A good number of diseases were cited, with malaria (16.39%) the most treated disease followed by stomach ache (8.47%), cough (8.44%), fever (6.57%), haemorrhoids (6.31%) and diarrhoea (5.80%) Figure 9.

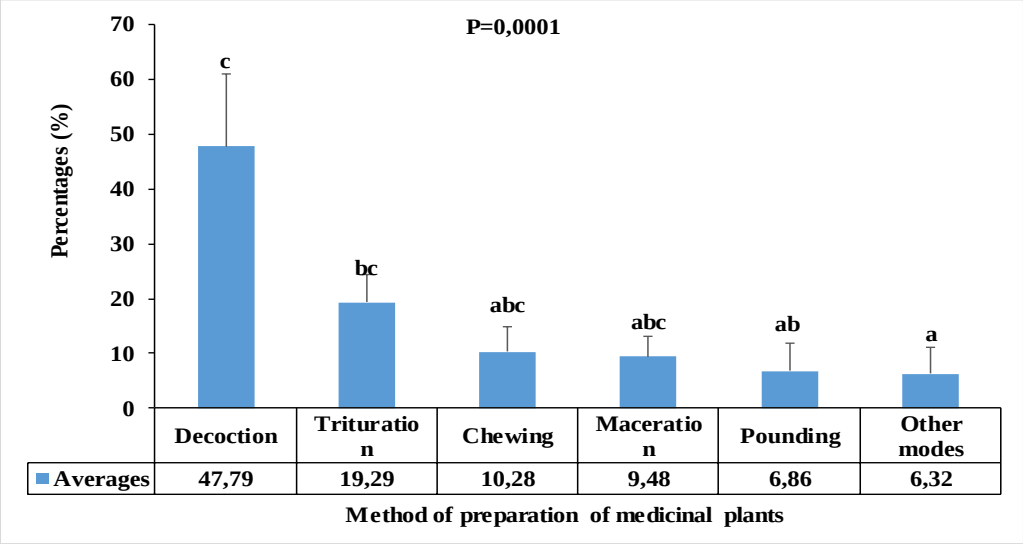

Figure 6: Dredge preparation method

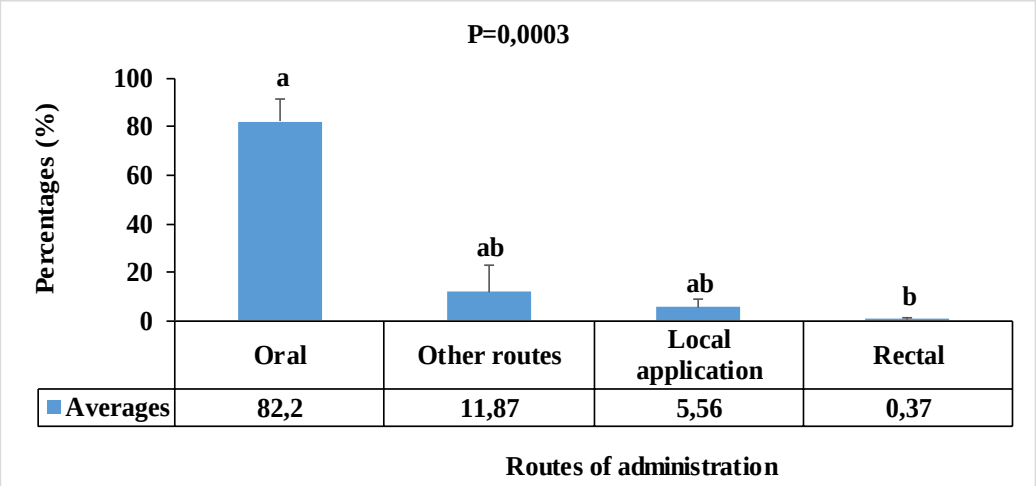

Figure 7: Routes of drug administration

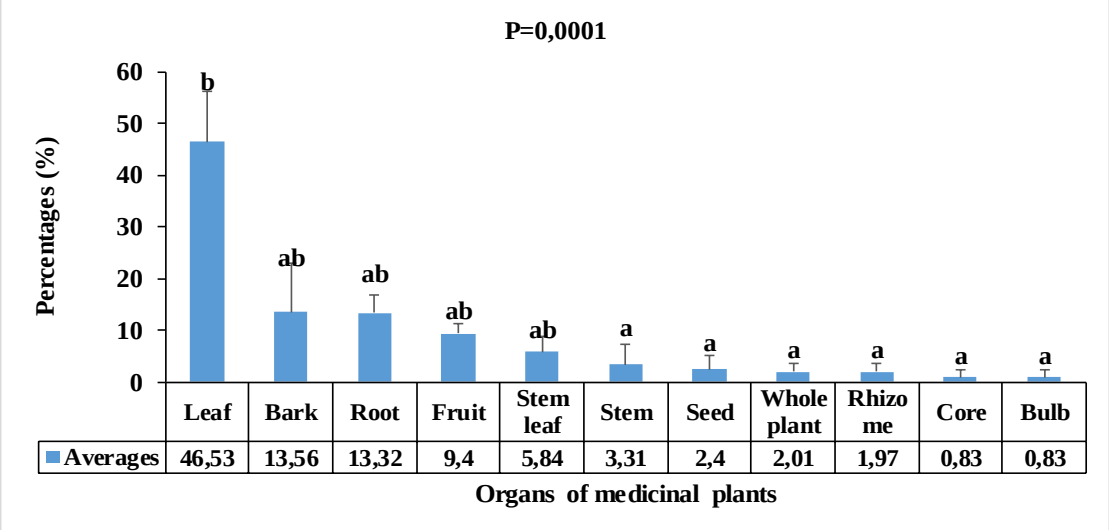

Figure 8: Organs involved in the preparation of the phytomedicine

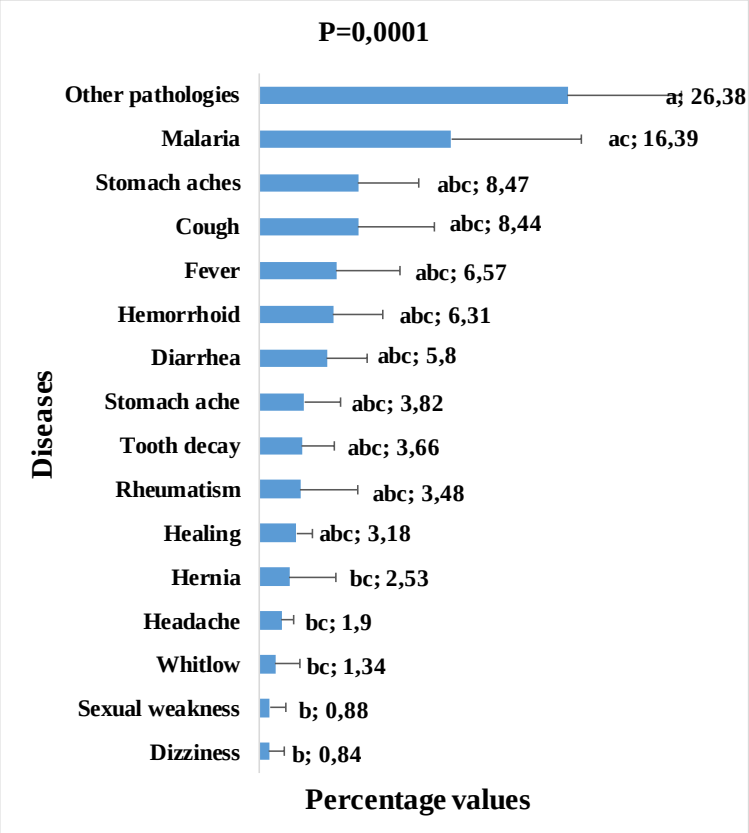

Figure 9: Histogram of diseases and symptoms treated

DISCUSSION

Diversity of taxa recorded

The large number of botanical genera (84) and families (56) recorded testifies to a high biodiversity, a characteristic feature of savannah areas. These results differ from those of Obilela (2018). This may be due to the number of informants interviewed and the number of villages surveyed. Regarding the botanical families surveyed, the Rubiaceae (8.91%), Asteraceae (7.80%), Fabaceae (7.05%) are the most representative followed by Zingiberaceae (4%). Our results differ from those of Kadri *et al.*, (2018). This difference could be explained by the fact that the works of these authors are carried out in different countries and habitats. The frequent use of Rubiaceae can be explained by their ability to treat several conditions such as infantile gastrointestinal pathologies, abdominal pain (colic), some parasitic and hepatobiliary conditions, and that of Asteraceae can be explained by the presence of chemical compounds and by their belonging to the evolved subclass (Yapi *et al*., 2015). As for the Fabaceae, their preponderance is explained by the medicinal, food, fodder and economic values they possess (Ndayishimiye, 2011) and some species are well recognized at the global level, possessing active principles. Regarding the provenance of the taxa surveyed, our results are similar to those of Latreche and Sadoudi (2017).

The high representation of spontaneous species (57.97%) compared to crops (37.60%) and spontaneous/cultivated (4.42%) may be due to their availability throughout the year, unlike cultivated species which are only partially available. The dominance of spontaneous plants is also reported by Mboussi (2016) in the Sub-Prefecture of Kayes in Congo. Their strong presence can also be explained by adaptive capacities to ecoclimatic conditions. The ecological characteristics of the plants inventoried show that perennial grasses (37.04%) are the most abundant, followed by shrubs (33.80%) and trees (19.06%). Our results differ from those of Ngbolua *et al*., (2019).

The predominance of perennial herbs, shrubs and trees in the medicinal flora in the Plateaux Department reflects the state of vegetation in tropical and equatorial regions. In addition, the perennial nature of the species also ensures the availability and use of medicinal plants (Ngbolua *et al.*, 2019). From the point of view of the habitat of the species inventoried, they are predominantly savannah (42.21%) and crop (40.58%). This dominance of savannah and cultivated species shows that our informants have more knowledge of savannah and cultivated species; it also proves that the floras of the villages surveyed have a savannah character. Our results corroborate those of Obilela (2018). Regarding the biological type, microphanerophytes (26.66%), mesophanerophytes (26.65%) followed by chamephytes (19.27%), geophytes (10.71%) are the most represented. This is in agreement with the work of Gnagne *et al*., (2017), Latoundji *et al*., (2018), but different from Banyanga (2014). This difference can be explained by the number

of species recorded and also by the fact that he only worked on spontaneous medicinal plants.

As for the phytogeographic type, the study reveals the dominance of pantropicals (61.43%) followed by Guinean-Congolese (15.96%) and Cosmopolites (12.46%). Our results corroborate those of Mpassi (2007), Banyanga (2014) and Ngbolua *et al.*, (2019). The dominance of pantropicals is demonstrated by the exploitation of the benefits that these plants offer to the population. Furthermore, this is underpinned by disturbance. It is also demonstrated by the fact that this study is conducted in a tropical area. Secondly, pantropical species are adaptive, long-distance dispersal and naturalization (Mpassi, 2007); but disagree with Latoundji *et al.*, (2019). This difference can be explained by the geographical location of Benin (Sudanian zone).

Ethnobotanical data

Phytotherapeutic aspects

Leaves (46.53%), barks (13.56%) and roots (13.32%) are the main organs used in the treatment of pathologies and symptoms. These results are in agreement with those of Latoundji *et al.*, These organs are used differently depending on their context because they do not possess the same quality or proportion of active ingredients (Ngbolua *et al.*, (2019). The high use of leaves is thought to be due to their easy accessibility and the fact that they are the seat of photosynthesis (Latoundji *et al.*, 2019). The high use of barks and roots is related to the natural richness of these organs in certain active principles such as anthraquinones which give them high anti-oxidative properties according to Latoundji *et al*., (2019).

In addition, the results of our study showed a diversity of traditional uses. This diversity of use shows that our informants have a good knowledge of endogenous knowledge. Of all the preparation methods, decoction is the most used (47.79%). This can be explained by the fact that it allows the collection of the most active ingredients and attenuates or cancels the toxic effect of certain recipes (Kimpouni *et al*., 2012; El Hafian *et al*., 2014) and the Per os is the most solicited way to administer drugs. These results confirm those of Kimpouni *et al*., (2014) and Yapi *et al.*, (2015).

As far as the dosage and dosing of drugs are concerned, they still remain on the whole random (Latoundji *et al.*, 2019). For Gnagne *et al.*, (2017), the prescription of per os would be explained by the fact that the pathology is related to deep organs, to reach them, any compound must transit through the digestive system to facilitate its assimilation. With regard to the pathologies treated, our survey revealed that the majority of therapeutic plants are used mainly against malaria (16.39%) and childhood illnesses such as coughs, fever and diarrhea in children, which means that these various predominant illnesses constitute the most urgent health problem of the populations of the Plateaux Department.

CONCLUSION

The ethnobotanical survey carried out in the Plateaux Department showed that the traditional use of medicinal plants is important among the M'bochi and Teke. This study made it possible to carry out an inventory of the medicinal plants used in the localities surveyed and to gather information on the therapeutic uses practiced. Eighty-eight (98) medicinal species, divided into 84 genera and 56 families were inventoried.

The most commonly used species are *Mangifera indica* L., *Morinda morindoides* (Baker) Milne-Redh, *Chromolaena odorata* (L.) King & H. Rob, *Senna occidentalis* L. and *Nauclea latifolia* Sm. Moreover, the study revealed that the leaves are the most used part and decoction is the most prevalent method. Moreover, malaria, stomach ache, cough, fever, hemorrhoids and diarrhea are recurrent pathologies that people face in these localities. This study will make it possible to establish a Congolese pharmacopoeia in the future and will thus constitute a source of information for scientific research in the fields of phytochemistry and pharmacology.

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