



ETHNOBOTANICAL SURVEY ON MEDICINAL PLANTS USED IN BURKINA FASO IN THE TREATMENT OF BREAST CANCER, PHYTOCHEMISTRY AND ANTIOXIDANT ACTIVITIES: *EUPHORBIA POISSONII* PAX AND *FLUEGGEE VIROSA* (WILLD.) VOIGT. (EUPHORBIACEAE)

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Cite this article:

Thiombiano H.M., Bangou M.J., Nacoulma A.P., Ouoba B., Sawadogo M., Lema A., Couliadiati T.H., Ouoba H.Y., Ouedraogo G.A. (2022), Ethnobotanical Survey on Medicinal Plants Used in Burkina Faso in the Treatment of Breast Cancer, Phytochemistry and Antioxidant Activities: *Euphorbia poissonii* Pax and *Flueggea virosa* (Willd.) Voigt. (Euphorbiaceae). African Journal of Biology and Medical Research 5(1), 1-16. DOI: 10.52589/AJBMR-UDC9CHLG

Manuscript History

Received: 3 Dec 2021

Accepted: 21 Dec 2021

Published: 12 Jan 2022

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ABSTRACT: *This study presents an ethnobotanical survey, a quantification of polyphenols and antioxidant activities on medicinal plants used in the treatment of breast cancer in the cities of Bobo-Dioulasso and Fada N'Gourma conducted among traditional practitioners. For this purpose, after the survey analyses, Euphorbia poissonii Pax (Euphorbiaceae) and Flueggea virosa (Willd.) Voigt. (Euphorbiaceae) were chosen. A methanolic extraction with soxhlet was performed on these plants. Then, the quantification of phenolic compounds was done by spectrophotometric method with Folin Ciocalteu reagent and aluminum chloride respectively. Likewise, the antioxidant activity was evaluated by three methods (ABTS, DPPH and FRAP). A total of 103 traditional practitioners were surveyed and 47 species divided into 27 families were obtained. Among the total extracts, the leaves of Flueggea virosa gave the highest content of total phenolics (52.05 ±1.49 mg EAG/100mg extract) and the root gave the highest content of flavonoids (3.30 ±0.32 EQ/100mg extract). The best antioxidant activity was observed at the ABTS method with best results obtained for the total extracts of Flueggea virosa (8413.78±110.16 μmol EAA/g). The results of the different phytochemical and antioxidant activities could partially justify the traditional use of these plants in the management of breast cancer patients.*

KEYWORDS: Cancer, Ethnobotany, Flavonoids, Polyphenols, Antioxidant.



INTRODUCTION

Cancer remains one of the public health concerns that has been increasing for years in the world and particularly in Africa (Coulidiati *et al.*, 2019). Cancer is not only a concern in developed countries, it is a disease that is also prevalent in developing countries (Aliam, 2017; WHO, 2018; Coulidiati *et al.*, 2019). According to WHO, in 2018, lung, liver, stomach, colon and breast cancers cause the most deaths per year. Moreover, at the National Hospital Center of Ouagadougou (Burkina Faso), breast cancer tops the list of female genital cancers, followed by cervical cancer (Ouédraogo, 1992; Ministry of Health, 2017). In view of the invasiveness of cancers, if no action is taken by 2030, there will be 1.4 million new cases with 1.05 million deaths as forecast (Globocan, 2012). There are modern treatments such as radiotherapy, chemotherapy, surgery... which depend on the evolution of the cancer (Globocan, 2012). However, these means of treatment and anticancer products are very expensive and are not yet available in developing countries (Sano *et al.*, 1998; Zongo *et al.*, 2015; Coulidiati *et al.*, 2019). Besides this, plants have always occupied an important place in human care.

Plants are of paramount importance in all civilizations that have used plants either wild or cultivated for food, defense, and clothing (Ouoba *et al.*, 2018). The therapeutic use of plants for the treatment of human diseases is very old (Bangou *et al.*, 2012) and has progressed with the history of humanity (Zakkad, 2017). In Burkina Faso, traditional medicine plays a very important role in the health of the population. Medicinal plants are used by traditional healers to treat all kinds of diseases for example malaria, ulcers, diabetes and especially cancer (Bayala *et al.*, 2014; Coulidiati *et al.*, 2019). This form of medicine is accessible to all, unlike modern medicine, and is less expensive (Sano *et al.*, 1998). An important element of cultural heritage, traditional medicine and pharmacopeia remain the main source of primary health care for 70% of the Burkina Faso population (Zerbo *et al.*, 2011). Plants are well known to contain several metabolites directed against many diseases. Indeed, the Euphorbiaceae family is involved in many pharmacological activities around the world (China, Tanzania, Uganda ...). Until the beginning of the 20th century, almost all medicines were plant-based and it is estimated that two thirds of today's medicines have a natural origin (Zakkad, 2017). Today medicinal plants still remain the primary reservoir of new drugs, as they are considered as a source of essential raw materials that allows for the manufacture of new drugs through the discovery of molecules of interest (Abou-char *et al.*, 1980; Belkhiri, 2018). It is therefore important to evaluate the therapeutic potential of plants used in the treatment of various diseases from a pharmacological point of view in order to evaluate them. It is within this framework that the present study was conducted.

The general objective of this study was to conduct an ethnobotanical survey among traditional practitioners, a quantification of polyphenols contents and antioxidant activity on extracts of the most listed medicinal plants used in the treatment of breast cancer in the cities of Bobo-Dioulasso and Fada N'Gourma.

MATERIALS AND METHODS

Study sites

Bobo-Dioulasso is located in the Hauts-Bassins region in western Burkina Faso. Its geographical coordinates are 11°10'59.999" North, 4°16'59.999" West. Bobo-Dioulasso is the economic capital of Burkina Faso. It is the second largest city in terms of population after Ouagadougou (the country's capital) covering an area of 136.78 km² with 90,3887 inhabitants (RGPH, 2020). The climate is South Sudanese with an average rainfall of 900.8 mm (Köppen-Geiger). The vegetation is dominated by wooded savannahs and open forests and includes all subtypes, from wooded savannah to grassy savannah (Guinko, 1984). Fada N'Gourma is located in the eastern region of Burkina Faso with coordinates of 12°03'00" North and 0°22'01" East. This city is populated with 180356 inhabitants (RGPH 2020) covering an area of 36 Km². The climate is South Sudanese with an average rainfall of 565 mm (Köppen-Geiger). Fada N'Gourma has vegetation characterized by a shrubby savanna (Monographie de la Région de l'Est, 2009). The population is mixed in these study areas and the local languages commonly spoken are Dioula, Fulfuldé, Gourmanchtèma, and Mooré (Figure 1).

Biological activities were conducted at the Laboratoire de Recherche et d'Enseignement en Santé et Biotechnologie Animale (LARESBA) of the Institut de Développement Rural (I.D.R).

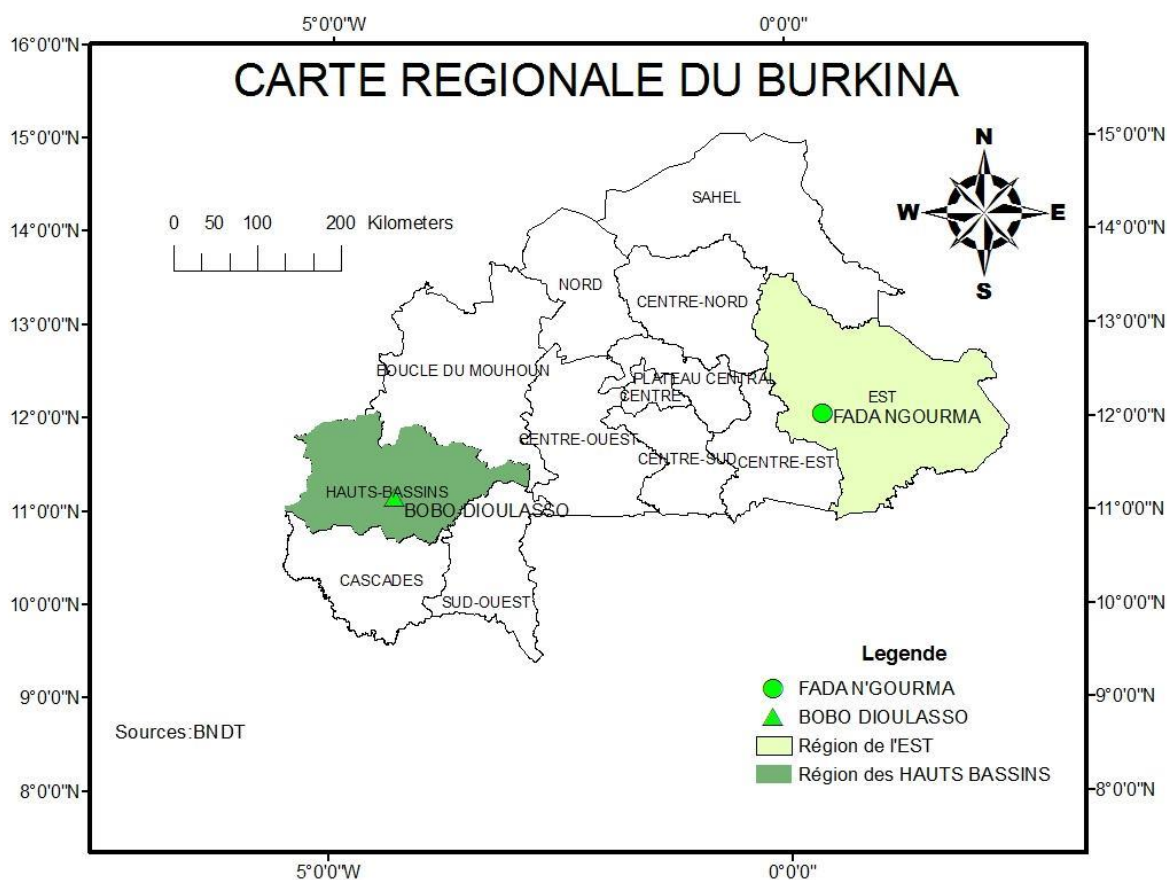


Figure 1: Ethnobotanical survey areas



Ethnobotanical survey

It took place during the period from August to November 2020 and involved one hundred and three (103) traditional practitioners divided into two (2) groups. The methodology used was a semi-structured interview using a survey form with each traditional practitioner. The data collected was about their knowledge of breast cancer, the names of the plants they use for the treatment of breast cancer and the parts of the plant used.

Plant material

The plant material consisted of leaves, bark and roots of *Euphorbia poissonii* and *Flueggea virosa* collected in December 2020 in the classified forest of Dendéréso (Bobo-Dioulasso) and in the forest of Siétougou (Fada N'Gourma). The two species were previously identified by Dr. Yempabou Hermann OUOBA Botanist and Phytoecologist at the Nazi BONI University before the harvest. Then, the samples were dried in the laboratory under the shelter of the sun, at room temperature and pulverized with an aluminum mortar to obtain powder. The powders thus obtained were packaged and labeled in zip lock bags that were finally used for the different operations in the laboratory.

Solvents and reagents

All solvents were analytical grade. Agilent Cary 60 UV-Vis Spectrophotometer was used in all spectrophotometric measurements. Ascorbic acid, ferric chloride (FeCl₃), aluminum chloride (AlCl₃), potassium acetate, quercetin, 2,2-Diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azinobis (3-ethylbenzothiazoline)-6-sulfonic (ABTS), Folin-Ciocalteu reagent, gallic acid, sodium carbonate, methanol was obtained from Sigma Chemical Co. (St. Louis, MO, USA). Millipore deionized water was used throughout. Thiazolyl Blue Tetrazolium Bromide (Sigma Aldrich, USA), Dimethyl Sulfoxide (Sigma Aldrich, USA).

Extraction

15 g of plant powder of each sample was loaded in cartridges, extracted with 200 mL using the soxhlet for at least 4 hours. After recovery of the solvent, the extract was concentrated, collected in a petri dish and dried under ambient laboratory conditions. The yields (R) of the extractions were calculated by the following formula:

$$R = \frac{\text{mass of the extract}}{\text{extracted mass}} * 100$$

Determination of polyphenolic compounds

Determination of total polyphenols: The estimation of total extractable phenolic compounds was performed by the Folin-Ciocalteu method described by Dakio *et al.* (2020). The sample solution diluted to one hundredth from the stock solution was used. We used three tubes into which a 0.125 mL volume of the diluted extract solution plus a 625 µL volume of the 0.2 N Folin-Ciocalteu reagent incubated for 5 min was introduced. After a volume of 0.5 mL of a solution of sodium carbonate at 75 g/L in distilled water is then added and the mixture incubated for two (02) hours. A fourth tube was used for the preparation of the blank which contained a volume of 125 µL of distilled water plus 125 µL of Folin-Ciocalteu reagent and sodium carbonate. At the end of the incubation, the optical densities are read at 760 nm with a spectrophotometer. The standard calibration curve was plotted using gallic acid (0-200 mg/ L)



($y = 0.004668x + 0.034$; $R^2 = 0.9991$). A total of three (03) readings are taken for each extract and the result given is an average from these analyses. The results are expressed as mg Gallic Acid Equivalent per 100 mg extract or fraction (mg GAE/ 100 mg extract).

Determination of total flavonoids: The method used for the estimation of flavonoid levels in plant extracts and fractions is that described by Dakio *et al.* (2020). The sample solution diluted to the hundredth was used to perform the operation. A total of four (04) tubes were prepared in which a volume of 625 μ L of the diluted solution of each sample was introduced, then we added to the first three (03) tubes 625 μ L of $AlCl_3$. The fourth tube considered as the control received 625 μ L of methanol and then incubated for 10mn in the dark. Quercetin (0-100 mg/L) was used as a standard for the development of the calibration curve ($y = 0.01259x$; $R^2 = 0.9990$). After incubation three readings are taken per extract sample using a spectrophotometer at 415 nm wavelength the result given is an average of the three. The results are expressed as mg Quercetin Equivalent (QE) per 100 mg of extract (mg QE/100mg).

Antioxidant Activities

Reducing power by the FRAP method

The FRAP (Ferric Reducing Antioxidant Power) method is based on the ability of the extracts to reduce ferric ion (Fe^{3+}) to ferrous ion (Fe^{2+}). The total antioxidant capacity of each plant extract was determined by the method described by Dakio *et al.* (2020). The sample solution was prepared with distilled water to 0.5 mL of sample solution, followed by 1.25mL of phosphate buffer (0.2 M) and 1.25mL of potassium hexacyanoferrate were added. This mixture was incubated for 30 minutes in a water bath at 50°C. After that, 1.25 mL of trichloroacetic acid (10%) was added and the whole centrifuged for 10 minutes at 300 rpm. 0.625 mL of the supernatant was added to 0.625 mL of distilled water and 0.125 mL of freshly prepared iron chloride ($FeCl_3$) with distilled water (0.1%). The absorbance of the latter mixture is read at 700 nm by a spectrophotometer. Ascorbic acid was used to produce the calibration curve ($y = 0.003270x$; $R^2 = 0.9990$). A blank was also prepared under the same conditions with distilled water. Determination of iron (III) reducing activity was performed in triplicate and expressed as μ mol of ascorbic acid equivalent (AAE)/g of extract.

Anti-free radical activity by the DPPH• radical inhibition method.

The antiradical activity of the extracts by the DPPH method, is their ability to scavenge the 2,2-diphenyl-1-picrylhydrazyl radical (DPPH•). The method used was as described by Dakio *et al.* (2020). 375 μ L of methanolic sample solution is mixed with 750 μ L of DPPH solution (20 mg/L). The mixture is incubated for 15 min in the dark. A blank is also prepared with methanol in place of the DPPH (20mg/L) solution. Measurements are performed by a spectrophotometer at 700 nm. Ascorbic acid was used as the standard ($-0.02224x+0.348$; $R^2=0.9966$). The average of three readings was used and the results expressed as μ mol of ascorbic acid equivalent (AAE)/g of extract.

Reducing power by the ABTS•+ method.

The method used is the one described by Dakio *et al.* (2020). The sample solution is prepared with distilled water. 990 μ L of ABTS•+ (2,2'-azinobis (3- ethylbenzothiazoline)-6-sulfonic) solution (0.1mg/mL) is added to 10 μ L of sample solution. The blank here is ethanol. Measurements are performed by a spectrophotometer at 734 nm. Ascorbic acid was used as



the standard ($y = -0.0007874x + 0.709$; $R^2 = 0.9993$). The average of three readings was used and the results expressed as μmol of ascorbic acid equivalent (AAE)/g of extract.

The results of antioxidant activities were determined by the formula:

$$C = \frac{c * D}{M * Ci}$$

C = concentration of free radical scavenging compounds in μmol AAE/g extract or fraction

c = concentration of the sample read on the standard curve

D = dilution factor of the sample (100)

Ci = initial concentration of the solution to be determined (10mg/ml)

M = molar mass of ascorbic acid (176.1 g/mol)

Statistical analysis:

The data analysis was done as follows: the analysis of the survey forms and the statistical analysis of the results. Thus, the responses to the questionnaires were coded, entered and processed using the EXCEL 2013 spreadsheet.

$$F = \frac{\text{Number of citations for the considered plant}}{\text{Total number of citations for all plants}} * 100$$

F : citation frequency

RESULTS AND DISCUSSION

Data on the Plants Surveyed

The survey data identified 47 species divided into 27 families used in traditional medicine in the fight against breast cancer (Figure 2). In Bobo-Dioulasso, 32 species were identified by 50 traditional practitioners, with the best citation rates being *Flueggea virosa*, *Khaya senegalensis*, and *Ximenia americana*, which were respectively 12.30%, 9.23% and 6.15%. In the city of Fada N'Gourma, of the 18 full-time tradipractitioners, 34 species were identified, of which *Euphorbia poissonii* (13.20%), *Flueggea virosa* (9.43%) and *Ximenia americana* (7.54%) had the highest citation rates. In the group of part-time tradipractitioners, 35 tradipractitioners were interviewed and 19 species were identified with *Flueggea virosa* leading the citations (16.66%) followed by *Euphorbia poissonii* (6.66%). This exploitation of data allowed us to note that there is an overlap of plant families between these two cities of study, in particular Euphorbiaceae, Combretaceae, Meliaceae, Mimosaceae, Anacardiaceae, Asclepiadaceae, Annonaceae, Caesalpiniaceae, Zygophyllaceae, Bombacaceae (figure 3). In addition, one of the plants (*Flueggea virosa* with a variation in citation rate from 9.43% to 16.66%) in the study overlaps in both surveyed areas. *Euphorbia poissonii* is absent in the Bobo-Dioulasso area. The reason for this absence is certainly related to its habitat. Indeed, this plant develops in a particular environment, it lives in savannahs, rocky areas... (Arbonnier,



2002; Thiombiano *et al.*, 2012). It is true that our study plants have not yet been studied for their efficacy in the treatment of breast cancer in Burkina Faso ; Researchers have isolated some molecules from plants (*Balanites aegyptiaca*, *Lantana ukambensis*) used in the treatment of cancers (Gnoula *et al.*, 2008; Bayala *et al.*, 2014). According to an ethnobotanical survey, some study were been conducted in Benin on traditional knowledge between two ethnic groups, the researchers were found that *E. poissonii* was used extensively in the treatment of some inflammatory diseases such as cancer with an average use value of 1.465 (Gbesso *et al.*, 2020). Also in 2010, an ethnobotanical survey was conducted in southwestern Nigeria by Ashidi and collaborators on plants used in cancer treatment. Kareru *et al.* in 2007 in Kenya conducted ethnobotanical surveys on *Flueggea virosa* and it was found that it is used in the treatment of breast cancer. Also in 2015 Magaji *et al.* in their studies proved that *Flueggea virosa* is used in multiple treatments. In addition, anti-cancer activities on KB, L1210 and P388 (Tatematsu *et al.*, 1991) and MCF-7, MDA-MB-231 (Monkodkaew *et al.*, 2009) cell lines were found with *Flueggea virosa* extracts. It appears from this study that our plants were fairly cited by the traditional healers. Also, many ethnobotanical studies have noted the usefulness of these plants in the traditional recipes of traditional practitioners. Because of these numerous uses of these plants by traditional practitioners, our interest in studying the two species could be justified.

Parts of the plants used

Various parts of the plants are used. Among traditional healers in Bobo-Dioulasso, leaves and roots were the most commonly used parts, with 34.78% and 21.73% respectively (Figure 4). As for the traditional healers in the city of Fada N'Gourma, the parts used varied from leaves (20%); stem bark (21.53%); roots (27.69%); fruits (10.76%); latex (6.15%); flowers (3.07%) and the whole plant (10.76%) for the group of full-time healers (Figure 5.1). Also in the group of part-time practitioners, the parts used varied: stem bark (39.47%), leaves (36.84%), roots (15.78%), the whole plant (5.26%) and fruits (2.63%) (Figure 5.2). As for the parts used, the leaves had a citation rate of 34.78% compared to 17.39% of the barks in Bobo-Dioulasso and in Fada N'Gourma they had a citation rate of 28.42% compared to 25.48% of the barks cited by the different groups of therapists. The parts of the plant are almost all used for the preparation of medicines. The degree of use differs from one to another. these results are similar to those of Zerbo *et al.* (2011) who showed that leaves are predominantly stressed during traditional treatments. These parts are much more used because they are easier to access. Moreover, these parts constitute the storage places of secondary metabolites (Nacoula-Ouédraogo, 1996).

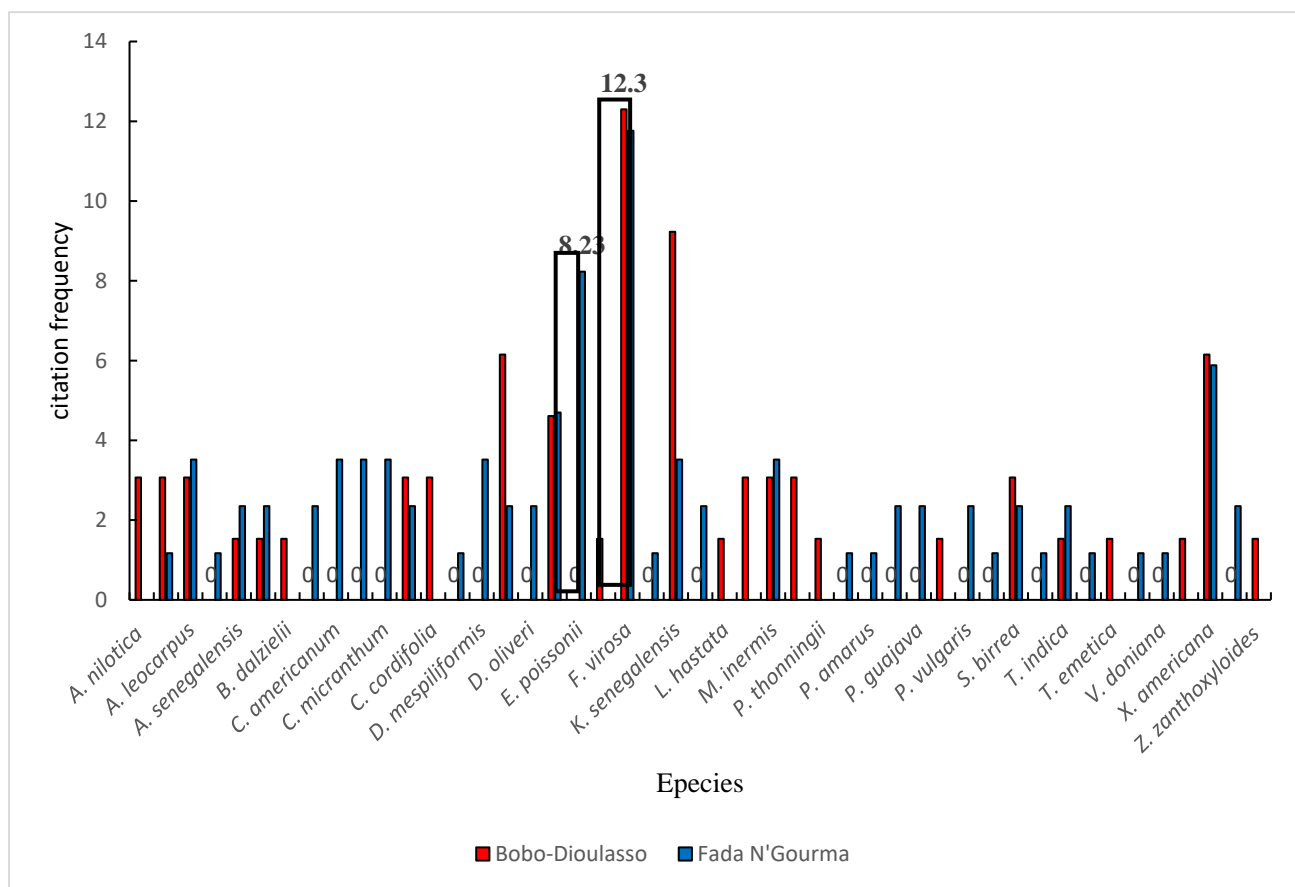


Figure 2: Frequency of citations of medicinal plants in different cities

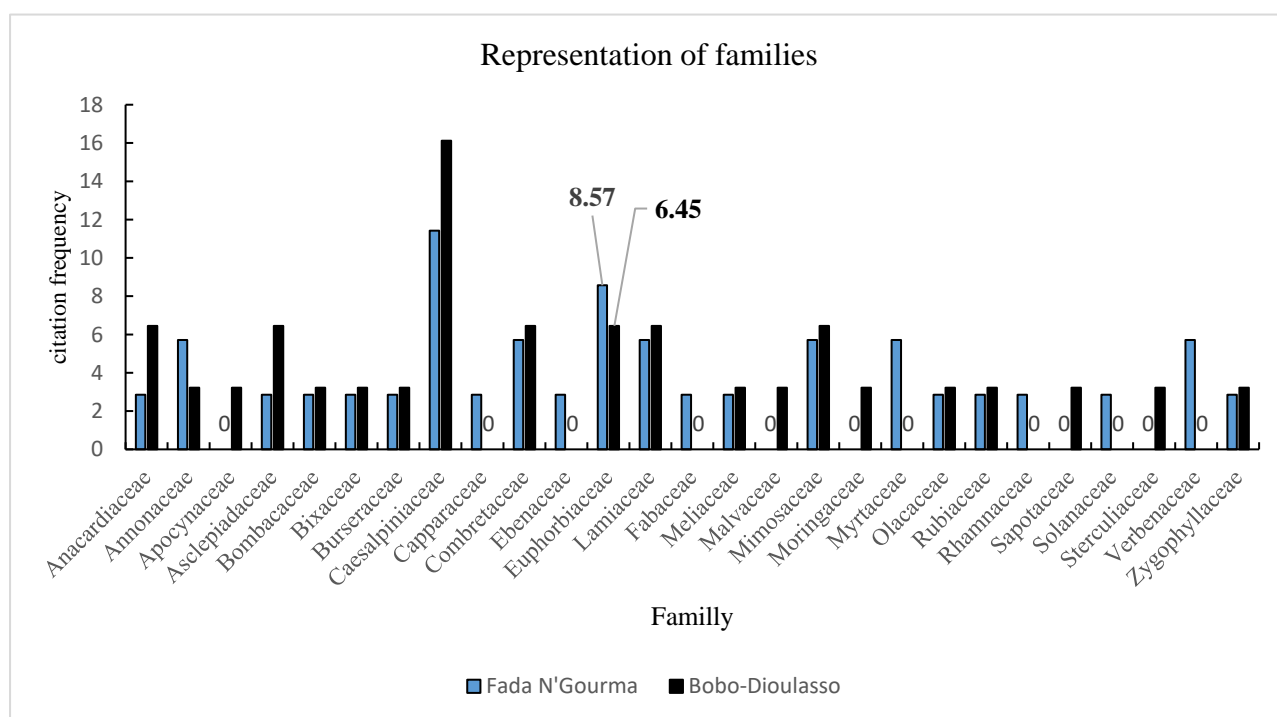


Figure 3: Families represented in the Bobo-Dioulasso and Fada N'Gourma areas

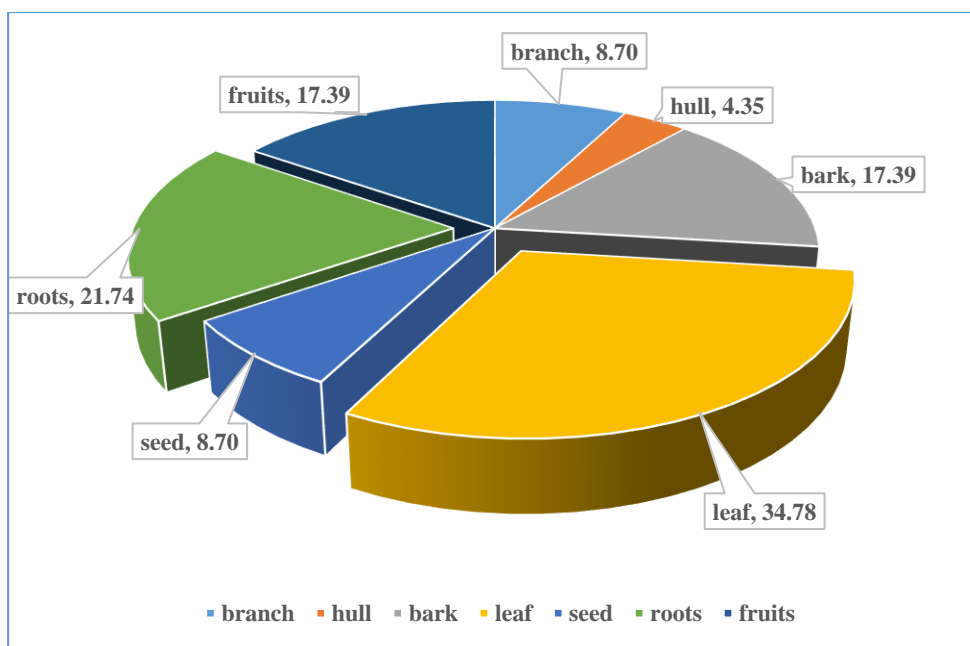


Figure 4: Frequency of citation of the parts used

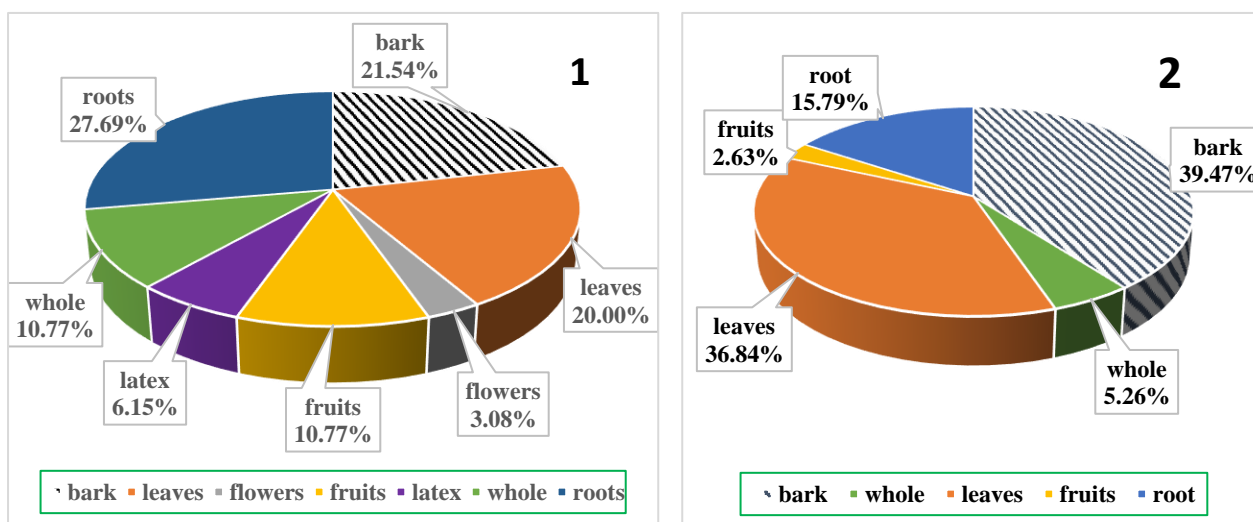


Figure 5: Frequency of citation: 1: of parts used ; 2: of parts used

Mode of Preparation and Mode of Administration

In general, the modes of preparation and administration varied among the different traditional practitioners. In Bobo-Dioulasso, three modes of preparation were listed (powder, decoction and incineration) where decoction was the most represented (50%) (Figure 6.A). The most listed mode of administration was "drinking" with 38.70% (Figure 6.B). In Fada N'Gourma, "decoction" was more frequently cited as the mode of preparation (50%) (Figure 7.A) in the group of full-time practitioners as well as in the group of part-time practitioners (92%) (Figure 7.B). For the use of the treatment, the mode of administration varied between "bathing", "drinking", "bathing and drinking", "chewing" and "massage" respectively with frequencies of use of 13.63%; 45.45%; 18.18%; 3.03% and 19.69% in the full-time group (Figure 7.C). Similarly, part-time practitioners used "bathing," "drinking," "drinking and bathing," "leaching," and "massage" respectively, with proportions of 28.94%, 47.36%, 18.42%, 2.63%, and 2.63% for self-care (Figure 7.D).

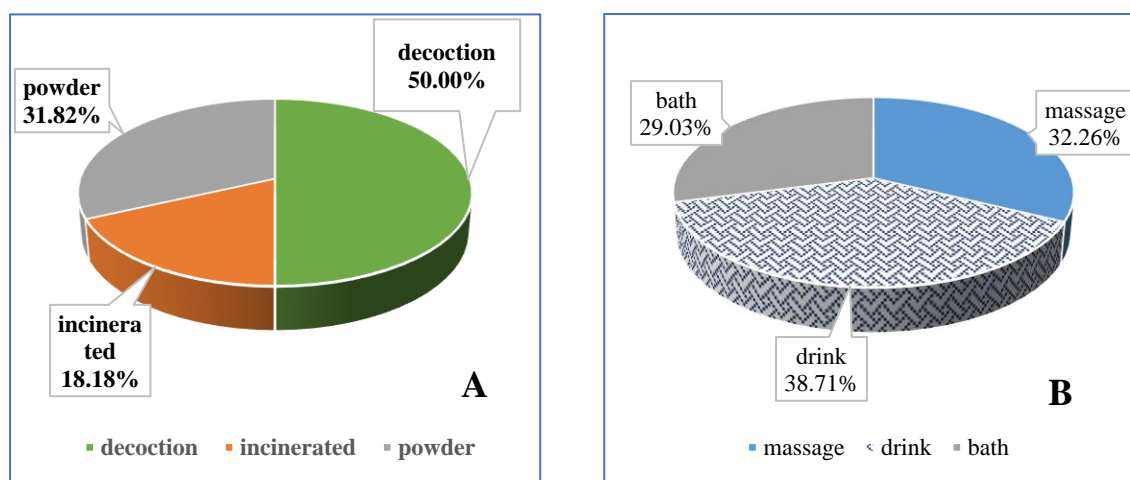
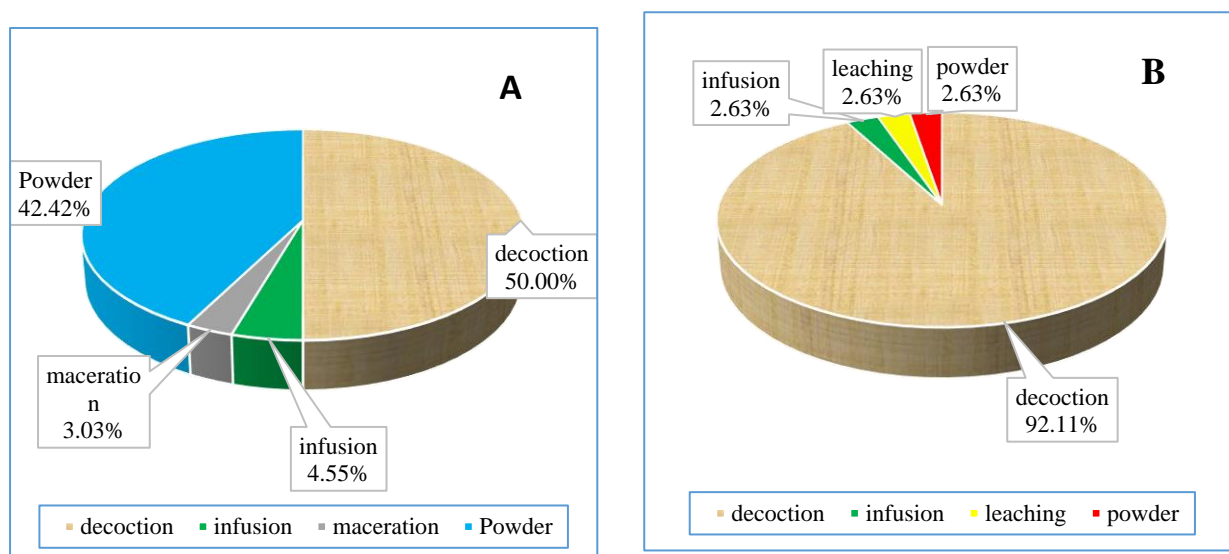


Figure 6: Frequency of Citation : A : preparation mode ; B : administration mode



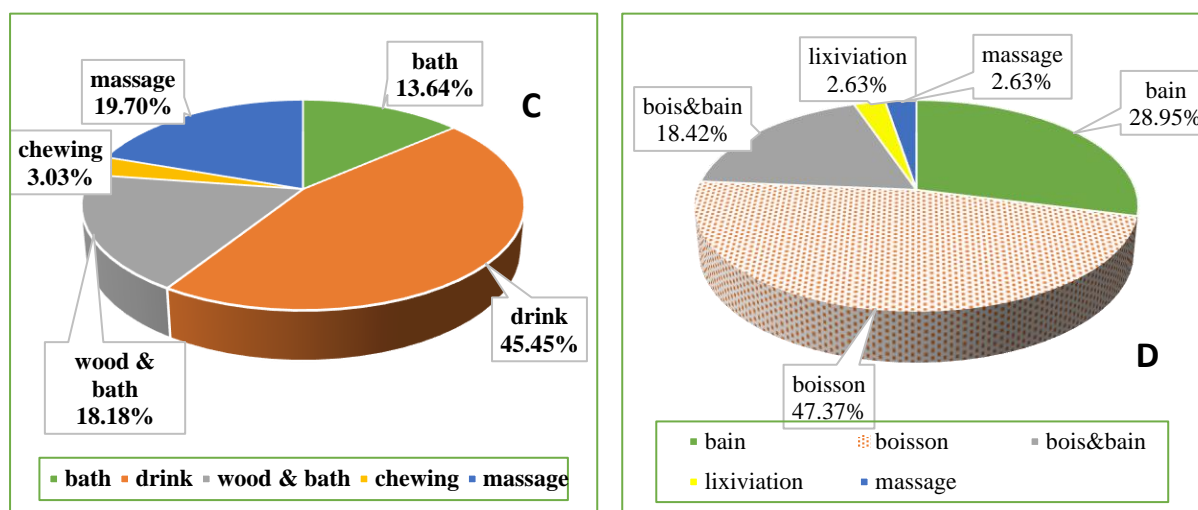


Figure 7 : Frequency of citation: A: of preparation mode ; B: of preparation mode C: administration mode ; D: administration mode

Extraction yields

Yields are expressed as a percentage of dry matter. The yields ranged from 6.69% to 26.34%. The leaf extract of *F. virosa* gave a higher yield with 26.34% and the best yield in *E. poissonii* was obtained with the bark extract (10.84%).

Determination of polyphenolic compounds and antioxidant activities

Determination of polyphenolic compounds

In this study, we evaluated the content of total phenolics and flavonoids in our total methanolic extracts. The folin-ciocalteu method was used for the quantification of total phenolics and the aluminum chloride method for total flavonoids. The results of total phenolic contents of methanolic extracts ranged from 22.06 ± 1.4 to 52.05 ± 1.49 mg EAG/100 mg. In *F. virosa* the best result was obtained in the leaves with 52.05 ± 1.49 mg EAG/100 mg. As for *E. poissonii*, the highest value was found in the bark (24.06 ± 2.16 mg EAG/100 mg). The results of the total flavonoid determinations of the methanolic extracts ranged from 0.73 ± 0.12 to 3.30 ± 0.32 mg EQ/100 mg. The bark gave the best result (3.30 ± 0.32 mg QE/100 mg) for the different parts of *F. virosa*. As for *E. poissonii* the highest content was obtained with the leaves (2.72 ± 0.56 mg EQ/100 mg) whose results are recorded in Table 1.

**Table 1: Results of the determination of polyphenolic compounds**

Plants	Parts used	Total phenolics (mg (EAG)/100mg)	Total flavonoids (mg (EQ)/100mg)
<i>Flueggea virosa</i>	leaves	52,06±1,49 ^a	2,01±0,61 ^{cd}
	Roots	39,13±1,60 ^c	1,95±0,84 ^d
	barks	42,13±6,06 ^b	3,30±0,32 ^a
<i>Euphorbia poissonii</i>	Leaves	24,06±2,16 ^d	2,72±0,56 ^b
	barks	22,06±1,4 ^e	0,73±0,12 ^e

Values are mean \pm SD ($n = 3$). Different letters in the same column indicate significant difference ($p < 0.05$).

For polyphenolic compounds assays, *Flueggea virosa* leaves presented the highest total phenolic contents with 52.06 ± 1.49 mg EAG/100 mg. Also, high total flavonoid contents were obtained with *Flueggea virosa* barks (3.30 ± 0.32 mg QE/100 mg). These results could lead us to say that the peripheral parts store more polyphenolic compounds than the other organs. This distribution varies from one plant to another and according to their roles. Their content can be modified by abiotic factors such as exposure, altitude, climate, season, age and by biotic factors such as man and animals. Other researchers in South Africa who worked on *F.virosa*, had found 156.43 ± 1.23 mg GAE/g as total phenolic content of acetone extracts of *F. virosa* roots (Chauke *et al.*, 2012). Compared to our work which gave 391.30 ± 1.60 mg EAG/g as the total phenolic content, the results of Chauke *et al.* (2012) are lower than ours. This difference in our results could be justified by the type of solvent used. Indeed, the composition of secondary metabolites in the two types of extract is different because acetone is less polar than methanol. This result could also mean that the secondary metabolites in the *F. virosa* root extract would be mostly polar.

Antioxidant activities

Three techniques were used to test the antioxidant activity of our total methanolic extracts. These are the ABTS^{•+}, DPPH[•] and the FRAP method. The reducing power of the total methanolic extracts by FRAP assay, ranged from 144.69 ± 10.03 μ mol EAA/g to 3235.81 ± 55.82 μ mol EAA/g with the different extracts from the organs of both plants. For the DPPH[•] assay, the results obtained ranged from 218.73 ± 6.43 μ mol EAA/g to 903.95 ± 7.80 μ mol EAA/g. For the ABTS^{•+} assay, extracts of both species gave contents ranging from 3028.96 ± 260.02 μ mol EAA/g to 8533.97 ± 208.18 μ mol EAA/g with the different parts. The overall results of the antioxidant activities are reported in Table 2.

**Table 2: Antioxidant activities of methanolic extracts**

Tests		DPPH [•] (μmol (AAE)/g)	FRAP (μmol (AAE)/g)	ABTS ^{•+} (μmol (AAE)/g)
<i>F. virosa</i>	Leaves	753,22 ± 66,26 ^c	3235,81 ± 55,82 ^a	8077,22 ± 99,23 ^c
	Barks	903,95 ± 7,80 ^a	2020,21 ± 140,35 ^b	8533,97 ± 208,18 ^a
	Roots	809,38 ± 17,67 ^b	1800,265 ± 101,75 ^c	8413,78 ± 110,16 ^b
<i>E. poissonii</i>	Leaves	218,73 ± 6,43 ^e	144,69 ± 10,03 ^e	3028,96 ± 260,02 ^e
	Barks	621,31 ± 33,90 ^d	1122,97 ± 80,22 ^d	4615,55 ± 249,82 ^d

Values are mean ± SD (n = 3). Different letters in the same column indicate significant difference (p < 0.05).

Both species presented interesting antioxidant activities with the different antioxidant tests namely the test by DPPH[•], ABTS^{•+} and FRAP. In the FRAP method, *F. virosa* leaves showed high antioxidant activity content with a value of 3235.81±55.82 μmol EAA/g. As for the ABTS^{•+} method, it is still the barks of *F. virosa* presented with a high content of 8533.97±208.18 μmol EAA/g. This shows the importance of secondary metabolite distributions and their defensive roles for the plant. Secondary metabolites do not participate directly in the basic processes of the living cell as opposed to primary metabolites produced by the plant to defend itself, for their organoleptic qualities (color, astringency, aroma ...). This could justify the orientation towards its organs by traditional practitioners during their harvests. Other researchers have tested the anti-free radical activity of *Flueggea virosa* extracts by the DPPH method. The ethanolic extract of *F. virosa* was found to be more antioxidant with an IC₅₀ of 0.72 g/l (Agbodan *et al.*, 2017). Furthermore, in their study Chauke *et al.* (2012) found that acetone extracts of *Flueggea virosa* had high antioxidant activity with an IC₅₀ of 30 μg/ml, closely matching the activity of ascorbic acid with an IC₅₀ of 25 μg/ml. The results of our antioxidant activities revealed that the methanolic extract of *F. virosa* was the one with higher total phenolic content (Table 1) and also the one with good antioxidant activity by DPPH method (753.22±66.26 μmol EAA/g) and by ABTS method (8533.97±208.18 μmol EAA/g) (Table 2). Also, Sanogo *et al.* (2009) in their study on *F. virosa*, had shown that kaempferol 3-O-(4-galloyl)-β-D-glucopyranoside presented a better antioxidant activity being also able to modulate the creation of hydroxyl radicals in a more efficient way, acting as a direct scavenger of hydroxyl radicals and chelating the iron. As for *E. poissonii*, the best antioxidant activity was found also by DPPH (218.73±6.43 μmol EAA/g and ABTS (4615.55±249.82 μmol EAA/g).

CONCLUSION

The ethnobotanical survey involved 103 traditional practitioners and identified 47 species divided into 27 families used in the treatment of breast cancer. As a result of this ethnobotanical survey, *Euphorbia poissonii* and *Flueggea virosa* were selected for their phytochemical and antioxidant activities leading to interesting results. Antioxidant activities are plant-dependent and *F. virosa* has the best activities especially with FRAP (3235.81 ± 55.82 μmol (AAE)/g) with leaves, ABTS^{•+} (8533.97 ± 208.18 μmol (AAE)/g) and DPPH[•] (903.95 ± 7.80 μmol



(AAE)/g) with barks. We believe that the anti-cancer activities are related to the presence of these secondary metabolites in the organs of the medicinal plant. Thus, the presence of polyphenolic compounds and the antioxidant activity could justify in part the use of these plant species in the treatment of breast cancer. Our next study will attempt to identify the different recipes used; as well as to study the different toxicities followed by anti-cancer activities on the cell lines in order to realize bio-guidance techniques for the commercialization of improved traditional drugs.

Acknowledgments

The authors are grateful to the associations of practitioners of the cities of Bobo-Dioulasso and Fada N'Gourma whose practitioners agreed to share their know-how.

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