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Research Article

Evaluation of the antioxidant potential and phytochemical analysis of *Terminalia mantaly* and *Terminalia ivorensis* two plants of the Ivorian pharmacopoeia

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Abstract

The neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease and amyotrophic lateral sclerosis are characterized by a significant increase in oxidative stress that can lead to cellular damage to neurons. In recent years, the antioxidant activity of medicinal plants has become important in research against cancer and neurodegenerative diseases.

Terminalia mantaly and *Terminalia ivorensis* are two plants traditionally used to treat lesions, wounds, ulcers and hemorrhoids, malaria and yellow fever. In the present work, we evaluated the antioxidant power and determined the secondary metabolites contained in these two plants.

The results show that *Terminalia mantaly* and *Terminalia ivorensis* have a good antioxidant activity.

They can be studied in the search for drugs against neurodegenerative diseases such as Alzheimer's disease.

Keywords : Alzheimer's disease, Neurons, Parkinson's disease, *Terminalia ivorensis* and *Terminalia mantaly*

INTRODUCTION

Medicinal plants are mainly used for the prevention and curative treatment of many diseases[1]. In recent years, the antioxidant activity of medicinal plants has become important in research against cancer and neurodegenerative diseases.

Many medicinal plants contain a wide spectrum of phytochemical compounds that can be sources of natural antioxidants such as α-tocopherols, phenolic acids, flavonoids, and tannins. These compounds possess in addition to their antioxidant activities other biological properties such as anti-inflammatory, antimicrobial and anticancer activity[2].

The use of these natural substances is not only limited to the therapeutic field but also to the industrial field where plants are increasingly preferred to replace synthetic antioxidants such as BHT (Butyl-hydroxytoluene), BHA (Butyl-hydroxyanisol) and propyl gallate (PG)[3].

The identification of new sources of natural substances of interest is currently one of the most active research areas in the world. It is also a privileged research theme of the Biology and Health Laboratory where this study was conducted. This choice is based on the one hand, on the abundance of medicinal plants in Côte d'Ivoire and on the other hand, on the lack of knowledge of the phytochemical composition and biological properties of many plants used in traditional medicine.

Our objective is therefore to provide a scientific basis for the traditional use of *Terminalia mantaly* and *Terminalia ivorensis* barks through experimental laboratory studies, starting from the hypothesis that the "medicinal" virtues of these plants are mainly due to their antioxidant activity.

MATERIALS

T. mantaly and *T. ivorensis* barks were collected in the Agboville region, located in the southeast of Côte d'Ivoire (Fig. 1).

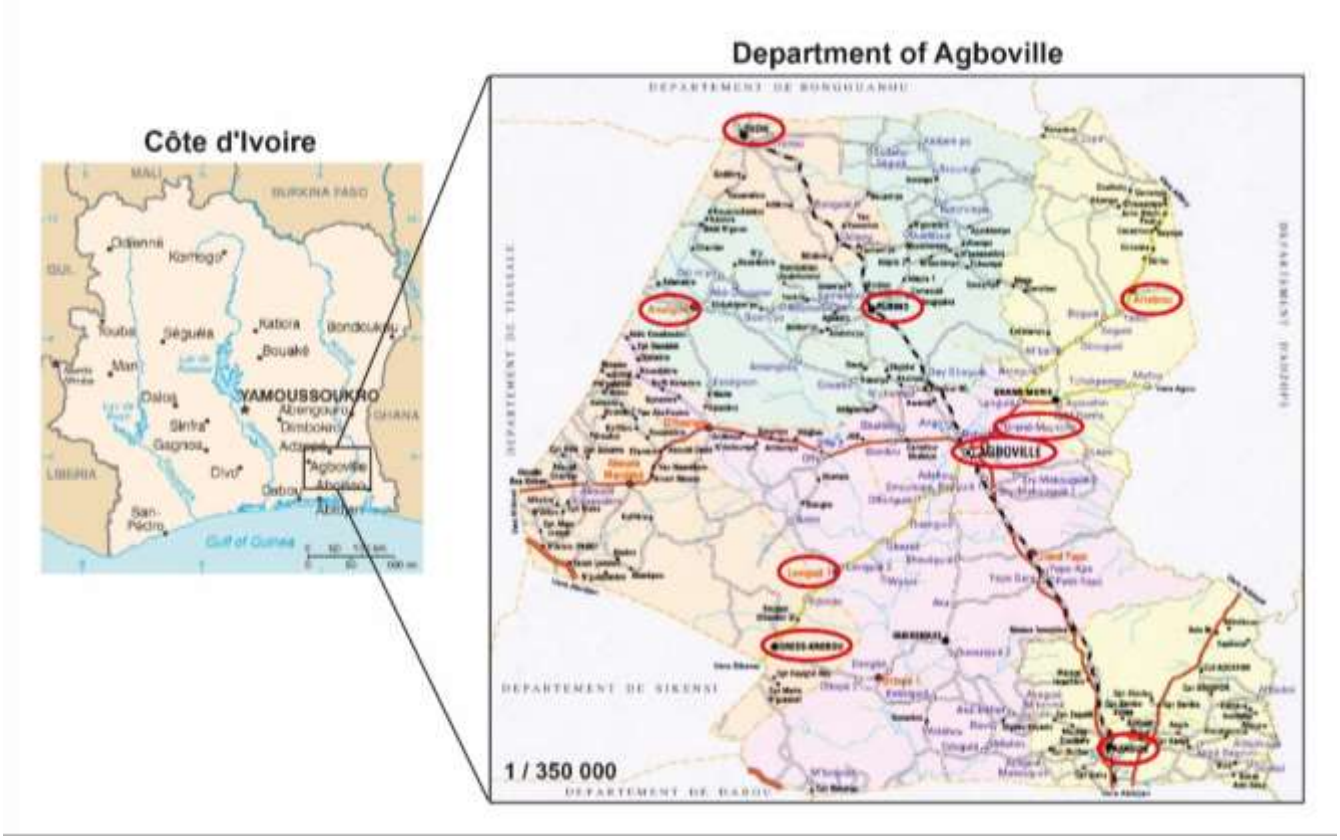

Figure 1. Geographical and administrative context of the Department of Agboville in Côte d'Ivoire

METHODS

Preparation of hydroalcoholic extracts

One hundred grams of plant powder was macerated in 1 L of 70% ethanol for 24H. The homogenate obtained was successively filtered once on clean cloth square, three times on hydrophilic cotton and once on Whatman 3 mm paper. The filtrate obtained was then dried in the "Venticel" oven at 55°C for 48 hours. This series of operations led to the hydroalcoholic extract of the plants.

Evaluation of the antioxidant activity by the DPPH method

Determination of free radical scavenging activity by DPPH assay was performed using the method described by Molyneux[4] slightly modified. An ethanolic solution of DPPH was prepared by dissolving 4 mg of it in 100 mL of ethanol. Then, to 0.8 mL of extract at a given concentration was added 3.2 mL of the DPPH solution. The extracts together with the reference (ascorbic acid) were tested at different concentrations (800 - 400 - 200 - 100 - 50 - 25 - 12.5 - 6.25 µg/mL). Absorbances were measured at 517 nm after 30 minutes of incubation in the dark. Three trials were performed for each concentration of product tested.

The antioxidant activity related to the $DPPH^{\cdot}$ radical scavenging effect is expressed as percent inhibition (I%) using the following formula:

I%= [(Control absorbance - Test absorbance)/ Control absorbance] x 100

Phytochemical study

Phytochemical examination is necessary to identify the major families of secondary metabolites existing in the barks of *T. mantaly* and *T. ivorensis*. We characterized the presence of total polyphenols, catechic tannins, gall tannins, quinones, saponosides, alkaloids, coumarins and anthocyanins.

Total polyphenols

To 2 mL of plant extract is added one drop of a 2% alcoholic solution of ferric chloride. The appearance of a more or less dark blue-black or green coloration indicates the presence of polyphenols.

Catechic tannins

Five milliliters of plant extract, is evaporated to dryness in a porcelain capsule heated on sand. To this residue are added 15 mL of stiasny's reagent. The whole was heated in a water bath at 80 °C for 30 min. The observation of a precipitate in large flakes indicates the presence of catechic tannins.

Gallic tannins

To 5 mL sample of plant extract, was filtered, saturated with sodium acetate. Then added 3 drops of 2% FeCl3 (2 g in 100 mL). The appearance of a blue-black coloration (specific) indicating the presence of gall tannins.

Quinones

In a porcelain capsule, a 2 mL sample of plant extract is evaporated to dryness in a sand bath and then triturated with 5 ml of hydrochloric acid diluted to 1/5. The whole is heated in a boiling water bath in a test tube for 30 minutes. After cooling, the hydrolysate is extracted with 20 mL of chloroform in a test tube. It is then saturated with 0.5 mL of diluted ammonia. A red or purple coloration was the sign of the presence of quinones.

Saponosides

To 2 mg/mL solution of the extract is mixed with water in a test tube. After shaking, the formation of a stable foam would be an indication of the presence of saponosides in the extracts.

Alkaloids

To 6 ml sample of plant extract is evaporated to dryness in a porcelain capsule in a sand bath. The residue is taken up in 6 mL of ethanol (60°). The resulting solution is divided into three test tubes, two drops of Dragendorff's reagent are added. The formation of orange precipitate indicates the presence of alkaloids.

Coumarines

To 2 ml of ethanoic solution (acetic acid) is added 0.5 mL of 10% NaOH. After heating and cooling, 4 mL of distilled water is added. The solution becomes transparent compared to the control. The reaction is positive if the acidification of the transparent solution with a few drops of concentrated HCl causes the yellow coloration to fade to cloudy or if a precipitate is formed.

Anthocyanins

To 2.5 ml of the extract is added 1 mL of 20% HCl. The addition of 5 mL of NH4OH turns the solution purplish blue indicating the presence of anthocyanins[5].

RESULTS AND DISCUSSION

Scavenging of the DPPH free radical

The antioxidant activity of a compound corresponds to its ability to resist oxidation[6]. Many methods are currently used to evaluate this activity. The DPPH radical has been widely used to study the antiradical activity of different plant extracts. The chemical compound 2,2-diphenyl-1-picrylhydrazyl was one of the first free radicals used to study the structure-antioxidant activity relationship of phenolic compounds[7]. It has an unpaired electron on a nitrogen bridge atom. The reduction of this radical is accompanied by its change from the characteristic purple color of the DPPH solution to the yellow color measurable by spectrophotometry at 517 nm[8]. From the values obtained, we calculated the percentages of inhibition using the formula given previously. The values obtained allowed us to draw curves represented in Fig. 2, which show the variation of the inhibition percentage as a function of the concentrations of our extracts. We determined graphically the concentration corresponding to 50% inhibition (IC50). In view of our results, *T. ivorensis* and *T. mantaly* have a very good antioxidant activity justifying their use in traditional medicine.

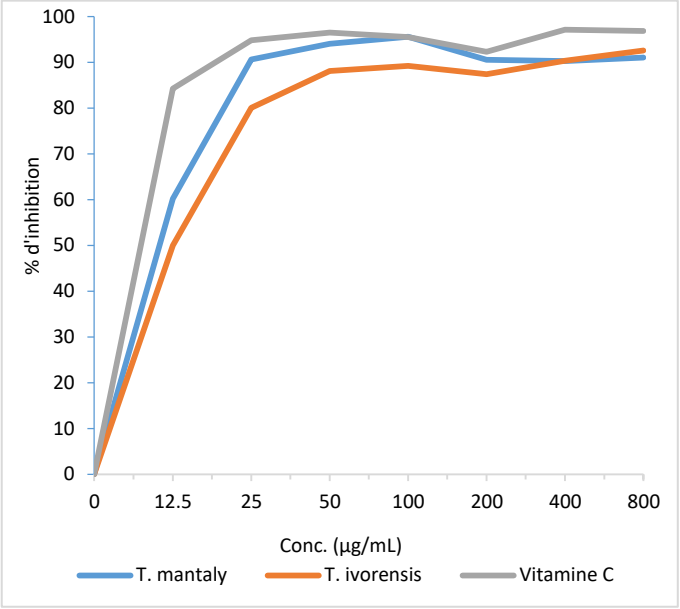

Figure 2: DPPH radical inhibition curve

Table 1: IC_{50} of products

	IC_{50} (µg/ml)
T. mantaly	10
T. ivorensis	12,6
Vitamin C	7,75

Phytochemical tests

Phytochemical tests consist in detecting the different families of secondary metabolites existing in the studied part of the plant by qualitative characterization reactions.

These reactions are based on phenomena of precipitation or coloration by reagents specific to each family of compounds[9]. The results of the phytochemical tests carried out on the hydro-ethanolic extract are grouped in Table 2.

We note that *T. ivorensis* and *T. mantaly* are very rich in polyphenols. Polyphenols are powerful antioxidants that help neutralize free radicals, which justifies the antioxidant power of these two plants. These plants also contain gall tannins, saponosides, anthocyanins, quinones and alkaloids. There is an absence of catechic tannins and coumarins.

Table 2: Phytochemical composition of hydroalcoholic extracts

	Total Polyphénols	Catechic Tannins	Gallic Tannins	Quinones	saponosides	Alkaloids	Coumarines	Anthocyanins
Terminalia ivorensis	+++	-	+++	+	+++	+	-	++
Terminalia mantaly	+++	-	+++	+	+++	+	-	+++

CONCLUSION

This study has shown that *Terminalia ivorensis* and *Terminalia mantaly*, two plants widely used in traditional medicine can be a source of new natural antioxidant molecules. They can be studied in the search for drugs against neurodegenerative diseases such as Alzheimer's disease.

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