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Phytochemical Screening of Eleven Medicinal Plants Used in the Traditional Treatment of Schistosomiasis in Adzopé (Côte d'Ivoire)

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ABSTRACT

A recent study conducted among the Attié people of the Adzopé Health District revealed 33 medicinal plants used against schistosomiasis. Among these species, 11 were selected according to their heritage value. This study aims to highlight the groups of phytochemical compounds of these selected plants that are likely to have antiparasitic activity against the schistosomes responsible for the pathology which still remains a neglected tropical disease (NTD). Tube staining tests were used to identify these compounds. The phytochemical screening carried out on the aqueous extracts of the plants revealed polyphenols, flavonoids, sterols and polyterpenes, saponins, alkaloids, catechic and gallic tannins and quinones, which would give them antiparasitic therapeutic properties. Some of these plants are potential candidates for the development of a phytomedicine against schistosomiasis.

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INTRODUCTION

Schistosomiasis or bilharzia is a neglected tropical disease (NTD) caused by worms of the genus *Schistosoma*. It is the second most common parasitic endemic in the world after malaria and is one of the most widespread parasitic diseases in the world (Zoni & Catalá, 2016). It has major health and socio-economic repercussions in developing countries, where it constitutes a major public health problem (Tchuenté *et al.*, 2013) and poses a barrier to achieving the Sustainable Development Goals (living good health and promoting well-being). In Côte d'Ivoire, the results of parasitological surveys have shown that urinary and intestinal schistosomiasis remain endemic with high prevalences in unfavourable hygiene and sanitation conditions despite control efforts (Yapi *et al.*, 1988; Todesco & Rey, 1989; Fournet *et al.*, 2004; Assaré *et al.*, 2014). To date, the effective control method remains chemoprevention (CP). Praziquantel (PZQ) remains the drug recommended by WHO in the control strategy for this disease (WHO, 1985). However, evidence of emerging drug resistance and low efficacy of PZQ has been reported in Egypt and Senegal (Cioli *et al.*, 2008). This is compounded by serious adverse effects, prolonged treatment duration and complex drug delivery systems (Pink *et al.*, 2005). Faced with these constraints, plants, being one of the main sources of biomolecules production, offer themselves as a therapeutic alternative to be explored. Indeed, the World Health Organisation (WHO) estimates that 80% of the population in developing countries rely on traditional medicine, mainly using plant extracts to meet their needs (WHO, 2002). Therefore, Traditional Medicine (TM) products remain the main source of health care for the vast majority of the population. In fact, the use of traditional herbal remedies can provide important information on the pharmacological effects of a particular group of chemical compounds on humans (Sawadogo and Thill, 1995). In addition, the management of schistosomiasis through herbal recipes could serve as a source of new schistosomicidal principles (Jatsa *et al.*, 2009; Rafe et al., 2010). Thus, the present study was conducted to identify groups of phytochemicals that may have anti-parasitic activity against schistosomes responsible for schistosomiasis in 11 plants selected according to their heritage value following an ethnobotanical survey in the Adzopé Health District (Bene *et al.*, 2023).

MATERIAL AND METHODS

Table I shows the 11 selected plants and the different parts used.

Table I: Selected plants and parts used

Medicinal plants	**Parts used**
Eleusine indica	Whole plant
Gouania longipetala	Leaves
Blighia unijugata	Leaves
Scoparia dulcis	Leafy twig
Cananga odorata	Stem bark
Mareya micrantha	Leaves
Vernonia amygdalina	Leaves
Eclipta prostrata	Leafy twig
Anthocleista djalonensis	Root bark
Cymbopogon Giganteus	Whole plant
Distemonanthus benthamianus	Stem bark

Phytochemical screening

This part started with the harvesting, drying (in the shade) and pulverisation of the plant organs. Aqueous extraction of the phytocompounds was carried out according to the method of Zirihi *et al.* (2003). Fifty grams of powder of each plant was homogenised in 50 mL of distilled water using a blender. The resulting homogenate was filtered through a white cloth square and then through cotton wool before passing through a Whatman filter. The resulting macerate was used as the stock solution for the detection of phytochemicals.

Phytochemical screening was carried out to detect some major groups of secondary metabolites contained in the aqueous extract of the selected plants. The chemical groups were characterised with the different reagents according to the classical tube reaction methods described (N'Guessan *et al.*, 2009; Mangambu *et al.*, 2014).

- ***Sterols and polyterpenes***

The Liebermann reagent was used to detect sterols and polyterpenes. Five mL of plant extract was evaporated to dryness in a capsule on a sand bath. The residue was dissolved in 1 mL of acetic anhydride while hot. To the resulting triturate, 0.5 mL of concentrated sulphuric acid was added. The appearance at interphase of a purple and violet ring, turning blue and then green, indicates a positive reaction.

- ***Polyphenols***

The detection of polyphenols was carried out using iron chloride ($FeCl_3$). To this end, to 2 mL of plant extract solution, add one drop of 2% alcoholic ferric chloride solution. The appearance of a more or less dark blue-black or green colour indicates the presence of polyphenols.

- ***Flavonoids***

In a test tube, introduce 1 ml of test extract, add 1 ml of hydrochloric acid (HCl) and 3 magnesium chips. The appearance of a red or yellow coloration reveals the presence of flavonoids.

- ***Catechic and gallic tannins***

Catechic tannins were identified using Stiasny's reagent (Formol 30%, concentrated HCL: 1/0.5). To 0.1 mg of plant extract, 15 mL of Stiasny's reagent was added. The mixture was kept in a water bath at 80 °C for 30 minutes. The observation of a coarse flake precipitate characterises the presence of catechic tannins.

Gallic tannins were confirmed by the use of iron chloride ($FeCl_3$). Indeed, the filtrate obtained by mixing 0.1 mg of plant extract and 15 mL of Stiasny's reagent was saturated with sodium acetate and then 3 drops of a 2% FeCl3 alcoholic solution were added. The appearance of an intense blue-black coloration indicates the presence of gallic tannins.

- ***Alkaloids***

For the detection of alkaloids, the Dragendoff (iodobismuthate reagent) and Bouchardat (iodoiodide reagent) reagents were used. Indeed, 6 mL of the extract was evaporated to dryness. The residue was taken up in 6 mL of alcohol at 60 °C. The addition of 2 drops of Dragendoff's reagent to the alcoholic solution causes a precipitate or an orange coloration.

The addition of 2 drops of Bouchardat's reagent to the alcoholic solution causes a reddish-brown precipitate and indicates a positive reaction.

- ***Saponosides***

To detect the saponosides, 10 mL of the aqueous extract was introduced into a test tube. The tube was shaken vigorously for 15 seconds and left to stand for 15 minutes. A persistent foam height of more than 1 cm indicates the presence of saponosides.

- ***Quinones***

Quinones were detected in the residues by the Borntraëger reagent. An aliquot of residue dissolved in 5 ml of 1:5 diluted HCl was heated in a boiling water bath for 30 min, then extracted with 20 ml of $CHCl_3$ after cooling. To the organic phase, 0.5 ml of NH_4OH diluted to 50% is added. The appearance of a red to violet colour indicates a positive reaction.

RESULTS

The results of the phytochemical screening are listed in Table II. It is noted that all plants contain sterols and polyterpenes. Only *Cananga odorata*, *Cymbopogon giganteus* do not contain flavonoids. *Mareya micrantha* alone contains gall tannins while catechic tannins are present in the other plants except for *Scoparia dulcis*, *Eleusine indica* and *Cymbopogon giganteus*. Five of them do not contain saponosides, namely *Eleusine indica*, *Cananga odorata Mareya micrantha*, *Anthocleista djalonensis* and *Cymbopogon giganteus*.

Vernonia amygdalina, *Eleusine indica* and *Canaga odorata* do not contain polyphenols. All aqueous extracts contain quinones except *Gouania longipetala*, *Canaga odorata* and *Anthocleista djalonensis.*

Finally, we note the absence of alkaloids in the following plants: *Cananga odorata*, *Eclipta prostrata.*

Sterols and polyterpenes are the most abundant phytochemical compounds, whereas gall tannins are almost non-existent in the species studied.

Table II: Results of phytochemical screening of selected plants

Medicinal plants	Secondary metabolites							
	Polyphenols	Flavonoids	Sterols et polyterpenes	Saponosides	Alkaloids	Catechic tannins	Gallic Tannins	Quinones
Eleusine indica	-	-	+	-	+	-	-	+
Gouania longipetala	+	-	+	+	+	+	-	-
Blighia unijugata	+	-	+	+	+	+	-	+
Scoparia dulcis	+	+	+	+	+	-	-	+
Cananga odorata	-	-	+	-	-	+	-	-
Mareya micrantha	+	+	+	-	+	+	+	+
Vernonia amygdalina	-	+	+	+	+	+	-	+
Eclipta prostrata	+	+	+	+	-	+	-	+
Anthocleista djalonensis	+	+	+	-	+	+	-	-
Cymbopogon giganteus	+	-	+	-	+	-	-	+
Distemonanthus benthamianus	+	+	+	+	+	+	-	+

+ : presence ; - : absence

DISCUSSION

The phytochemical study carried out on the 11 plants revealed the presence of phytocompounds such as: polyphenols, flavonoids, tannins, quinones, alkaloids, sterols and polyterpenes, saponosides. The anti-schistosomiasis effect of these plants could be linked to the presence of these phytocompounds. According to Molan *et al*. (2000), tannin plants inhibit the hatching of parasitic worm eggs. These effects would be due to the presence of condensed tannins. In addition, several authors such as Min *et al.* (2003) and Brunet *et al.* (2008) reported that condensed tannins would diffuse to the membrane surface of eggs and larvae in order to bind to free proteins of the membrane, thus inducing the inhibition of egg hatching and larval mortality. Alkaloids by their analgesic property could relieve pain during micturition and abdominal pain in bilharzia patients (Guenfis & Guermoudj 2018). In addition, studies have shown the antiparasitic effect of polyphenols, tannins, flavonoids and alkaloids (Fournet *et al.*, 1988; Robertson *et al.* 1995; Schofield *et al.*, 2001; Muanda, 2010; Vasquez Ocmin, 2018).

CONCLUSION

The qualitative phytochemical analysis of 11 aqueous extracts of medicinal plants revealed numerous compounds such as polyterpene sterols, polyphenols, tannins, flavonoids, alkaloids, quinones and saponosides. These compounds are thought to be responsible for several biological properties, including anti-schistosomiasis. Their presence confirms their traditional use in the treatment of bilharzia. The extracts of these plants can be packaged as phytomedicines effective in the fight against this neglected tropical disease.

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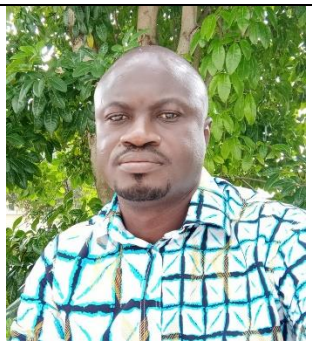	***BENE Kouadio*** *NANGUI ABROGOUA University* *02 BP 801 Abidjan 02*
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