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Comparative Studies of Phytochemical Compounds from Plants Parts of *Piliostigma thoninngii*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Herbal treatment is cheap when compared to conventional medicine; this has resulted in an increased demand for herbal remedies worldwide leading to realization of enhanced new drugs. The bio-activity in natural products is due to phytochemicals, often elaborated for the plant defense against pathogen attack, inter-plant competition and against abiotic stresses. *Piliostigma thonningii* is used for various medicinal purposes in African and attention was drawn to this plant because of several claims on its enormous applications as an ethnomedicinal plant used to cure several diseases. This study was conducted to extract the phytochemical compounds from plant parts of *Piliostigma thoninngii.* Maceration method of extraction was used to extract the phytochemical compounds from the plant parts (leaf, stem bark, and root bark) using ethanol and aqueous as extracting solvent. The phytochemical tests were conducted using standard conventional methods. The phytocompound tested were alkaloid, Saponin, Steroid, Tanin, Flavoniod, Anthraquinones and Triterpenoids. Result of the phytochemical test showed the absent of saponins and anthraquinones in leaf aqueous extract and also saponin and triterpenoids in ethanol extract, while the stem and root bark of *Piliostigma thonningii* showed the absent of steroid, flavonoids and anthraquinones on aqueous extract while triterpenoids was absent in ethanol extracts. *Piliostigma thonningii* is a small tree or shrub which has many uses as it is used in traditional medicine, and modern medical research has found that they have beneficial properties. This study revealed that *Piliostigma thonningii* is a plant with available phytochemical compound which can be harness for modern drug design.

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1. INTRODUCTION

Piliostigma thonningii is a leguminous plant belonging to family of Ceasapinaceae [1,2]. It is perennial in nature which shows varying color of its petals from white to pink. It is found growing abundantly as a wild uncultivated tree in many parts of Nigeria and usually distributed in Africa and Asia in open woodlands and savannah region that are moist as well as wooded grass lands in low to medium altitude [3,1]. Its' fruits are hairy, hard and flattish pod which turns rusty brown, woody, twisted and splits at ripening [1]. Other common names of *Piliostigma thonningii include* Camel's foot and monkey bread. In Nigeria it is locally known as *Kalgo* or *Kargo* in Hausa; *Abefe* in Yoruba; and *Okpoatu* in Igbo [3,4]. According to Bello et al. [1], *Piliostigma thonningii* has been reported in literature to have age-long use in traditional medicines. Its' therapeutic value has been established in the treatment of various diseases such as ulcers, gastric heart pains, gingivitis, antipyretia, malaria, fever, leprosy, sore throat, cough, dysentery, snake bites, hookworms, skin infection, etc [5,6]. Plants have shown to possess some biological (phytochemicals) constituents that have significant activity against microorganism (Bacteria, viruses, fungi). As a result of the easy assimilation and elimination as well as the less toxicity of the medicinal plant as against the synthetic drugs, makes it very effective and do not usually accumulate in the body [7,2]. Plant synthesizes a wide variety of chemical which can be arranged by their chemical class, biosynthetic origin and functional groups into primary and secondary metabolites, hence, more Information on the chemical component of plants is desirable, not only for the discovery as therapeutic agents, but because such information be of value in disclosing new resources of such chemical substances [1].

The current trend of antibacterial resistance to commonly used antibiotics has led to a search for newer and alternative compounds for the treatment of drug-resistant infections. Production of substandard drugs and its' consumption by patients has caused diverse health hazards to human thereby causing difficulties in the treatment of bacterial infections [8]. Therefore, this study was carried out to determine the phytochemical compounds present in the plant part of *Piliostigma thonningii* extracts.

Fig. 1. Tree of *Piliostigma thonningii*

2. MATERIALS AND METHODS

2.1 Collection of Plant Material Samples

Fresh leaves stem and roots bark of *Piliostigma thonningii* were collected from Ubulu in Kasuwan Magani, Chikun Local Government Area of Kaduna State, Nigeria, Africa. The plant was taxonomically identified and authenticated at the Herbarium unit of the Department of Biological Science, Faculty of Science, Kaduna State University, Nigeria.

2.2 Preparation of Extract

The *Piliostigma thonningii* parts were washed using clean tap water and shade-dried. The dried plant parts were crushed to powdery texture with a mortar and pestle. Fifty gram (50g) of the fine powder of the leaves, stem and root bark were measured each and separately placed in 250ml solvent (95% ethanol and water) for 48hr with constant agitation to obtain their crude extracts. The extracts were filtered through Whatman filter paper No. 1. The extracts were evaporated to dryness using hot air oven at a temperature of $50^{o}C$ [9].

2.3 Phytochemical Screening

The fraction of various solvent of the plant parts of *Piliostigma thonningii* was subjected to preliminary phytochemical screening to identify the phytocompounds present.

2.4 Alkaloid

About 0.5g of the extract was dissolved in 5ml of 1% aqueous hydrochloric acid on a water bath and filtered. The filtrate was divided into three portions. To the first portion few drops of freshly prepared Dragendorff reagent was added and observed for formation of orange to brownish precipitate. To the second portion 1 drop of Mayer reagent was added and observed for formation of white to yellowish or cream color precipitate. To the third portion one drop of Wagner reagent was added to give a brown, reddish or reddish- brown precipitate. The presence of precipitate in most or all of the above reagents indicates the presence of alkaloids [10,11].

2.5 Flavonoid

2.5.1 Shinoda test

The presence of flavonoid was estimated by shinoda test. The extracts (0.2g) were treated with few drops of concentrated HCL and magnesium chips. The appearance of pink or red color within few minutes indicated the presence of flavonoid [12].

2.5.2 Steroid

The extract (1ml) was dissolved in 10ml of chloroform and equal volume of concentrated H_2SO_4 was added from the side of the test tube. The upper layer turns red and H_2SO_4 layer showed yellow with green fluoresces. These indicate the presence of steroid [13].

2.5.3 Saponin

Distilled water (20ml) was added to 0.5g of the extract in a graduated cylinder and agitated for 15 minutes. The formation of 1cm layer of foam indicates the presence of saponin [13].

2.5.4 Tannin

About 1% gelatin solution containing sodium chloride was added to the extract (2ml). The formation of white precipitate indicates the presence of tannins [14].

2.5.5 Anthraquinones

To the extract (2ml) in a dry test tube, 5ml of chloroform was added and then shaken for at least 5minutes. this was filtered and the filtrate shaken with equal volume of 10% ammonia solution , bright pink color in (upper) layer indicates the presences of free anthrquines [10].

2.5.6 Triterpenoids

Lieberman Bouchard test; 1 mL of anhydrous acetic acid and 3 drops of concentrated sulfuric acid were added to 2 mL of the extract dissolved in isopropyl alcohol. After 5 min a blue-green color middle layer was indicative of sterols, but pink, red, magenta or violet color revealed the presence of terpenoids [15].

3. RESULTS AND DISCUSSION

3.1 Phytochemical Compounds of Aqueous and Ethanol Extract of *Piliostigma thonningii*

The phytochemical screening of the leaf, stem bark and root bark of *Piliostigma thonningii* (Table 1). The phytocompounds tested from the leaf, stem bark and root bark include: alkaloid,

saponin, steroid, tannin, flavonoid, anthraquinones and triterpenoids. The aqueous extract of leaf showed the presence of alkaloids, steroid, tannin, flavonoid and triterpenoids as Ipav et al. [4] recorded similar findings. However, the aqueous extract of both stem and root bark showed the presence of alkaloid, saponin, tannin and anthraquinones. On the other hand, the ethanolic extract of leaf was negative for saponin and triterpenoids. The ethanol extract of the root bark and stem bark was positive for all the phytocompounds except triterpenoids which tested negative in both stem and root bark as similar findings was reported by Sibanda et al. [8]. Furthermore, Ewansiha, Okafor, Doughari and Busari [2] reported the presence of flavonoid in the aqueous leaf extract of *P. thonningii*. The result of the study is also comparable to that of Dluya and Dahiru (2018) who reported the presence of alkaloids, tannins, flavonoids and saponins from the methanol extract of stem bark of *P. thonningii*. Similarly, Deshi, Wonang and Dongs [16] reported the presence of alkaloids, Flavonoids, Saponins and Tannins in the bark and leaf of *P. thonningii*. The variation in metabolite recovered from the different studies according to Ewansiha et al. [2] can be accredited to the fact that secondary metabolites (group of compound classes that occur naturally) in herbs are biosynthesized by different biochemical pathways whose content and regulation is highly subject to environmental influences and to potential herbal predators. Abiotic and biotic factors might be specifically induced by means of various mechanisms, which create variation in the accumulation or biogenesis of secondary metabolites.

The results show that the stem and root bark of ethanol extract yielded more phytocompounds than the leaf extracts. It also put to indicator that ethanol is a better extract for *Piliostigma thonningii* than aqueous, because all the plant parts extracted with ethanol tested positive to more phytocompounds when compared to the aqueous extract of the same plant part suggesting that polar solvent ethanol is most successful in extracting secondary metabolites.. The findings of the study agrees to the findings of Ighodaro and Omale [3], Ipav et al. [4]. That established that ethanol is a better extract than aqueous. The result shows that the stem and root bark of ethanol extract yielded more phytocompounds than the leaf extracts, this is in line with the report by Anyanwu and Okoye, (2017) who reported that higher concentration of secondary metabolites in plants occur in the plant bark, and the concentrations varies from one plant species to another and from season to season and environment.

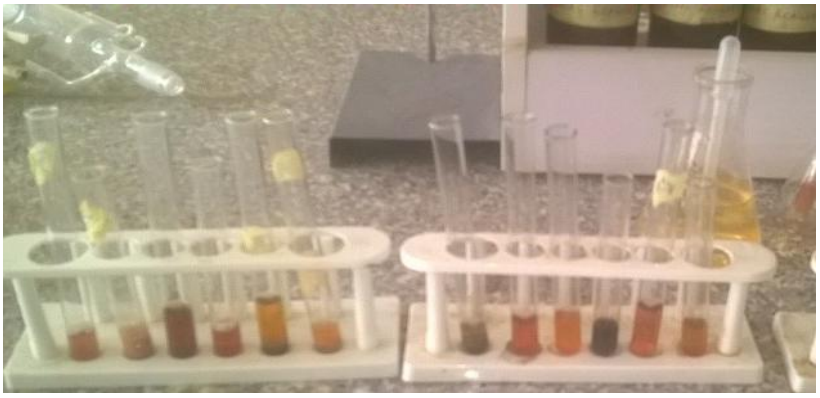

Fig. 2. Illustrating test for identification of phytocompound

Table 1. Physical Characteristics of Aqueous and Ethanol fractions of the plant parts of *Piliostigma thonningii*

Plant parts	Solvent	Texture	Colour
Leaves	Aqueous	Hard	Dark Green
	Ethanol	Semi solid	Dark Green
Stem bark	Aqueous	Hard	Deep Red
	Ethanol	Hard	Deep Red
Root bark	Aqueous	Hard	Deep Red
	Ethanol	Hard	Deep Red

Table 2. Phytochemical Constituents of Aqueous and Ethanol Extract of *Piliostigma thonningii*

Plant parts	Leaf		Stem bark		Root bark	
Phytochemicals	Aqueous	Ethanol	Aqueous	Ethanol	Aqueous	Ethanol
Alkaloid	+	+	+	+	+	+
Saponin	-	-	+	+	+	+
Steroid	+	+	-	+	-	+
Tannin	+	+	+	+	+	+
Flavonoid	+	+	-	+	-	+
Anthraquinones	-	+	-	+	-	+
Triterpenoids	+	-	+	-	+	-

Keys: + (present), - (not detected)

4. CONCLUSION

The phytochemical analysis reveal the presence of alkaloid, tannin, and triterpenoids in aqueous extract of the plant parts while alkaloid, steroid, tannin, flavonoid and anthraquinones were present in ethanol extract of the plant part. These finding indicate that ethanol extract is a better extract for *P. thonningii* than aqueous, because all the plant parts extracted with ethanol tested positive to more phytocompounds when compared to the aqueous extract of the same plant part. Hence, *Piliostigma thonningii* is a plant reach in phytocompounds.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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