



Phytochemical Screening of (*chrysophyllum albidum*) Leaf Extracts

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ABSTRACT

Chrysophyllum albidum is a medicinal plant used for different diseases. The present work was aimed to screen this medicinal plant for phytochemical studies. The method of cold maceration was used in the extraction by serial exhaustive extraction method which involves successive extraction with solvents of increasing polarity from a non polar (hexane) to a more polar solvent (methanol) to ensure that a wide polarity range of compound could be extracted. Extracts of Leaf of *C. albidum* revealed the presence of flavonoids, phenols, glycosides, terpenoids, saponins, steroids and alkaloids in methanol extract and absence of anthraquinone, tannins, glycosides extract. The phytochemical compounds identified known to be bioactive and have been confirmed have medicinal as well as physiological activity and therefore could be said to be responsible for the efficacy of the leaves of the plants studied in treatment of different ailments. These classes of phytochemical compounds are known to show curative activity against several bacteria and it is not surprising that these plant extracts are used traditionally by herbalist to cure bacteria related ill-health. The plant extracts could therefore be seen as a potential source for useful drug and the continued traditional medicinal use of these plants is therefore encouraged.

INTRODUCTION

Plants have been used for alleviating human suffering from the very beginning of human civilization, and records of the use of plants are available since about 5000 years ago. The active principles isolated, have provided leads in the development of several life saving drugs, which are in use today. Different civilizations developed their own indigenous system of medicines (Gupta et al.; 2010). Medicinal plants are of great importance to the health of individuals and communities (Edeoga et al.; 2005). Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Ncube et al.; 2008). The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body and these chemical substances are called phytochemicals. These are non-nutritive

chemicals that have protective or disease preventive property (Subhashini *et al.*, 2010). Sofowora (1982) pointed out that tropical plants represents largely untapped medical resource, and the use of many of them familiar to traditional healers are still unknown to western healers (Ijomah *et al.*; 1997). Sofowora (1993) has stated that despite the aggressive activities in this field of chemistry, the task is still at its early stages. Sandberry and Brulm (1979), reported that only about 10% of all plants have been investigated in detail for bioactive agents. Perhaps one of the greatest arguments against traditional medicine today is the lack of scientific proof of its efficacy. Most of the claims are made by traditional medical practitioner themselves and may have not been thoroughly investigated scientifically (Sofowora 1982). For this reasons therefore, it could be argued that further investigation into this medicinal plant is needed. The rural inhabitants and traditional medicine practitioners in Calabar municipality Government of Cross River State uses the *Chrysophyllum albidum* leaves for the treatment of malaria, yellow fever, diarrhea, vaginal and dermatological infections. Botanically called *Chrysophyllum albidum*, white star apple belongs to the Sapotaceae family. It is distributed throughout the southern part of Nigeria. Amusa *et al.*; (2003) pointed out that across Nigeria, it is known by several local names and is generally regarded as a plant with diverse ethno-medicinal uses in Southwestern Nigeria, the fruit is called agbalumo and popularly referred to as udara in Southeastern Nigeria. Houessou *et al.*; 2012 accounted for the multipurpose nature of *Chrysophyllum albidum* as follows; Its fleshy fruits are widely consumed and the different plant parts are used in folk medicine to treat several diseases and disorders and the fruits contribute to improve health, nutrition, food security and income of the local communities. Amusa *et al.*; (2003) pointed out that across Nigeria, it is known by several local names and is generally regarded as a plant with diverse ethno-medicinal uses

C. albidum is widely used as an application to sprains, bruises and wounds in herbal medicine in southern Nigeria. The seeds and roots extracts of *C. albidum* effectively arrested bleeding from fresh wounds, inhibited microbial growth of known wound contaminants and accelerates wound healing process (Okoli and Okere 2010). The people of south western Nigeria have been using *C. albidum* leaves for the management of infections / ailments since prehistoric times (Duyilemi and Lawal 2009). The roots and leaves of *C. albidum* have been widely used for medicinal purposes (Adewusi, 1997). In addition, its seeds are a source of oil, which is used for diverse purposes. (Ugbogu and Akukwe 2008). *C. albidum* is used in folklore in the treatment of yellow fever, malaria, diarrhea, vaginal and dermatological infections (Abiodun *et al.*; 2011). Abiodun *et al.*; (2011) accounted for the ethnobotanical uses of *C. albidum* as follows; The bark is used for the treatment of malaria and yellow fever, while the leaf is used as an emollient and for the treatment of skin eruption, stomachache and diarrhea (Idowu *et al.*, 2006). *Chrysophyllum albidum* is established to have haematinic potentials (Adewoye 2012). In addition, its seeds are a source of oil, which is used for diverse purposes (Ugbogu and Akukwe, 2008). The fruits also contain 90% anacardic acid, which is used industrially in protecting wood and as source of resin, while several other components of the tree including the roots and leaves are used as a remedy for yellow fever and malaria (Duyilemi and Lawal 2009). The leaves are used as emollients and for the treatment of skin eruptions, diarrhea and stomach ache, which are as a result of infections and inflammatory reactions (Adisa 2000). The people of south western Nigeria have been using *C. albidum* leaves for the management of infections / ailments since prehistoric times, although scientific evidence for its antimicrobial effect is still lacking (Duyilemi and Lawal 2009). The cotyledons from the seeds of *C. albidum* are used as ointments in the treatment of vaginal and dermatological infections in Western Nigeria. This present study has the main aim of presenting a medicinal plant *C. albidum* in Calabar Municipality Local Government of Cross River State with view to promoting this natural herb and to optimize the use of available natural resources in the environment. The specific objectives were extracting, conducting simple chemical tests to detect the presence of some secondary metabolites like anthraquinones, alkaloids; saponins, tannins, glycosides, flavonoids and phenols.

MATERIALS AND METHODS

Sample Collection and Preparation

Chrysophyllum albidum leaves were collected from their natural habitat of plain sandy soil of coastal plain sands in Calabar Municipality (04° 15'N; 08° 25'E), Nigeria. The sample was air-dried for about two weeks and then milled into fine powder using a milling machine.

Method of Extraction

The method of cold maceration was used in the extraction by Serial exhaustive extraction method which involves successive extraction with solvents of increasing polarity from a non polar (hexane) to a more polar solvent (methanol) to ensure that a wide polarity range of compound could be extracted. The extracts of the leaves was prepared by soaking 100 g of each in 250 ml hexane for four days with frequent agitation until soluble matter is dissolved. The resulting mixture was filtered by gravity filtration and the filtrate was concentrated by evaporation using rotatory evaporator, kept in a vaccum oven over night at room temperature to remove all the solvent and weighed. The procedure was repeated on the residue using the following solvents: chloroform, ethyl acetate, acetone and methanol sequentially in order of polarity. The extracts were kept in a refrigerator under argon condition until required for testing.

Phytochemical Screening Assay

Phytochemical examinations were carried out for all the extracts using standard procedures to identify the constituents. Qualitative analysis of the crude extracts were carried out as described by Brain and Turner (1975), Sofowora (1993), Osuagwu *et al.*, (2007), Ushie and Adamu (2010) and Okoli *et al.*; (2010) to identify the presence of the classes of Secondary Metabolites (alkaloids, anthraquinones, flavonoids, tannins, saponins, glycosides, cardiac glycosides, terpenes, steroids, phenol, etc)

RESULTS AND DISCUSSION

Nature and yield of crude extracts from the leaves of *Chrysophyllum albidum*

The results obtained from the cold extraction of secondary metabolites from the leaves of *Chrysophyllum albidum* using hexane, chloroform ethyl acetate, acetone and methanol in the order of increasing polarity are summarized in table 1

Table 1 Nature and yield of crude extracts from the leaves of *Chrysophyllum albidum*

Solvents	Extract colour	Extract Texture	Extract yield	Percentages recovery (%)
Hexane	Dark green	Sticky solid Powder	11.2 g	11.8
Chloroform	Dark Green	Semi sticky powder	9.00 g	10.0
Ethyl acetate	Greenish	Hard powder	5.10 g	9.00
Acetone	Greenish	Hard powder	8.00 g	6.8

Methanol	Light green	Powder	6.00 g	5.8
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Result of the preliminary phytochemical screening of *Chrysophyllum albidum* leaf extracts.

The hexane, chloroform, ethyl acetate, acetone and methanol extracts of the leaves of *Chrysophyllum albidum* were screened for the presence of some phytochemicals such as alkaloids, anthraquinones, saponins, steroids, terpenes, flavonoids, tannins, phenols, glycosides and cardiac glycosides. The results obtained reveal the absence of anthraquinones, tannins, and glycosides in all the extracts. Also, alkaloid was not detected in all the extracts except methanol extracts while phenol is was detected in chloroform, ethyl acetate and methanol extracts. Flavonoids, steroids, terpenes, cardiac glycosides and saponins are present in all the extracts. These are presented in table 2 below.

Table 2: Preliminary screening of leaf extracts from *Chrysophyllum albidum*

Phytochemicals	Reagents	Extracts				
		Hexane	Chloroform	Ethyl acetate	Acetone	Methanol
1 Alkaloids	a) Wagners	-	-	-	-	+
	b)Mayer	-	-	-	-	+
	c)Drangerdoff	-	-	-	-	+
	d)Hager	-	-	-	-	+
2 Anthraquinone	Extact in benzene + Ammonia	-	-	-	-	-
3 Tannins	Solutions of extracts + ammonia solution	-	-	-	-	-
4 Flavonoids	a)Lead acetate	+	+	+	+	+
	b)Ferric chloride	+	+	+	+	+
	c)Alkaline test	+	+	+	+	+
	d)extracts + ethyl acetate + ammonia	+	+	+	+	+
5 Steroids	Extacts + acetic anhydride + H ₂ SO ₄	+	+	+	+	+
6 Terpenes	Extacts + chloroform +H ₂ SO ₄	+	+	+	+	+
7 Glycosides	a)Extracts + dil H ₂ SO ₄ + NaOH+ Fehling solution	-	-	-	-	-
	b)Extracts +ferric chloride in boiling water + benzene	-	-	-	-	-

Presence of constituent = +

Absence of constituent = -

DISCUSSION

The phytochemical screening of crude yields of the chemical constituents of *C. albidum* showed that flavonoids, steroids, terpenes, cardiac glycosides and saponins are present in all the leaf extracts. Alkaloids were detected in the methanol extract only which corroborates with previous research by Okoli and Okere (2010) on their work on the ethanolic extracts. These classes of secondary metabolites are known to show medicinal activity as well as exhibiting physiological activity (Sofowara, 1993). These classes of phytochemical compounds are known to show curative activity against several bacteria and it is not surprising that these plant extracts are used traditionally by herbalist to cure bacteria related ill-health (Njoku and Obi 2009).

Chrysophyllum albidum can be used as anti-inflammatory, antispasmodic, antianalgesic and diuretic properties which can be attributed to their high flavonoids, steroids, glycosides and saponins (Savithramma 2011). Okoli and Okere (2010) pointed out that flavonoids are potent water soluble super antioxidants and free radical scavengers which prevent oxidative cell damage, have strong anticancer activity and inhibit tumor growth (Stauth, 1993). The beneficial effects of fruit, vegetables, and tea or even red wine have been attributed to flavonoid compounds rather than to known nutrients and vitamins (Félicien, 2008).

Saponin causes complexation with cholesterol to form pores in cell membrane bilayers, e.g., in red cell (erythrocyte) membranes, where complexation leads to red cell lysis (hemolysis) on intravenous injection. (Francis *et al.*; 2002). Saponins have also been used as adjuvants in vaccines (Skene *et al.*, 2006). There is tremendous, commercially driven promotion of saponins as dietary supplements and nutraceuticals. There is evidence of the presence of saponins in traditional medicine preparations (Xu, *et al.*, 1996).

Chrysophyllum albidum is important in pharmacy because it contain steroidal compounds which are of importance and interest in pharmacy due to their relationship in sex hormones (Okwu 2001), development and control the reproductive tract in humans, molt insects, induce sexual reproduction in aquatic fungi. Pharmacologically, glycosides has been found to be useful in treatment of several illness for instance cardiac glycoside have long been employed as important ingredient for arrow poisons and drugs (Trease and Evans 1989).

Alkaloids were detected in methanol extract only which corroborates with previous research by Okoli and Okere (2010) on their work on the ethanolic extracts of *Chrysopyllum albidum*. Hence, *Chrysopyllum albidum* can be used as an analgesic, anaesthetic and as social drugs since it contains alkaloids.

The alkaloids contained in plants are used in medicine as anaesthetic agents (Herourat *et al.*; 1988). Harborne (1988) also reported on analgesic properties of alkaloids. Alkaloids has contributed to the majority of the poisons, neurotoxins and traditional psychedelics and social drugs [e.g. nicotine, caffeine, methamphetamine (ephedrine) cocaine, and opiates] consumed by humans (Zenk and Juenger 2007). The presence of terpenoids that have carboxylic acid groups could also be responsible for the activity of the organic extracts (Njoku and Obi 2009). *Chrysophyllum albidum* can be used in the treatment of certain illnesses because it contains cardiac glycoside which have long been employed as important ingredient for arrow poisons and drugs (Trease and Evans, 1989)

CONCLUSION

The results reveal the presence of phytochemicals which are medicinally active constituents in the *Chrysophyllum albidum* leaf extracts studied. The phytochemical compounds identified have been documented by many researchers to be bioactive and have been confirmed by previous workers to

have medicinal as well as physiological activity and therefore could be said to be responsible for the efficacy of the leaves of the plants studied in treatment of different ailments. The plant extracts could therefore be seen as a potential source for useful drug. The continued traditional medicinal use of these plants is therefore encouraged. Further work is being carried out by the group on antimicrobial activities, to isolate, purify and possibly characterize the active constituents responsible for the activity of this plant.

REFERENCES

- [1]. Abiodun Humphrey Adebayo , Amos Olalekan Abolaji , Roseline Kela , Olayemi Oluseun Ayepola , Titilayo Banwo Olorunfemi and Olugbenga Samson Taiwo (2011) Antioxidant activities of the leaves of *Chrysophyllum albidum* G. Pak. J. Pharm. Sci., Vol.24, No.4, pp.545-551
- [2]. Adamu ,H. M., O. J. Abayeh O. J. and O. J. Agho O. J. (2007). Phytochemical screening and Antimicrobial activity of extracts of *Zizyphus Mucronata*. *Nigerian journal of Botany* vol. 20(2) 327 – 334.
- [3]. Adamu, H.M. O.A.Ushie and A.H.Gwangwala (2013). Estimation of Total Flavonoids And Tannins in the Stem Bark and Leaves of *Anogeisus leiocarpus* Plant. *International Journal of Traditional and Natural Medicines*, 2013, 2(3): 141-148
- [4]. Adewoye E. O, Salami A.T, Emikpe B. O (2012) Effect of Methanolic Extract of *Chrysophyllum albidum* Bark on Hematological Parameters in Mice with Experimental Hemorrhagic Anemia *African Journal of Biomedical Research*, Vol 15, No 2 (2012)
- [5]. Adisa, S.A. (2000). Vitamin C, Protein and Mineral contents of African Apple (*Chrysophyllum albidum*) In: Proceedings of the 18 th annual conference of NIST (Eds) Garba SA. Ijagbone IF, Iyagba AO. Iyamu AO, Kilani AS, Ufaruna N, pp. 141-146.
- [6]. Alan L, Miller ND (1996). Antioxidant Flavonoids: Structure, Function and Clinical Usage. *Alt. Med. Rev.*, 1: 103-111.
- [7]. Amusa NA, Ashaye OA and Oladapo MO (2003). Biodeterioration of the African star apple (*Chrysophyllum albidum*) in storage and the effect on its food value. *Afr. J. Biotechnol.*, 2: 56-59.
- [8]. Duyilemi and Lawal (2009) Antibacterial activity and phytochemical screening of *Chrysophyllum albidum* leaves. *Asian Journal of Food and Agro-Industry* S75-S79 ISSN 1906-3040 Available online at www.ajofai.info
- [9]. Edeoga H O, Okwu D E, Mbaebie B O (2005). Phytochemical constituents of some Nigerian medicinal plants. *Afr. J Biotechnol.*;4:685–688.
- [10]. Félicien Breton (2008). "Health benefits of Oligomeric Proanthocyanidins" <http://www.frenchscout.com/polyphenols#procyanidins>.
- [11]. Francis, G. Zohar K, Harinder P, Makkar S, and Klaus B (2002) The biological action of saponins in animal systems: a review. *British journal of Nutrition* 88 (6) 587-605
- [12]. Harbone JB (1988): *Phytochemical Methods: A guide to modern techniques of plant analysis*, 2nd Edn. Chapman and Hall, London;; pp 55-56.
- [13]. Houessou Laurent G, Toussaint O Lougbegnon, François G H Gbesso, Lissette E S Anagonou and Brice Sinsin (2012). Ethno-botanical study of the African star apple (*Chrysophyllum albidum* G.Don) in the Southern Benin (West Africa) *Journal of Ethno biology and Ethno medicine*, 8:40 <http://www.ethnobiomed.com/content/8/1/40>

- [14]. Ncube NS, Afolayan AJ, Okoh AI. (2008) Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods and future trends. *African Journal of Biotechnology* 7 (12): 1797-1806.
- [15]. Sandberg, F. and Brulm, J.G. (1979), Screening of plants for biological active substances, *African Medicinal Plants* (Ed Sofowora. A), Obafemi Awolowo University Nigeria.
- [16]. Subhashini R., U.S. Mahadeva Rao, P.Sumathi and Gayathri Gunalan (2010) A comparative phytochemical analysis of cocoa and green tea *Indian Journal of Science and Technology* Vol. 3 No.2 ISSN: 0974- 6846
- [17]. Soforowa, A. (1982): *Medicinal plants and traditional medicine in Africa* part 11:pp 128. 142, 146. Pitman Press Ltd.
- [18]. Sofowora, A. (1993) *Medicinal Plants and Traditional Medicines Africa*, Spectrum Books Ibadan
- [19]. Ijomah, J.U, Idu, M and Umar, A. H Medicinal plants used by the Fulani traditional herbalist in yola north and yola south local government of adamawa state. *Journal of applied science and management*, paraclete publishers yola, Nigeria.
- [20]. Idowu TO, Onawunmi GO, Ogundaini AO and Adesanya SA (2003). Antimicrobial constituents of *Chrysophyllum albidum* seed cotyledons. *Nig. J. Nat. Prod.*
- [21]. Ikekwe, V. L. Nyanere, N. F. and Akinjobi, C. O. (2001): Studies on antibacterial activity and Phytochemical qualities of extracts of orange peels, *Int. J. E. Viro Herth and Human development* 2(*1): 41-46.9.
- [22]. Njoku, O.V and Obi. C (2009) Phytochemical constituents of some selected medicinal Plants. *African Journal of Pure and Applied Chemistry* Vol. 3 (11), pp. 228-233
- [23]. Okwu, D.E. (2001). Evaluation of the chemical composition of indigenous spices and flavouring Agents. *Global J of Pure Appl. Sci.* 7(3): 455-459
- [24]. Okwu, D.E. Josiah, C. (2006). Evaluation of the chemical composition of two Nigerian medicinal plants. *Afr. J. Biotechnol.*, 5(4): 357-361.
- [25]. Okoli B.J. and Okere O.S. (2010) Antimicrobial Activity of the Phytochemical Constituents of *Chrysophyllum albidum* G.Don_Holl. (African Star apple) Plant *Journal of Research in National Development* Volume 8 No 1
- [26]. Gupta, V.K. Singh, G.D. Surjeet Singh A and Kaul (2010) *Medicinal Plants: Phytochemistry, Pharmacology and Therapeutics* Daya Publishing House 1123/74, Deva Ram Park Tri Nagar, Delhi - 110 035 ISBN 978-81-7035-627-1
- [27]. Savithamma N, M. Linga Rao and Beena Prabha, (2011). Phytochemical Studies of *Diospyros myosuroides* (Roth.) Benth. In. Wall. and *Talinum cuneifolium* (Vahl.) Willd. *Research Journal of Phytochemistry*, 5: 163-169
- [28]. Trease.G.E. and Evans.W.C (1989) *Pharmacognosy* 13th ed *Baillere.Tindall London* pp 176-180
- [29]. Xu R. Zhao W. Xu J. Shao B, Qin, G. (1996). Studies on bioactive saponins from Chinese medicinal plants. *Advances in Experimental Medicine and Biology* 404: 371-82
- [30]. Ugboogu, O.C. and Akukwe, A.R. (2009). The antimicrobial effect of oils from *Pentaclethra macrophylla* Bent, *Chrysophyllum albidum* G.Don and *Persea gratissima* Gaerth F on some local clinical bacteria isolates. *African Journal of Biotechnology*, Vol. 8(2), pp. 285-287.
- [31]. Ushie, O.A, H.M. Adamu, D. A. Ogar and H.J.Gunda (2013) "Phytochemistry of *Borreria verticillata* Stem Bark" *International Journal of Traditional and Natural Medicines*, 2(2): 97-103
- [32]. Ushie, O.A, Neji, P.A and Nsor, G.E (2013) "Phytochemical Screening and Antimicrobial Activities of *Phyllanthus Amarus* Stem Bark Extracts" *International International Journal of Modern Biology and Medicine*, 3(3): 101-112 Zenk MH,