

# Journal of Clinical and Medical Reviews

## Review Article

# Anthocleista Djalonenensis: A Review of Its Ethnobotanical, Phytochemical and Pharmacological Potentials

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**Received Date:** 15 July 2022; **Accepted Date:** 25 July 2022; **Published Date:** 03 August 2022

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## Abstract

*Anthocleista djalonenensis* is widely used in African folk medicine to treat conditions. This review aims to provide for the first time ethnopharmacological information while critically evaluating the traditional medicinal uses, chemical constituents and pharmacological activities so as to unveil opportunities for future research. Ethno-medical uses of the, leaf, root and stem bark extracts include treatment of wound, constipation, diarrhoea, dysentery, abdominal pain, hepatitis, jaundice, cirrhosis, fungal skin infection, filarial worm infections, acute inflammation and boils on skin, anti-diabetes, antimalarial, anti-pyretic, anthelmintic, antimycobacterial, and anti-bacterial properties. Some of the compounds isolated are phthalide and xanthenes sweroside, djalonenoside, lichex-anthone, stigmasterol, 3-oxo- $\Delta^4$ '5-sitosterone, sitosterol, ursolic acid, djalonenin and D-(p)-bornesitol. The pharmacological activities of the leaf, stem bark and root has been scientifically proven by in vitro and in vivo studies. The cytotoxic activity of the crude methanol extracts obtained from the stem, roots and leaves and three natural plant constituents (djalonenol, sweroside and djalonenosone respectively) isolated from the extract had been evaluated in vitro. This review has been able to show the therapeutic potentials of *Anthocleista djalonenensis* through its ethnobotanical and pharmacological uses.

**Keywords:** Leaf, Root and stem bark extracts include treatment of wound, Constipation, Diarrhoea, Dysentery, Abdominal pain, Hepatitis, Jaundice

## Introduction

*Anthocleista djalonenensis* A. Chev belongs to the family Gentianaceae and the Yoruba people of South west Nigeria refers to it as "Ewe Shapo" (Onocha and Okorie, 2003). The tree grows up to 15 m tall; bole up to 40 cm in diameter; twigs sometimes with 2 erect spines or small cushions above the leaf axils (Jensen and Schripsema, 2002). The Genus *Anthocleista* comprises 14 species (Neuwinger, 2000). The West Africa species have the same vernacular names (Cabbage tree) and are used by local practitioners for the same medicinal purpose. Several members of the genus are used

for similar medicinal purposes. It is very difficult to differentiate between the dried bark of the different species (De Ruijter, 2007).

## Ethnobotanical Uses

Some of the ethno-medical uses of the extract of *Anthocleista djalonenensis* leaves, roots and stem bark include treatment of wound, constipation, diarrhoea, dysentery, abdominal pain (Okoli Iroegbu 2004), hepatitis, jaundice, cirrhosis, fungal skin infection, filarial worm infections, acute inflammation

and boils on skin (Aiyeloja and Bellow, 2006). It has also been used to treat sexually transmitted infections (STI) and has been reported to have several functions including anti-diabetes, antimalarial, anti-pyretic, anthelmintic, antimycobacterial, anti-bacterial and wound healing properties (Okoli and Iroegbu, 2004; Chah et al., 2006; Nweze and Ngongeh, 2007; Esimone et al., 2009). It is widely used throughout its distribution area as a strong purgative and diuretic (Neuwinger, 2000). A root decoction is commonly taken to treat constipation, to regulate menstruation and as an abortifacient. It is used as a wash, bath or as a vapour bath to treat leprosy, venereal diseases, oedema and scrotal elephantiasis. A root infusion is taken to treat intestinal problems, acute inflammations, and boils on the skin (Akubue et al., 1983; Okoli and Iroegbu, 2004). The plant is known to possess anti-inflammatory (Okunrobo et al., 2009) and free radical scavenging activities (Awah et al., 2010). The plant is a source of secondary metabolites which are cytotoxic (Okorie, 1976; Onocha et al., 2003) and antifungal (Bierer et al., 1995).

## Chemical Constituents

Some of the compounds that have been isolated from *Anthocleista djalensis* are phthalide and xanthenes (Okorie, 1976). The root bark of the plant is reported to contain iribacholine (Bierer et al., 1995). Other compounds isolated from the plant include triterpenes, a monoterpene-diol djalonenol, a dibenzo-pyrone djalonensone, an iridoid glycoside sweroside (djalonenoside) (Onocha et al., 1995) as well as amplexine and axanthone lichexanthone (Okorie, 1976). The stem bark is also reported to contain the phthalide djalonensin (Okorie, 1976). Ogunwande et al. (2013) pioneering work on the volatile oil contents of *Anthocleista djalensis* revealed sesquiterpene compounds (82.5%) are the dominant class of the 49 compounds in *Anthocleista djalensis* and the main compounds are  $\alpha$ -humulene,  $\beta$ -caryophyllene, humulene epoxide II and caryophyllene oxide. A monoterpene diol, djalonenol have been isolated from *Anthocleista djalensis* and the isolation of dibenzo- $\alpha$ -pyrone, djalonensone from a plant source and its structural elucidation as tetrahydro-3-hydroxyhydroxymethylene-4-(3-hydroxymethylene prop-1-ene)-2H-pyran-2-one was reported for the first time (Onocha et al., 1995). The isolation of sweroside, djalonenoside, lichex-anthone, stigmasterol, 3-oxo- $\Delta^4$ 5-sitosterone, sitosterol, ursolic acid, djalonensin and D-( $\beta$ )-bornesitol from *Anthocleista djalensis* have also been reported (Okorie, 1976; Onocha et al., 1995).

## Pharmacological Activities

In African traditional medicine, the leaves, stems and roots of *Anthocleista djalensis*, is prepared as a decoction or macerated in water or alcohol, and the solution is given orally as a treatment for diabetes in Guinea, Nigeria, Togo, Ghana

and Cameroun (Ampofo, 1977; Abuh et al., 1990; Madubunyi et al., 1994; Olowokudejo et al., 2008; Jiofack et al., 2010; Diallo et al., 2012; Soladoye et al., 2012; Tchacondo et al., 2012). The hypoglycemic effect of the leaves, stem bark and roots of *Anthocleista djalensis* has been scientifically proven by in vitro and in vivo studies (Abuh et al., 1990; Olagunju et al., 1998; Mbouanguere et al., 2007; Okokon et al., 2012; Olubomehin et al., 2013; Osadebe et al., 2014a, 2014b; Sunday et al., 2014). The leaves, stem barks and roots of *Anthocleista djalensis* revealed  $\alpha$ -amylase inhibitory activity at 1mL of 250mg/mL concentration of their aqueous methanol extracts (Olubomehin et al., 2013). *A. djalensis* had a better activity than other *Anthocleista* species which indicated that it might contain more of the active principles necessary for the management of diabetes. The different plant parts of *Anthocleista djalensis*, at doses ranging from 50–3000mg/kg have all revealed in vivo antiplasmodial activities against *Plasmodium falciparum* or *Plasmodium berghei* in a dose dependent manner (Bassey et al., 2009; Alaribe et al., 2012; Odeghe et al., 2012a; Okon et al., 2014; Gboeloh et al., 2014; Ogbuehi et al., 2014). Iribacholine, isolated from *Anthocleista djalensis* revealed potent in vitro activity against three pathogenic fungi: *C. albicans*, *C. neoformans*, and *A. fumigatus*, with minimum inhibitory concentrations (MIC) of 1.25, 0.04 and 0.08  $\mu$ g/mL respectively (Bierer et al. 1995). Similarly, Iribacholine showed potent activity (MIC  $\leq$  0.04  $\mu$ g/mL) against the dermatophyte *Trichophyton rubrum*. In Nigeria and Togo, the leaf, bark and root of *Anthocleista djalensis* and *Anthocleista vogelii* are used to treat hypertension. The root of *Anthocleista djalensis* is also macerated in combination with three other plants (*Crematogaster pilosa*, *Securida calondepedunculata* and *Nauclea latifolia*) and one teaspoon is taken three times daily to treat hypertension in Nigeria (Olorunnisola et al., 2015). Anti-inflammatory agents/drugs make up about half of analgesics, because they remedy pain by reducing inflammation or swelling. Traditionally, a cold infusion of the stem bark of *Anthocleista djalensis* with 8 other plants is prepared and two tablespoons is taken daily for the treatment of Asthma in Nigeria (Sonibare and Gbile, 2008; Borokini et al., 2013). For swellings, rheumatism and wounds, the area affected is poultice to relieve the soreness and inflammation, and to cleanse the wound (Musa et al., 2010). The action of *A. djalensis* at central and peripheral sites to inhibit neurogenic and inflammatory pains has been proposed by Kagbo and Simon (2015), after investigation of the analgesic properties on the methanol root extract of *Anthocleista djalensis* in albino rats using chemical, mechanical and thermal models of pain. The methanol extracts of *A. djalensis* leaves showed a very potent DPPH and O<sub>2</sub><sup>-</sup> anion radical scavenging activities (IC<sub>50</sub>  $\approx$  8.6970.95  $\mu$ g/mL and 5.3271.05  $\mu$ g/mL respectively). Also, the extract displayed significantly higher OH radical and non-enzymatic lipid peroxidation inhibitory potentials than that of standard antioxidants (IC<sub>50</sub>  $\approx$  33.0675.65  $\mu$ g/mL

and 59.1474.64 µg/mL respectively), likewise, it inhibited the accumulation of nitrite in vitro (Awah et al., 2010). The in vitro antihelmintic activity of the ethanol extract of *Anthocleista djalensis* was studied against larvae of *Heligmosomoides polygyrus* (roundworm) at 25, 50, 100 and 200mg/mL concentrations (Nweze and Ngongeh, 2007). The extract had a concentration-dependent lethal action on *H. polygyrus* larvae. At a concentration of 100mg/mL, the extract recorded 98.45% mortality which was equivalent to that of levamisole (the positive control) at 10mg/mL. This is indicative of the validity of its use traditionally against worms and other internal parasites in the body, and thus, the mode of action of the species on the worms needs to be investigated. Traditionally, *A. djalensis* is used in South West Nigeria to boost libido, induce erection, increase sperm count and consequently male fertility (Olowokudejo et al., 2008). Reactive oxygen species are important mediators of sperm dysfunction (Wang et al., 1997; Bansal and Bilaspuri, 2011). Production of MDA, an end product of lipid peroxidation, has been reported in spermatozoa. *Anthocleista djalensis* possess the ability to improve sperm function thereby increasing male fertility, and hereby it gives support to its traditional use in the treatment of male fertility problems. Traditionally, *Anthocleista djalensis* is used as purgative by locals/natives in Nigeria, Cameroun and other African regions (Dalziel, 1955, Okorie, 1976; Adjanohoun et al., 1986; Igoli et al., 2005; Olowokudejo et al., 2008; Lawal et al., 2010; Ariwaodo et al., 2012). The leaf, bark or roots are usually boiled with water and drank to obtain its purgative/laxative effect.

### Toxicity Studies

The cytotoxic activity of the crude methanol extracts obtained from the stem, roots and leaves of *Anthocleista djalensis* and three natural plant constituents (*djalonenol*, *sweroside* and *djalonensone* respectively) isolated from the extract were evaluated in vitro against ST-57 brain tumor transformed fibroblasts (Onocha et al., 2003). Comparatively, the three crude extracts as well as *djalonenol* and *sweroside* exhibited low cytotoxicity (ED<sub>50</sub> 40–70 µg/mL) while *djalonensone* was not significantly cytotoxic against the brain tumor transformed fibroblasts (Onocha et al., 2003).

### Conclusion

This review has been able to show the therapeutic potentials of *Anthocleista djalensis* through its ethnobotanical and pharmacological uses. These potentials might have been as a result of the array of phytochemicals found in it. However, there is need for substantial advanced research on the chemistry and pharmacological properties (both in vivo and in vitro), the determination of the mode of action of the active principles for new and already known pharmacological activities

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**Citation:** Adebayo A.O, Olamide O.C, *Anthocleista Djalensis*: A Review of Its Ethnobotanical, Phytochemical and Pharmacological Potentials. *J. Clin. Med. Rev.* Vol 1, Iss 1. (2022). DOI: 10.58489/2836-2330/002