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ORIGINAL RESEARCH

Phytochemical and Anti-nutritional potentials of leaves and stem-bark of *Cathormion altissimum* (Hook.f.) Hutch. & Dandy

Felix Okponanabofa YOUKPARIGHA*[1], Bio Louis NYANANYO[2] , Ayodele Adelusi OYEDEJI[1]
[1]Department of Biological Sciences, Faculty of Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
[2]Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria
*Corresponding Author email: felix.1968.youkparigha@gmail.com

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ABSTRACT
The phytochemical and anti-nutritional constituents of leaves and stem-bark of *Cathormion altissimum* (Hook.f.) Hutch & Dandy was evaluated. The leaves and stem-bark of *Cathormion altissimum* used for this study were obtained from several communities in the eight local government area of Bayelsa State, Nigeria. The plant was qualitatively and quantitatively analyzed for some phytochemical and anti-nutrients constituents. The results of quantitative analysis showed that alkaloids, saponins, flavonoids, glycosides, phytate, tannins, oxalate and phenols concentrations were 8.04%, 7.7%, 6.94%, 0.432mg/kg, 0.0917%, 2.684%, 71.0 mg/g and 1002.88 mg/kg, respectively in the leaves, and 3.36%, 5.0%, 3.36%, 0.432mg/kg, 0.0917%, 1.026%, 18.10 mg/g and 62.88 mg/kg, respectively in the stem-bark. The qualitative results showed that saponins in both plant parts was very highly present, flavonoids in leaf and tannins in stem-bark were highly present, while terpenes, steroids, phenol in both plant parts and flavonoids in stem-bark and tannins in leaf were fairly present. The study showed that the leaf and stem-bark of the plant has pharmacological potentials against different diseases. While the phytate and oxalate suggests that the plant could be toxic over a prolonged period of use. As such, there is the need for research to be carried out to evaluate the concentration of the anti-nutrients that could be toxic to humans, and therapeutic properties of both plant parts.

.**KEY WORDS:** *Herbal medicine, Medicinal plant, Phytochemicals, Qualitative and Quantitative*

INTRODUCTION

Phytochemicals are useful chemicals obtained from plants. Some of them have been known to confer protection on the plants, while several others have pharmacological/ therapeutic potentials (Izah and Aseibai, 2018). Stace (1980), Buchanan *et al*. (2000), Okeke *et al*. (2015) reported that phytochemicals are considered with the enormous variety of organic substances that are accumulated by plants and involved with the chemical structures of these substances including their biosynthesis, metabolism, natural distribution and biological function. Several phytochemicals have been reported in varying amounts in different plants. But the most useful class of compounds isolated from plants include flavonoids and steroids (their wide occurrence amongst plant species make them valuable taxonomic markers), in addition to alkaloids, terpenes and sulphur based compounds (Okeke *et al*., 2015). Phytochemical characteristics of plants are also known to support taxonomical studies especially between closely related species in addition to other biosystematics, morphological, genetic and anatomical studies

Cathormion altissimum (Hook.f.) Hutch. & Dandy is a low branching forest tree of about 50ft in family Fabaceae. The

genus *Cathormion* Hassk has only a single species represented in Nigeria (Keay, 1989). The plant occurs in all of tropical Africa including Nigeria, Zambia, Sierra Leone and Sudan to Uganda, D.R. Congo, Angola, and tropical America (Bingham *et al*., 2017) where it is commonly found in fresh water swamp forests and secondary forests. The fresh leaves which are discolourous and alternate, bipinnately compound has 4-8 pairs of pinnae, with 10-25 pairs of opposite leaflets in a pinna. The white flowers are bisexual, regular and sessile. The fruits, which are pods, is characteristically twisted into the shape of a coil and constricted between the one-seeded segments (Keay, 1989; Lemmens, 2006; Royal Botanic Garden, 2018). It flowers between September to January and fruits between February to March and July to November (Keay, 1989).The plant can grow between 5-35 m tall, 1.8 m in girth, enlarged at the base, and the juvenile is often spinous.

The fruit pulp and seed are used as food. The fermented seeds (called 'oso') are used as soup condiment in parts of Nigeria (Lemmens, 2006; Jolaoso *et al*., 2012). Bark decoction is used as anodyne to treat tooth-ache, stomach – ache and pulmonary infections. Leaf decoction is used in vapour bath to treat cold or fever and burnt leaves are applied to venomous snake or insect bites (Lemmens, 2006). Preparations from the leaves are used to treat cutaneous parasitic infections. The bark and root is combined to treat insanity and also used as soap substitutes (Burkill, 1985; Lemmens, 2006). Based on the extensive medicinal uses of *C. altissimum*, this study investigates the phytochemical and anti-nutritional potentials of its leave and stem-bark.

RESULTS AND DISCUSSION

Table 1 presents the qualitative analysis of crude phytochemical constituents of parts of *C. altissimum.* Saponins in both plant parts was very highly present, flavonoids in leaf and tannins in stem-bark were highly present, while terpenes, steroids, phenol in both plant parts and flavonoids in stem-bark and tannins in leaf were fairly present.

Table 2 presents the quantitative crude phytochemical compounds found in *C. altissimum.* The level of alkaloids, saponins, flavonoids, glycosides, phytate, tannins, oxalate and phenols are 8.04%, 7.7%, 6.94%, 0.432mg/kg, 0.0917%, 2.684%, 71.0 mg/g and 1002.88 mg/kg, respectively in the leaf and 3.36%, 5.0%, 3.36%, 0.432mg/kg, 0.0917%, 1.026%, 18.10 mg/g and 62.88 mg/kg, respectively in the stem-bark. The study showed that alkaloids, saponins, flavonoids, tannins, oxalate and phenols were relatively higher in leaf compare to the stem-bark. While glycosides and phenols has equal content in both plant parts. The observations of this study revealed that both plant parts under study are rich in bioactive ingredients.

Table 1: Qualitative analysis of crude phytochemical constituents of parts of *C. altissimum*

Phytochemical	*Leaf of C. altissimum*	*Bark of C. altissimum*
Saponins	+ +	+ +
Tannins	+	+ +
Terpenes	+	+
Steroids	+	+
Phenols	+	+
Flavonoids	+ +	+

KEY + + + = very highly present + + = highly present + = fairly present

The presence of phytochemicals in plants have been reported to aid in its pharmacological properties (Kigigha *et al*., 2015, 2016; Epidi *et al*., 2016a, b; Kalunta, 2017; Kigigha and Kalunta, 2017; Izah, 2018; Izah *et al*., 2018a-e). These phytochemicals detected in this plant parts have been reported to confer specific therapeutic properties. For instance, Amari *et al*. (2014) reported that the presence of phenolic and flavonoids contents in plants could be responsible for its free radical scavenging activity. Amari *et al*. (2014), Subhashini *et al*. (2011) reported that phenolic compounds including flavonoids help plants to confer antioxidant activities. Basically the antioxidant activity of phenolic compounds is associated with their redox properties that are essential in neutralizing free radicals, quenching singlet and triplet oxygen (Amari *et al*., 2014). In addition, flavonoids have been reported to possess broad spectrum of biological activities including antioxidant, anticarcinogens, antimicrobial and antitumor properties (Kigigha *et al*., 2015; Osuntokun and Oluwafoise, 2015), protection against allergies, inflammation, free radicals, platelet aggregation, ulcers, hepatoxins, viruses and tumors (Okwu, 2004; Doherty *et al*., 2010), immune enhancers and hormone modulators (Doherty *et al*., 2010). The presence of phenolic compounds in the leaf and stem-bark suggests that it has antimicrobial properties. Again, phenolics are electron

Table 2: Quantitative crude phytochemicals and anti-nutritional characteristics of *C. altissimum*

Phytochemicals	*Leaf of C. altissimum*	*Bark of C. altissimum*
Alkaloids (%)	8.04	3.36
Saponins (%)	7.7	5.0
Flavonoids (%)	6.94	3.36
Glycosides (mg/kg)	0.432	0.432
Phytate (%)	0.0917	0.0917
Tannins (%)	2.684	1.026
Oxalate (mg/g)	71.0	18.10
Phenols (mg/kg)	1002.88	62.68

donors that can be easily oxidized to form phenolate ion or quinine, an electron acceptor, and they have bactericidal properties (Doherty *et al*., 2010).

Saponins also has several biological activities including formation of foam in aqueous solutions, hemolytic activity, cholesterol binding properties, bitterness (Okwu, 2004; Doherty *et al*., 2010), expectorant, cough suppressant, hemolytic activity (Sofowora, 1993; Kigigha *et al*., 2015; Okwu, 2005; Osuntokun and Oluwafoise, 2015; Epidi *et al*., 2016a,b). Alkaloids have several pharmacological properties and have been ranked as the most effective plant substance (Doherty *et al*., 2010). As such plant alkaloids and its synthetic derivatives have analgesic, antispasmodic, bactericidal properties (Doherty *et al*., 2010; Kigigha *et al*., 2015; Osuntokun and Oluwafoise, 2015; Epidi *et al*., 2016a, b), anti-ulcer (Ateufack *et al*., 2015), ability to ward off pests (Agu and Thomas, 2012). Tannins in plants provide hot, bitter and pungent taste. They have the tendency to inflame mucous membrane and heal wounds (Okwu and Okwu, 2004; Dorherty *et al*., 2010), burns and hemorrhoids and bacteriostatic activities (Dorherty *et al*., 2010). Glycosides are known for several biological activities including antibacterial (Soulef *et al*., 2014), anti-cancer (Khan *et al*., 2018), analgesic and anti-inflammatory activities. Some of the glycosides could help plants to ward off pests.

Plant steroids are known to possess medicinal, pharmaceutical and agrochemical activities (Patel and Savjani, 2015). According to Okwu (2001), Edeoga *et al*. (2005), steroidal compounds are essential in pharmacy due to their relationship with other compounds such as sex hormones. The authors further stated that this may be the reason why expectant or breast feeding mothers eat leaves with steroids to ensure hormonal balance, since steroidal structure could serve as potent starting material in synthesis of these hormones. Furthermore, terpenoids have been widely reported in plants used in herbal medicine preparations.

Oxalates have the tendency to occur as insoluble salts (of calcium, magnesium and iron), and soluble salts (of potassium and sodium) or as a combination of these two forms which could vary based on plant species (Noonan and Savage, 1999; Natesh *et al*., 2017). Insoluble oxalates can be excreted while the soluble oxalates affect the human body by forming a strong chelate with dietary calcium and other minerals rendering the complex unavailable for absorption and assimilation. In the body this soluble oxalates cause several health challenges such as kidney stones. This could impede calcium absorption when the oxalates values are very high. Franceschi (2001) reported that calcium oxalate is biomineral in plants, occurring as crystals of

various shapes. As such the consumption of plants high in oxalates is a source of concern to human health. Phytates in human body have adverse effects on the digestive enzymes, and it acts through chelation of mineral cofactors or interaction with protein and can interfere with zinc homeostasis (Natesh *et al*., 2017). The raw intake of leafy vegetables containing high phytates could be detrimental over a prolong period of time. However, processing into different forms could aid in the reduction of the phytic acid level.

CONCLUSION

The study assessed the phytochemical and anti-nutritional characteristics of leaf and stem-bark of *C. altissimum* in Bayelsa State, Nigeria. The study found that the leaf and stem-bark contain alkaloids, saponins, flavonoids, glycosides, phytate, tannins, oxalate and phenols. Apart from glycoside and phytate the quantitative analysis showed that the leaves had relatively higher values. In the qualitative techniques, tannins and flavonoids levels varied in both plant parts, while other phytochemicals such as saponins, terpenes, tannins, steroids and phenol were found in minute quantity. The presence of the phytochemical properties suggests the pharmacological potentials of the plant parts while the oxalate and phytate values showed that the plant could be toxic over a prolonged period of use. There is, therefore, need for further research to focus on the potential anti-nutritional and phytochemical compounds of the plant parts with laboratory animals.

MATERIALS AND METHODS

Plant collection and identification

The leaves and stem-bark of *C. altissimum* used for this study were obtained from several communities in the eight local government area of Bayelsa state, Nigeria. The plant specimens were identified at the Forestry Research Institute of Nigeria (FRIN) and the Herbarium of the Department of Plant Science and Biotechnology, University of Port Harcourt, Rivers State. Voucher Specimens of the plant were deposited in these herbaria for reference and further studies.

Phytochemical analysis

Qualitative phytochemical screening of the leaves and stem-bark of the plant for flavonoids, saponins, tannins, terpenes, steroids and phenols was done based on the methods documented by Lambert and Muir (1973), Stewarte *et al.* (1974), Sofowora (1993), Edeoga *et al*. (2005), Okwu (2005), Doherty *et al.* (2010), Kanife *et al.* (2012). Standard procedures used for the quantitative determination of phytochemicals were namely; alkaloids (Harborne, 1973), flavonoids (Boham and Kocipal-Abyazan, 1994), Phenol (King and Armstrong, 1934), phytic acid (Kent-Jones and Amos, 1967), Tannic acid (AOAC, 1970). Saponin assessment was carried out by Soxhlet extraction/Gravimetric method (Harborne, 1973), cyanogenic glycoside was by alkaline Titration Method (AOAC, 1984) and oxalate by standardization of potassium permanganate solution (Lambert and Muir, 1973).

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