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EVALUATION OF DIVERSE POTENTIALS IN THE GENUS *ANTHOCLEISTA*: A SHORT COMMUNICATION ON THE PANACEA TOWARDS EXPLOITING AND OPTIMIZING *ANTHOCLEISTA* SPECIES,

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ABSTRACT

The continual inquiry and the curiosity of man for natural plant products has become a premise for the exploring strategies involved in understanding and obtaining required plant materials and their component. Review of several studies by scientists and researchers have shown that plants species such as Anthocleista species have relatively some amount of constituents called "the active ingredient or principle'' produced by the plants. These are called metabolites which vary in constituent and concentrations. These extract or metabolites are located in stem barks, leaf, fruit and roots. Firstly, the review is aimed at adding value to the natural utility variables with the objectives of evaluating the Anthocleista species for their phytochemicals and non-phytochemicals potentials as a means for their exploitation. Secondly substantiating in qualitative terms the potential attribute of Anthocleista species found in parts of Nigeria for effective diversification and as a sure way to optimizing their resources. Information and data gathering was based on the phytogeographical occurrence and distribution of the species, (websit-internet sources), Floras, Botanical annals, Monographs, journal articles, and herbarium documentation. The review and assessment of existing literatures revealed that Anthocliesta among its therapeutic potentials as antimicrobial agent, medicine, antioxidant, and hypoglycemic agent could also be a potential source of anti-corrosion agent and environmental bio-indicator. Therefore, it can be concluded that the continuous evaluation and research in Anthocliesta species and its potential in human affairs can never be over emphasized and / or undermined for further evaluation.

Keywords: *Anthoclesita* species, Antimicrobial agent, hypoglycemia agent, antioxidant, industries

INTRODUCTION

The search for the multiplier potential of *Anthocliesta* species cut across diverse initiatives of human endeavours in many parts of the world. In more common and particular potency is their use in both orthodox and ethno-medicine in many countries of the world because of their contributions and benefit to health care and medical researches. The continual inquiry and the curiosity of man for natural plant products has become a premise for the

exploring strategies involved in understanding and obtaining required plant materials and their component (Farnsworth, 1966).

Plants which are observed to be effective with frequently active compounds are potential drug candidates considered for further examination. The Genus *Anthocleista* Afzel *ex*. R. Br, is a medium size tropical Africa genus usually of small trees with soft white wood (Keay, 1989), belonging to the family Loganiaceae. There are about 50 species in the genus, native mainly to tropical Africa, Madagascar and Mascarene Island. Of the 50 species, about six (6) species (*Anthocleista djalonesis* A. Chev*; A. vogelii* Planch; *A. nobilis* G. Don; *A. liebrechtsiana* De Wild, *A. schweinfurthii* Golg, and *A. procera* Lepr ex Bureau) are found and of high economic importance in various parts of Nigeria (Keay, 1989). Four (*Anthocleista djalonesis* A. Chev*; A. vogelii* Planch; *A. nobilis* G. Don; *A. liebrechtsiana* De Wild.) of the six species in Nigeria, through phytogeographical study and distribution has been revealed of common occurrence in parts of Niger Delta (Edwin-Wosu. *et al*., 2010). These four species have actually and distinctly shown some degree of variation in morphological attributes (Edwin-Wosu, 2012; Edwin-Wosu *et al*., 2015) in addition to other evidence of botanical studies (Edwin-Wosu and Ndukwu, 2012a, b; Edwin-Wosu *et al*., 2012). The genus is commonly called candelabrum or cabbage tree in English language, Duwa Kuchi in Nupe language, Kwari in Hausa language and Apa Ora in Yoruba language (Ayodele, *et al*., 2012). The genus *Anthocleista is* faced with the problem of classification. One of the significant problems with classifying this genus under Loganiaceae family was that most taxa assigned to this family had rather widespread or primitive (plesiomorphic) traits (Leeuwenberg and Leehourts, 1980). However, phylogenetic studies have ones placed this genus under the family Gentianaceae and later transferred to the family Loganiaceae. *Anthocleista* moved away from the gentian flora due to its possession of supermerous corollas and staminal parts (8 - 16 merous) and appears to lack post genital fusion of carpels which is typical to gentians (Struwe and Albert, 2002). So it was concluded that *Anthocleista* is a tropical woody genus with showy flowers and fleshy or leathery berries, whereas most gentians are smaller herbs or shrubs with dry capsular fruits (Struwe *et al.,* 2002).

Globally, good percentage of world populations in underdeveloped countries still rely on traditional medicine practitioners and local medicinal plants for primary health care (WHO, 1995). Several works have shown that *Anthocleista* contain compounds that are potential candidates for human welfare and use and could rightly be considered for further evaluation. Information and data gathering was based on the phytogeographical occurrence and distribution of the species and the ecological dynamics and tajectories of bioactive compounds in plants of the genus - *Anthocliesta* found in parts of Niger Delta, Nigeria (Edwin-Wosu, 2010; Edwin-Wosu, and Omara – Achong, 2010; Edwin-Wosu *et al*., 2015; Edwin-Wosu *et al*.,2017). Other information sources are internet search, documentation from Floras (Keay, 1989; Hutchinson and Dalziel, 1963), Botanical annals such as Burkill (1995), Monographs, journal articles, field and laboratory reports

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and herbarium documentation. From the foregoing it becomes imperative that if *Anthocleista* species are evaluated for their empirical and molecular potential particularly for phytochemicals and non-phytochemicals as a means for their exploitation, they could add value to the discovery of new natural chemotherapeutics and utility variables. This review therefore aim at substantiating in qualitative terms the potential attribute of *Anthocliesta* species found in parts of Nigeria for effective diversification and as a sure way to optimizing their resources.

Multiplier Potentials of *Anthocleista* Species Found in Parts of Niger Delta, Nigeria

Scientists and researchers have shown that relatively small amount of constituents called "the active ingredient or principle'' are produced by plants. These ingredients or principles include alkaloids, tannins, saponins, terpenoids, phlobatanins flavonoids, steroids, and cardiac glycosides and they vary in constituent and concentrations (Sofowora, 1978; Trease and Evans, 1983; Edwin-Wosu *et al*., 2017). These active ingredients or phytochemicals and properties are located in the root, leaf, fruit and stem bark (Edwin-Wosu *et al*., 2017).

These compounds, which are significantly present in the plant, are well known for their large spectrum of pharmacological properties, including antimicrobial (alkaloids) and antioxidant (polyphenols) activities (Proestos *et al.,* 2005; Slobodnikov *et al.*, 2004). Besides the known therapeutic potentials of *Anthocleista* species, it could also be a source of raw materials for the environment and anti-corrosion industries.

Anthocleista species as antimicrobial agent

Historically, plants and microbial pathogens have been living together for many centuries. In such co-evolution, plants develop elegant and numerous biochemical defense strategies to counter microorganism attack by producing specialized secondary metabolites that have toxic effect on the microbes. These bactericidal / bacteriostatic and anti-infective naturally occurring compounds are used as medicines (Joosteen, and Van Veen, 2011). Indeed, despite the fact that plant pathogenic microorganisms have played a key role in the early evolution of the secondary metabolites diversity, there is little chance for a microbe to gain resistance from a plant as it is known for antibiotic-producing microbes which possess genes protecting them from the toxic effects of these compounds. Like microbial antibiotics, plant antimicrobial secondary metabolites cell membranes inhibit quorum sensing phenomena (Taylor, 2013).

The antimicrobial activity of extracts from *Anthocleista liebrechtsiana* against *staphylococcus aureus* and *Escherichia coli* strains has been studied (Koto-te-Nyiwa, *et al*., 2014). The study revealed that the Gram positive bacteria *S. aureus* were more sensitive to *Anthocleista liebrechtsiana* than the Gram negative *E. coli.* (Koto-te-Nyiwa, *et al*., 2014). The higher sensitivity of Gram-positive bacteria could be attributed to their outer peptidoglycan layer which is not an effective permeability barrier. Gram-negative bacteria having outer phospholipidic membrane carrying the structural lipopolysaccharide components make the cell wall impermeable to lipophilic solutes while porins constitute a selective barrier to hydrophilic solutes with an

exclusion limit of 600 Da (Kaur and Arora, 2009). The present findings also indicate that *Anthocleista liebrechtsiana* and *Anthocleista schweinfurthii* stem bark could serve as promising source of antimicrobial agent (Neuwinger, 2000).

Anthocliesta species for Medicine

Medicinal plants are used in pharmaceuticals, cosmetics, and food supplements and even as traditional source of medicines because of their anti tumor, anti arthritic and antithrombotic functions (Thomson *et al*., 2002). The presence of various secondary metabolites in *Anthocliesta* species could justify its medical use. Many of this species have been used in treatment and cure for different diseases (Luter *et al*., 2012). All parts of the plants are found to contain alkaloids with the root as the most pharmacologically active and the most used as a purgative and dietary, a poison antidote, an emmenagogne, abortifacient to treat leprosy, edemas and elephantiasis of the scrotum (Ayodele *et al*., 2012).

A boiled combination of dry falling leaves of *Anthocleista* species and root of *Combretum smeathmanni* (Combretaceae), pepper and ash could be taken as a drink for chest pain, Jaundice and haemostatic in Sierra Leone (Lewington, 1990). The bark is known for its antipyretic and tonic purgative properties in Nigeria (Ayodele *et al*., 2012). The pulped back is applied as antiseptic and Cistercian on sores, swollen buboes and abscesses and to treat yaws, sap is considered in the treatment of ear ache and ophthalmia in Congo (Burkill, 1995).

The phytochemical analysis of the extracts of *A. nobilis* has indicated the presence of alkaloids, tannins, saponins, flavonoids, steroids, cardiac glycosides and terpenoids in the stem barks (Trease and Evans, 1983; Edwin-Wosu *et al*., 2017). *Anthocleista nobilis* is used in local medicine as root decoction in Serra Leone and other parts of West Africa for curing constipation, fever, stomach ache, diarrhoea, and gonorrhoea, and are also as poultice for sores (Chema and Ward., 1990; Maingi, *et al.*, 1996; Dokosi, 1998). Also in Congo, the root decoction is given to women as a purgative to cleanse the abdomen and to ensure that the urinogenital parts return to its proper place (Burkill, 1995).

The seed and bark of *A. vogelii* are known for their use as purgative and antidote for snake bite while the bark and root are used in the healing of dropsy, swellings, oedema, gout and venereal diseases, the leaf-bud also serves as antidotes for venomous stings, bites (Burkill, 1985). Alaribe *et al.* (2012) has demonstrated the antiplasmodial effects of petroleum ether extract of leaf of *A. vogelii* while the aqueous and methanol extracts of the stem bark possesses spasmogenic activity on both ileal and stomach smooth muscle fragments (Ateufact *et al.*, 2010). The *in-vivo* anti-malaria activity of ethanolic leaf and stem bark extracts of *Anthocleista djalonensis* has been reported by Anita *et al.*, (2009). *Anthocleista schweinfurthii* is been reported to be treatment source for bacterial infections (Ngombe *et al*, 2010).

***Anthocleista* species as Antioxidant**

Antioxidants are molecules that halt oxidation processes while the molecules get oxidized in the process. The *Anthocleista* species has antioxidant property that promote the activity of phenolics, which is

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derived from their ability to act as reducing agents, donating hydrogen, electrons and stabilizing Reactive Oxygen Species (ROS) (Huda-fanjam, *et al*., 2009). Reactive oxygen species (ROS) such as hydroxyl radicals (OH·), superoxide anion radicals (O2·) and singlet oxygen (1O2) have been implicated in many disease processes such as cancer, diabetes, ageing, atherosclerosis and neurodegeneration [Saeed, *et al*., 2012]. Consumption of fresh fruits and vegetables rich in plant polyphenols (antioxidants) as food has been reported as a protection against several diseases which include cancer, cardiovascular diseases, diabetes, and asthma suggesting that the mechanism of action of the secondary metabolites can be traced to the antioxidant properties of *Anthocleista nobilis* (Pandey and Rizvi., 2009).

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Anthocleista species as hypoglycemic agent

Modern-day Western solid diets are frequently high in fats and sugars, and may be energy dense (Archer *et al*., 2007). High carbohydrate and fat diet is fast becoming the trend in developing countries like Nigeria. These solid dietary components are increasingly consumed in association with sweetened soft drinks by children more than doubled between 1965 and 1996 (Cavadini *et al*., 2000). For several decades obesity has been on the rise, although dietary fat has fallen but caloric intake for most pediatric groups, particularly in developed western countries such as US, has been on the increase (Troiano *et al.,* 2000). Simply carbohydrate intake may be to blame, particularly in children who regularly consume fruit juices and snacks like potato chips (Slyper, 2004). Some traditional healers in Nigeria have claimed that some medicinal plants like *Anthocleista vogelii* could be used to treat obesity. When we eat lot of sugar, most of the fructose gets metabolized by the liver where it consequently turns into fat, which is then secreted into the blood. It has been investigated that the impact of ethanolic root bark extract of *A. vogelii* on weight reduction in high carbohydrate diet (HCD induced obesity in male Wistar rats (Ateufact *et al.,* 2010).

Anthocleista species for anti-corrosion industries

The corrosion of metals by acids is a major dilemma encountered in numerous industrial processes. A significant method to protect the metals from corrosion is the addition of *Anthocliesta* species extract to the solution in contact with the surface in order to inhibit the corrosion reaction and reduce the corrosion rate (Cardozo da Rocha, *et al*., 2010). The leaf extract of *Anthocleista djalonesis* has been noted for its inhibiting effect on mild steel corrosion in aqueous acidic environments (Mabogo, 1990; Neuwinger, 2000). Chemical compounds isolated from the leaves include an iridoid, glucoside, djalonenoside, dibenzopyrone (djalonensone), ursolic acid, 3-oxo-4, and 5-sitosterone, (Mabogo, 1990; Neuwinger, 2000). Corrosion rates in the absence and presence of the extract have been determined using the gravimetric and electrochemical techniques, while density functional theory (DFT) based quantum chemical computation was employed to model the electronic and adsorption structures of some active components of the extract (Cardozo da Rocha, *et al*., 2010). The key hypothesis here is that some phytochemical constituents of plant extracts including tannins, proteins, polysaccharides, polycarboxylic acids, alkaloids, etc., possess electronic structures akin to those of

conventional organic corrosion inhibitors and some have actually been reported to function as inhibitors of metal corrosion (Oguzie, *et al*., 2007; Oguzie, 2008; Okafor, *et al.*, 2008; Ostovari, *et al.*, 2009; Satapathy, *et al*., 2009; Abiola *et al*., 2010; Cardozo da Rocha, *et al*., 2010; Oguzie, *et al*., 2010; Rosliza *et al*., 2010).

Anthocleista species as Environmental bio-indicator

Studies has shown that *Anthoclesita* species stomata are considered to be one of the major structures within the leaf organ that have allowed the plants to adapt to virtually all terrestrial environments, by means of adjustment of their size, density and distribution (Zarinkamar, 2006b). An alteration of leaf stomatal density can be used as an indicator of environmental change (Case, 2004). Several researchers have shown changes in stomatal densities in response to water availability (Edward and Meidner, 1978), light intensity (Retallk, 2001; Lu *et al*., 1993), temperature (Ciha and Brun, 1978), geographical location (Retallk, 2001) and CO_2 concentration (Woodward, 1987; Woodward and Bazzaz, 1988). This has the potential to facilitate appropriate monitoring and analysis of environmental changes. Suitable sites for such monitoring could be found amongst protected areas of conservation priorities. These areas have experienced minimum levels of local environmental disturbance such as water and air contamination, waste pollution and human intervention.

The need for continuous evaluation and research on *Anthoclesita* species and its potential uses can never be undermined. Scientists and modern researchers have shown that medicinal plants have relatively small amount of constituents called "the active ingredient or principle'' produced by plants. These ingredients or principles include among others such metabolites as Alkaloids, Tannins, Saponins, Terpernoids, Phlobatanins and they vary in constituent or concentrations. The use of *Anthocleista* is holistic, it cut across different potential source including in steel industries, where it inhibit effect of corrosion in aqueous acidic environment and in field of medicine and also used as an antioxidant, promote the ability to act as reducing agent donating hydrogen electrons and stabilizing reactive oxygen species (ROS).

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