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Phytochemical Evaluation of Leaves of some Medicinal Plants from Parts of Niger Delta

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Abstract: *Leaves of some medicinal plants (Eugenia owariensis, Psidiumguajava,Carica papaya and Citrus sinensis) from some parts of Niger Delta have been analysed for secondary metabolites. The result showed variation in the mean concentration of the bioactive compounds (secondary metabolites); alkaloids (2.80-10.27)%, flavonoids (1.11-3.29)%, oxalate (0.46-0.94)%,tannins (0.26-0.85)%, saponin (1.37-3.67)% and cyanogenic glycosides (0.49-1.05). The highest concentrations of alkaloids, oxalate, tannins, saponin and cyanogenic glycosides were found in Eugenia owariensiswhile Psiduimguajava had the highest flavonoids concentration. The result of this study revealed that the therapeutic values of these species are tied to the types, concentration and combination of these metabolites present in the plants. This however, could account for the different medicinal abilities of the species.*

Key words:*Medicinal plants, Secondary metabolites, Alkaloids, Flavonoids, Tannins*

I. Introduction

Medicinal plants constitute the main source of new pharmaceuticals and healthcare products (Ivanova, *et al.*, 2005; Edeoga, *et al.* 2005). In industrialized countries, these plants have been extracted and used in the development of new drugs (Shrikumar and Ravi, 2007). They constitute the basis of health care throughout the world since the ancient days and are still widely used and have considerable importance in international trade (Patrick,*et al.,* 2008). Approximately 20% of the world plants have been subjected to pharmacological or biological test and it could be said that natural products of plant origin are important source of constituents that could be developed into drugs, dyes, fragrance and pesticides (Hamburger and Hostattman, 1991).

These plants contain secondary metabolites (alkaloids, flavanoids, saponins, steroids, tannins and phenolic compounds), vitamins and minerals which are bioactive compounds and have been known to have antimicrobial properties (Chung *etal*., 1998), medicinal importance (Edeoga, *et al.*, 2003), physiological effect in animals (Edeoga and Eriata, 2001) and are widely distributed among different plant species (Tedong, *et al.* 2006). Also, these compounds are found in varying concentrations in human and animal diets. Most of these medicinal plants have been under-utilized in orthodox medicine but have been confirmed to been used worldwide in pharmaceuticals, food, cosmetics and perfume industries. These secondary metabolites can be extracted from any part of the plant like bark, leaves, flowers, roots, fruits, seeds, (Gordon, 2001).

This study aimed at investigating the comparative phytochemical composition of guava (*Psidiumguajava* Linn, Myrtaceae), pawpaw (*Carica papaya* Linn, Caricacea), local apple (*Eugenia owariensis*P. Beauv.Myrtaceae) and sweet orange (*Citrus sinensis*Linn.,Rutaceae) in some part of Niger Delta-Nigeria and thus their medicinal significance.

II. Materials and methods

Plant materials: The leaves of Pawpaw (*Carica papaya* L.), Guava (*Psidiumguajava*), Orange (*Citrussinensis*) and Apple (*Eugenia owariensis*) each are collected from 10 different locations in some part of Niger Delta were used for this study (Figure 1). These plants were collected and properly identified by the Herbarium Curator in the Department of Plant Science and Biotechnology, Faculty of Biological Science, University of Port Harcourt.

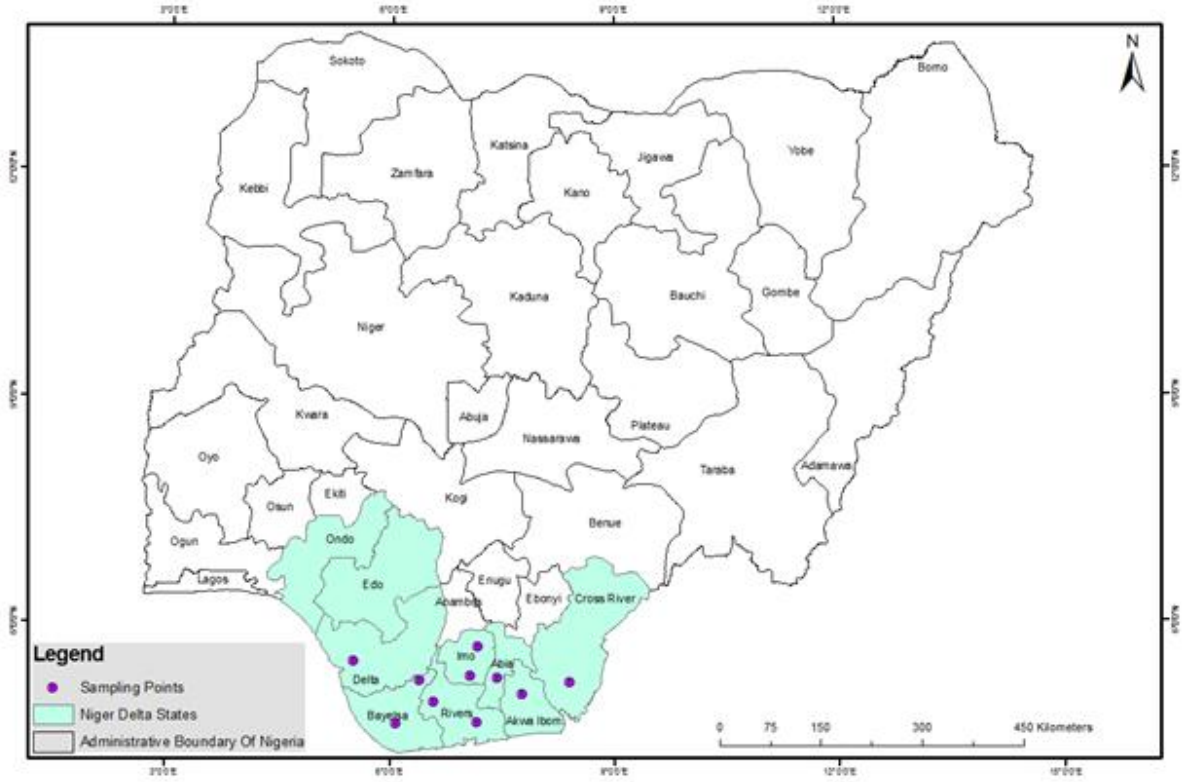

Figure 1: Map of study area showing sampling points

Sample preparation and analysis: The leaves of these plant species were detached wash with distilled water, air dried, crushed into powder and 500g of each sample stored in glass bottles. The method of determination of phytochemicals were Cyanogenic glycosides (AOAC, 2004), Oxalates (Sanchez-Alonso and Lachica, 1987), Alkaloids and Flavonoid(Harborne, 1973), Saponins determination(Obadoni and Ochuko, 2001) and Tannin (AOAC, 2006)

Statistical analysis

Data collected were subjected to one-way analysis of variance (ANOVA) using SPSS software and range, mean and standard deviation (STD) determined.

III. Result and discussion

The summarized results of the phytochemicals of the five medicinal plants studied are presented in Tables 1. The result showed the presence of secondary metabolites such as alkaloids, tannins, saponins, cyanogenic glycoside and flavonoids in all the species studied. The occurrence of these metabolites among different plant species have been reported (Geyid, *et al.,* 2005; Tedong, *et al.* 2006). The importance of these medicinal plants is tied to the type and combination of these metabolites present in the plants. However their concentration varies from species to species and could account for the different medicinal abilities of different plant species.

Alkaloids are produced by a large variety of organisms including bacteria, fungi and plants. Alkaloids from *Solanum* spices have been used in the partial synthesis of drugs. They often have pharmacological effects and are used as medications (Brighente, *et al.*, 2007). The phytochemical analysis of these species showed that the mean concentration of alkaloids among the species varied from 2.80% to 10.27%. *Carica papaya* had the lowest percentage concentration 2.50 -3.20(2.80 ±0.23)% while maximum percentage concentration of 9.60 - 10.80 (10.27±0.41)% was observed in *Eugenia owariensis***.**In *Citrus sinensis*and *Psidiumguajava* the concentration of alkaloid were 4.80 -6.00 (5.54±0.43)% and 3.60 - 4.40 (4.11±0.29)% respectively (Table 1). Their application in human medication spanned from being as analgesis, bacteriaocidal and antisplamodic properties when given in the natural state. Alkaloids are reported to be useful against Human Immunodeficiency Virus (HIV) infection (Boyd, 1995). For example, morphine and cordine alkaloids such as barbarine were found potentially to be active against trypanosomes and plasmodia (Omulokoli, *et al*., 1997); have microbiocidal and anti-diarrhoeal effect due to their effect on transit time in the small intestine and their ability to intercalate with microbial deoxyribonucleic acid (DNA) (Phillipson and Niell, 1997). The presence of

alkaloids in these species made potential sources of raw materials to the pharmaceutical industries. Also, the use of these plants in the treatment of several illnesses is worthy to note and is attributed to these compounds.

Table 1: Summary of the phytochemical characteristics of the samples studied

Parmeters	*Carica papaya* Range (mean±STD)	*Citrus sinensis* Range (mean±STD)	*Psidium guajava* Range (mean±STD)	*Eugenia owariensis* Range (mean±STD)
Alkaloid (%)	2.50 -3.20 (2.80 ±0.23)	4.80 – 6.00 (5.54±0.43)	3.60 - 4.40 (4.11±0.29)	9.60 - 10.80 (10.27±0.41)
Flavoniods (%)	1.00 - 1.20 (1.11±0.09)	1.30 - 1.70 (1.47±0.14)	3.00 - 3.50 (3.29±0.17)	2.50 – 3.00 (2.67±0.18)
Saponin (%)	2.40 - 2.90 (2.62±0.16)	2.80 - 3.30 (3.07±0.18)	1.20 - 1.60 (1.37±0.13)	3.40 - 3.90 (3.67±0.16)
Oxalate (%)	0.43 - 0.49 (0.46±0.02)	0.54 - 0.60 (0.57±0.02)	0.70 - 0.80 (0.75±0.03)	0.90 – 1.00 (0.94±0.03)
Cyanide (%)	0.48 – 0.51 (0.49±0.11)	0.82 – 0.88 (0.84±0.19)	0.92 – 0.99 (0.95±0.21)	1.01 – 1.08 (1.05±0.22)
Tannin (%)	0.22 - 0.30 (0.26±0.03)	0.48 - 0.58 (0.53±0.03)	0.57 - 0.67 (0.63±0.04)	0.82 - 0.90 (0.85±0.03)

Table 2: Analysis of variance (ANOVA) based on the phytochemical data

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	188.5877	5	37.71753	12.1917	2.91E-05	2.772853
Within Groups	55.68673	18	3.093707			
Total	244.2744	23				

Tannins are diverse class of phenolic compounds occurring in many plant species. Structurally, up to five types could be found in a plant species (Vincken, *et al.*, 2006). Compounds with phenolic group in its structure such as tannin have pharmacological potential (Amarowicz, *et al.*, 2008) which is shown on its therapeutic abilities such as antimicrobial, hypoglycemic, antidiabetic (Aslan, *et al.*, 2008) and antidiarrhoeal (Albuquerque, et al., 2010). In this study, the mean concentration of tannin among the species varied from 0.26% to 0.85% (Table 1). The various concentrations observed in the plant species studied include; *Carica papaya* 0.22 - 0.30 (0.26±0.03)%, *Citrus sinensis* 0.48 - 0.58 (0.53±0.03)%, *Psidium guajava* 0.57 - 0.67 (0.63±0.04)% and*Eugenia owariensis* 0.82 - 0.90 (0.85±0.03)% Table 1. There is significant difference in the concentration of tannin among the species (Table 2) and therefore suggests that their antimicrobial and antidiarrhoeal properties will vary from *Carica papaya* (minimum effect) to *Eugenia owariensis* (maximum effect) (Alencar, *et al.*, 2009).

Flavoniods was also found in all the species. The percentage concentrations include: *Carica papaya* 1.00 - 1.2 (1.11±0.09)%, *Citrus sinensis*1.30 - 1.70 (1.47±0.14)%, *Psidium guajava*3.00 - 3.50 (3.29±0.17)% and *Eugenia owariensis* 2.50 – 3.00 (2.67±0.18)% (Table 1). The biochemistry and medical importance of flavonoids have been emphasized by different authors. This class of secondary metabolite forms the basis for colors of flower and inhibit or kill many bacterial strains, inhibit important viral enzymes and destroy some pathogenic protozoan (Havsteen, 2002) and has antifungal, antiviral and antibacterial activity (Sathiamoortthy, *et al.*, 2007). In contrast to tannins, there is no significant difference between the plant with therapeutic indications (antidiabetic and antidiarrheal) among the species. The antioxidant properties of plant extracts are attributed to their polyphenolic contents (Lu and Foo, 2001). As such plants containing a high level of polyphenols have a greater importance as natural antibiotics. This therefore infers that the antibiotic properties of *Psidium guajava*will be higher than the other species studied (Baravalia,*et al*., 2009).

Saponin was among the phytochemicals found in the species studied and has bitter taste. Some are toxic which are referred as sapotaxin. Among the medicinal plants studied, the maximum concentration of saponin was found in *Eugenia owariensis* 3.40 - 3.90 (3.67±0.16). This was followed by *Citrus sinensis* 2.80 - 3.30 (3.07±0.18),*Carica papaya* 2.40 - 2.90 (2.62±0.16) and *Psidium guajava* 1.20 - 1.60 (1.37±0.13). Saponins possess beneficial properties of lowering cholesterol level in the body. Some saponins are used as analgesies (pain relievers) or anesthetic particularly Morphine and Codeine and anti-cancer properties (Man, et al., 2010).

Oxalate concentration among the species revealed; *Carica papaya*0.43 - 0.49 (0.46±0.02)%, *Citrus sinensis* 0.54 - 0.60 (0.57±0.02)%, *Psidium guajava* 0.70 - 0.80 (0.75±0.03) %, *Eugenia owariensis* 0.90 – 1.00 (0.94±0.03) %. The highest concentration was found in *Eugenia owariensis* (0.94%) while the lowest concentration was found in *Carica papaya* (0.46%). This range of values are below the concentrations 2-5g observed in some plants (Munro and Bassir, 1969) and there suggest that these species could have minimal adverse health impact when consumed.

Cyanogenic glycosides are compounds synthesize in plants which on hydrolysis give off hydrogen cyanide (Ballhom, 2011) and the process is well documented among plants of different genera and families

(Seigler, 1975). Daily exposure of humans and animals to low concentrations of hydrogen cyanide (HCN) may impose health risk and most cases of cyanide poisoning have been associated with consumption of plants from Rosaceae, Euphorbiaceae, Fabaceae, or Gramineae family (Drochioiu, *et al.*, 2008). In this present study, the mean concentration of HCN ranged from 0.49% (mg/100g) to 1.05% (mg/100g) for *Carica papaya* and *Eugenia owariensis*respectively (Table 1). The relationship among the species based on the HCN concentration is *Eugenia owariensis*>*Psidium guajava*>*Citrus sinensis*>*Carica papaya* (Table 1). The values obtained for all plant samples investigated were below the lethal dose (2-5mg/100g) for man (Bolhius, 1954) indicating the safety in the therapeutic usage of these plants. Also, according to ISO 2164-1975 NT standard, relating to the determination of cyanogenicheterosides in leguminous plants, a sample is regarded as free from hydrogen cyanide if it contains a lower rate to 10 mg per kg; consequently, knowing that concentrations found in our samples are higher than 10 mg/kg.

Previous study have shown that *Carica papaya* possesses anthelmintic, antiprotozoan, antibacterial, antifungal, antiviral, anti-inflamatory, antihypertensive, hypoglycemic and hypolipidemic, wound healing, antitumor, free-radical scavenging, antisickling, neuroprotective, diuretic, abortifacient, and anti-fertility activities (Lim, 2012). It is used as topical ulcer dressings to promote granulation, healing, and reducing odor in chronic skin ulcers in Jamaica (Hewitt, *et al.,* 2000), management of colic, fever, beriberi, abortion, asthma in India (Krishna, 2008) and cancer in Australia (Otsuki, et al., 2010).

The application *Citrussinensis* extracts in treatment of different illness is well known in the field of medicine and traditional medicine. This has been attributed to the presence of phytochemicals. In previous study, antibacterial properties of extracts are well documented. Extracts of *Citrussinensis*inhibited the growths of pathogenic bacteria *Staphylococcus aureus, Bacillus subtilis, Escherichia coli, Klebsiella pneumonia* and *Salmonella typhi* (Ashok kumar, *et al,* 2012), treatment of colic, stomach upset, cancer, diuretic, cormunative, immuno–enhancing, stomachic, tonic to digestive system, immune system and skin. It is also used to treat and prevent vitamin deficiencies, colds, flu, and scurvy and helping to fight viral and bacterial infections (Lawal, et al., 2013) and as anticancer, antiviral, anti-tumor, anti-inflammatory (Okwu, 2008). These properties have been due the presence of phytochemicals like flavonoids, alkaloids, saponins, tannins, triterpenoids, phytosterols and steroids (Peter, *et al.,* 2013; Okwu, 2008). The consumption of citrus fruits is also believed to confer some protection against diseases such as cardiovascular disease and cancer (Atolani,*et al*., 2012). The concentrations of these bioactive compounds among the fruits *Citrus* species which had therapeutic effect include alkaloids (0.22-1.60%), saponin (0.30-0.98%), flavonoids (0.30-0.89), phenols (0.02-0.64%) and tannins (0.23-1.45%). However, in this present study the concentrations of these compounds on the leaves revealed alkaloids (4.80-6.0), flavonoids (1.30-1.70 and saponin (2.80-3.30). These values are higher than that of the fruits while and tannin (0.48-0.58) is lower. This made the leaves of these species potential sources of these phytochemicals and possibly more therapeutic abilities than the fruits.

The applications of the members of this genus *Eugenia* in traditional medicine have been emphasized by different authors. These includehypoglycemic and antidiabetic, antioxidant and anti-inflammatory properties (Evellyne, *et al.,* 2013) and antibacterial, acetylcholinesterase inhibitory activity and therapeutic uses of these species are attributed to the presence of polyphenols, flavonoids and other phenolic compounds (Michele, *et al.,* 2012). Base on the findings of this study, *Eugenia owariensis* is yet to be properly exploited for its medicinal values and suggests the possible research to enhance the pharmaceutical potentials of this species in Nigeria.

Psidumguajavahas been used in folk medicine. In most of these studies, their different therapeutic values were reported. Antimicrobial activities of this species include growth inhibition of *Staphylococcus aureus, Pseudomonasaeruginosa, Escherichiacoli, Salmonella typhi*, Vibriocholerae (Fagbohun, *et al.*,2013; Meigy, *et al.*, 2014). Also, the pharmacological actions and the medicinal uses of methanolic extracts of guava leaves in folk medicine include the treatment of various types of gastrointestinal disturbances such as vomiting, diarrhoea, inhibition of the peristaltic reflex, gastroenteritis, spasmolytic activity, dysentery, abdominal distention, flatulence and gastric pain (Lozoya, *et al.,* 1994). The medicinal activities have been attributed to the presence of phenolic compounds (alkaloids, flavonoids and tannins) (Adeyemi, *et al.,* 2009). In this present study, these compounds were found in varying concentration in the species studied and could account for their use in treatment of different diseases in Niger Delta.

IV. Conclusion

The phytochemical screening of *Eugenia owariensis, Psidiumguajava*,*Carica papaya* and *Citrus sinensis* showed that chemical compounds such as alkaloids, flavonoids, saponins and tannins contribute to the therapeutic values of the species studied. These secondary metabolites have biological significance to living organisms and can be useful in pharmaceutical industry, ethno-medicine and leather industry. This thus verified the usefulness of the analyzed in traditional medicine.

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