Direct Research Journal of Biology and Biotechnology
Vol. 7(6), Pp. 52-57, July 2021
ISSN 2734-2158
DOI: https://doi.org/10.26765/DRJBB917302548
Article Number: DRJBB917302548
Copyright © 2021
Author(s) retain the copyright of this article
This article is published under the terms of the
Creative Commons Attribution License 4.0.
https://directresearchpublisher.org/drjbb

Full-Length Research Paper

Comparative Phytochemical Analysis of *Vernonia amygdalina* Collected from Selected Areas of Delta and Edo States

Eraga, Linda I* and Ijeh, David

Department of Science Laboratory Technology, School of Applied Sciences and Technology, Delta State Polytechnic, Otefe-Oghara, Delta State, Nigeria.
*Corresponding author email: lindaosumah@gmail.com

Received 5 April 2021; Accepted 19 June 2021; Published 23 July 2021

ABSTRACT: *Vernonia amygdalina* is a valuable medicinal plant that is widespread in West Africa. The aim of this research was to investigate and compare the phytochemical composition of *V. amygdalina* leaf and stem extracts collected from Delta and Edo States of Southern Nigeria. The results show the presence of alkaloids, which was observed in all local government areas of Delta and Edo State except Ovia South West LGA (Edo State), Burutu and Uvwie LGAs (Delta State). It was observed that Akoko Edo, Owan East and Egor of Edo State and Isoko North as well as Ughelli North of Delta State had high presence of alkaloids. Tannin was absent in Akoko Edo, Etsako East, Etsako West, Oredo, Owan East and Uhunmwonde of Edo State as well as Aniocha North, Bomadi, Okpe, Oshimili South, Uvwie, Warri South and Warri South West LGAs of Delta State. High presence of tannins was observed in Esan South East, Igueben and Ovia North East of Edo State as well as Ika South and Ughelli North of Delta State. Ika South, Ughelli South and Uvwie LGAs showed high presence of saponins while the absence of saponins was observed in Aniocha North, Burutu, Isoko South, Patani, Ughelli North, Warri North and Warri South West LGAs of Delta State. Flavonoids and phenols were highly present in Uhunmwonde LGA (Edo State), Ika South, Isoko South, Oshimili North, Patani and Sapele LGAs (Delta State) as well as Akoko Edo, Esan Central and Etsako East LGAs (Edo State), Ethiope East, Ndokwa East and Sapele LGAs (Delta State); respectively. The results suggest the high presence of alkaloids, saponins, flavonoids and phenols in the leaves and stems of *V. amygdalina* collected from different LGAs of Delta and Edo State while the absence of Tannins was observed.

Keywords: Phytochemical analysis, *Vernonia amygdalina* leaf, Delta State, Edo State

INTRODUCTION

Phytochemicals are chemical compounds that are naturally found in plants. They are responsible for the colour and organoleptic properties of the plant (Edeoga et al., 2006). It is also referred to as those chemicals that may have biological significance but are not established as an essential nutrient in plant. It could be available as dietary supplements, but the potential health benefits of phytochemicals are derived from consumption of the whole plant (Okwu, 2012). Several phytochemicals have a wide range of activities, which helps to give immunity against long term disease. Harbone, (1973) and Okwu, (2012) considered phytochemicals as compounds formed during the plants normal metabolic processes and these chemicals are often referred to as secondary metabolites. Alkaloids, flavonoids, tannins, saponins, glycosides, phytosterols, phenols, diterpens etc. are examples known to show medicinal activity as well as exhibit physiological activity (Challand and Willcox, 2009). Phytochemicals working together with nutrients found in fruits, vegetables and nuts help to decrease the aging process

(Okwu and Emineke, 2006) and reduce the risk of many diseases such as cancer, heart disease, stroke, cataracts, osteoporosis and urinary tract infections Yedjou et al., 2008). Screening of phytochemicals is a valuable step in the detection of the bioactive principles present in medicinal plants and subsequently may lead to the discovery and development of drugs (Challand and Willcox, 2009).

Vernonia amygdalina is a valuable medicinal plant that is widespread in West Africa, it is known as bitter leaf due to its characteristic bitter taste and flavour, and can be used as an active anticancer, antibacterial, antimalarial and antiparastic agent. This plant contains complex active components that are useful pharmacologically. In ethno medicine, the roots and leaves are used to treat fever, hiccups, kidney problems and stomach discomfort. Many West African countries like Cameroon, Ghana and Nigeria use the stem and root as chewing sticks (Yedjou *et al*., 2008). The aqueous and alcoholic stem, root and leaf of *V. amygdalina* extracts are reported to be extensively used as purgative and anti-malarial as well as in the treatment of eczema (Preethi *et al.,* 2010). The plant has acquired special relevance recently, having been shown in human medicine to possess potent anti-tumorigenic properties.

V. amygdalina is used mainly in soup making in the tropics and also as an appetizer and febrifuge, and has successfully been used as a supplement in weaning foods (Izevbigie *et al.*, 2004). Analysis had shown that *V. amygdalina* leaves, stems, and root is enriched with proteins, fats, fibres, amino acids, minerals, vitamins and carbohydrates (Igile *et al.,* 1994; Alabi and Amusa, 2005; Owu *et al*., 2008). The nutritional compositions of *V. amygdalina* leaf, root and stems varied from one study to another, probably due to different geographical location, genetic, environmental, harvest conditions, and ecology of the plant.

Several studies carried out on this plant had suggested that it contains different bioactive compounds, including, flavonoids, saponins, alkaloids, tannins, phenolics, terpenes, steroidal glycosides, triterpenoids and several types of sesquiterpene lactones (Luo *et al.,* 2017). These bioactive compounds made them possess different pharmacological properties like antimicrobial, antimalarial, antithrombotic, antioxidant, antidiabetic, laxative, hypoglycemic, antihelmintic, anti-inflammatory, cathartic, anticancer, antifertility, anti-fungi, antibacterial, among others (Preethi *et al.,* 2010). Bitter leaf is an abundant source of the poly-unsaturated fatty acids, linoleic and linolenic. These poly-unsaturated fatty acids have been found to be protective against cardiovascular disease (Tapsell *et al*., 2006; Challand and Willcox, 2009). It is very useful in the care of the liver and kidney and multi healer. It should be taken always for good health (Ibrahim *et al.,* 2010; Swee *et al.,* 2010).

It soothes inflamed joints and eradicates pains common with arthritis or rheumatism patients (Okoli *et al*., 2007). It is also used for improvement of contraction during labour, treatment of toothache, hypertension, whooping cough, gingivitis and sexually transmitted diseases. The study was aimed to compare the phytochemical constituents of *V. amygdalina* leaf and stem extracts collected from Delta and Edo States of Southern Nigeria.

MATERIALS AND METHODS

Collection of samples

The bitter leaf (*V. amygdalina*) was collected from two local government areas of Delta and Edo States, respectively and was brought to Delta State Polytechnic, Otefe – Oghara for further analysis.

Method of extraction

The stems and leaves were washed with distilled water and the stem cut into pieces and were air dried for weeks. After drying, the stems and leaves were pounded using mortar and pestle. Thereafter, 50 g of each pounded sample was weighed using weighing balance and was placed in a beaker. 100 ml of methanol was poured into the beaker containing the pounded sample and was left for 24 h. Thereafter, the mixture was then filtered into different test tubes using a white handkerchief and the extract was used for the phytochemical screening test.

Phytochemical screening of extract

The methods described by Harbone (1973) and Sofowara (2003) were used for screening of alkaloid, tannins, flavonoids, saponins and phenols with slight modification.

Test for Alkaloid

Meyer's Test: The filtrates were treated with Meyer's reagent (potassium meredric iodic). Formation of a yellow coloured precipitate indicates the presence of alkaloid.

Detection of Saponin

Froth Test: Extracts were diluted with distilled water to 20 ml and this was shaken in a graduated cylinder for 15 min. Formation of 1 cm layer of foam indicates the presence of saponins.

Detection of flavonoid

Alkaline Reagent: Extracts were treated with few drops of sodium hydroxide solution. Formation of intense yellow colour, which becomes colourless on addition of diluted hydrochloric acid.

Detection of phenol

Ferric chloride test

Extracts were treated with 3 – 4 drops of ferric chloride solution. Formation of bluish black colour indicates the presence of phenol.

Detection of Tannins

Gelatin Test

1% gelatin solution was mixed with sodium chloride; the mixture was added to the extract. Formation of white precipitate indicates the presence of tannins.

RESULTS AND DISCUSSION

The qualitative analysis of the extracts from the leaf sample of *V. amygdalina* phytochemical screening for alkaloids, phenols, flavonoids, saponins and tannins obtained from Delta and Edo State local government areas showed that alkaloids were found present in all local government areas except in Ovia South West, Burutu and Uvwie. It was observed that Akoko Edo, Owan East and Egor of Edo State and Isoko North as well as Ughelli North of Delta State showed high presence of alkaloids. Alkaloid is a plant derived compound that is toxic or physiologically active, contains nitrogen in a heterocyclic ring with complex structure and is of limited distribution in the plant kingdom. Alkaloids are formed as metabolic by-products and have been reported to be responsible for antibacterial activity (Erasto *et al.,* 2007). Alkaloids are known to play some metabolic roles and control development in living system (Edeoga *et al.,* 2006).

It also interferes with cell division, hence the presence of alkaloids in *V. amygdalina* could account for their use as antimicrobial agents. Alkaloids are beneficial chemicals to plants serving as repellant to predators and parasites. This probably endows these group of agents its antimicrobial activity (Usunobun and Okolie, 2006). Tannins were present in some local government areas except Akoko Edo, Etsako East, Etsako West, Oredo, Owan East, Uhunmwonde of Edo State and Aniocha North, Bomadi, Okpe, Oshimili South, Uvwie, Warri South and Warri South West of Delta State.

It was observed that Esan South East, Igueben, and Ovia North East of Edo State as well as Ika South and Ughelli North of Delta State showed high presence of tannins (Tables 1 and 2). Tannins have been found to form reversible complexes with proline-rich proteins, resulting in the inhibition of cell protein synthesis. Herbs that have tannins as their component are astringent in nature and are used for the treatment of intestinal disorders such as diarrhoea and dysentery (Bajai, 2001). Tannins are also known to be useful for the prevention of cancer as well as treatment of inflamed or ulcerated tissues (Okwu and Emineke, 2006; Li *et. al.,* 2003). Thus, the presence of tannins in *V. amygdalina* supports the traditional medicinal use of this plant in the treatment of ailments caused by microorganisms. Saponins were present in all Edo State samples and also present in some Delta state samples except Aniocha North, Burutu, Isoko South, Patani, Ughelli North, Warri North and Warri South West of Delta State. Ika South, Ughelli South and Uvwie showed high presence of saponins. Saponins as a class of natural products are involved in complexation with cholesterol to form pores in cell membrane bilayers and as such may be used as anti-cholesterol agents or cholesterol lowering agent. Studies have shown that saponins could possess anti-tumor and anti-mutagenic activities and can lower the risk of human cancer by preventing cancer cells from growing (Kittakoop et al., 2014). Saponins are believed to react with the cholesterol rich membranes of cancer cells, thereby limiting their growth and viability (Kittakoop et al., 2014). Saponins in medicinal plants are responsible for most biological effects related to cell growth and division in humans and have inhibitory effect on inflammation (Okwu and Emineke, 2006). Saponins present in *Vernonia amygdalina* leaves thus supports the usefulness of the plant in managing inflammation. Flavonoids were highly present in Uhunmwonde LGA of Edo State and Ika South, Isoko South, Oshimili North, Patani, as well as Sapele LGAs of Delta State. Similarly, phenols were highly present in Akoko Edo, Esan Central and Etsako East of Edo State as well as Ethiope East, Ndokwa East and Sapele of Delta State. It has been reported that flavonoids and phenolics are free radical scavengers that prevent oxidative cell damage and have strong anticancer activities (Kittakoop et al., 2014) and they might induce mechanism that affect cancer cells and inhibit tumor invasion (Rafat *et al.,* 2008). They also lower the risk of heart disease and provide anti-inflammatory activities attributable to their ability to neutralize and quench free radicals (Omale and Okafor 2008). It can also be due to their redox properties, presence of conjugated ring structures and carboxylic group which have been reported to inhibit lipid peroxidation. These observations support the usefulness of *Vernonia amygdalina* in folklore remedies. The highly antioxidant

Table 1. Qualitative Phytochemicals of *V. amygdalina* (Leaf Samples) from Edo and Delta State.

Phytochemicals/Local Government	Alkaloids	Tannins	Saponins	Flavonoids	Phenols
Edo State					
Akoko Edo	++	-	+	-	++
Esan Central	+	+	+	-	++
Esan North- East	+	+	+	-	+
Egor	++	+	+	+	+
Esan South East	+	++	+	+	+
Esan West	+	+	+	+	+
Etsako East	+	-	+	-	++
Etsako Central	+	+	+	-	+
Etsako West	+	-	+	-	-
Igueben	+	++	+	-	-
Ikpoba –Okha	+	+	+	+	-
Oredo	+	-	+	-	-
Orhionmwon	+	+	+	+	-
Ovia North- East	+	++	+	+	+
Ovia South- West	-	+	+	+	-
Owan East	++	-	+	+	-
Owan West	++	+	+	+	+
Uhunmwonde	+	-	+	++	-
Delta State					
Aniocha North	+	-	-	-	+
Aniocha South	+	+	+	-	-
Bomadi	+	-	+	-	-
Burutu	-	+	-	+	-
Ethiope West	+	+	+	+	-
Ethiope East	+	+	+	+	++
Ika North East	+	+	+	+	-
Ika South	+	++	++	++	-
Isoko South	+	+	-	+	-
Isoko North	++	+	+	++	-
Ndokwa East	+	+	+	+	++
Ndokwa West	+	-	+	+	-
Okpe	+	+	+	+	-
Oshimili North	+	+	+	++	-
Oshimili South	+	-	+	-	-
Patani	+	+	-	++	+
Sapele	+	+	+	++	++
Udu	+	+	+	-	+
Ughelli North	++	++	-	+	+
Ughelli South	+	+	++	-	-
Ukwani	+	+	+	-	-
Uvwie	-	-	++	-	-
Warri North	+	+	-	+	+
Warri South	+	-	+	+	-
Warri South West	+	-	-	+	-

Hints: “++” indicate high presence, “+” moderate present and “- “indicates absence.

Table 2: Qualitative Phytochemical Screening of *V. amygdalina* (Stem Samples) from Edo and Delta State.

Phytochemicals/Local Government	Alkaloids	Tannins	Saponins	Flavonoids	Phenols
Edo State					
Akoko Edo	+	+	+	++	++
Esan Central	+	-	+	-	++
Esan North- East	++	+	+	-	++
Egor	+	++	+	-	+
Esan South East	++	+	+	++	++
Esan West	+	+	+	-	+
Etsako East	-	-	+	+	+
Etsako Central	+	+	+	+	+
Etsako West	+	-	++	+	++
Igueben	+	+	+	_	++
Ikpoba –Okha	+	+	+	++	+
Oredo	++	++	+	++	++
Orhionmwon	+	+	+	-	++
Ovia North- East	-	++	+	-	++
Ovia South- West	+	+	+	-	+
Owan East	+	-	+	++	+
Owan West	++	-	+	+	+
Uhunmwonde	++	-	+	++	++
Delta State					
Aniocha North	+	++	+	+	+
Aniocha South	-	-	++	++	+
Bomadi	-	+	-	-	++
Burutu	+	-	+	-	+
Ethiope West	+	++	+	++	+
Ethiope East	+	+	+	+	++
Ika North East	+	++	+	++	+
Ika South	-	++	++	+	+
Isoko South	_	+	+	-	++
Isoko North	-	++	+	+	++
Ndokwa East	+	++	++	++	+
Ndokwa West	+	++	+	-	+
Okpe	+	+	+	+	+
Oshimili North	+	+	+	-	+
Oshimili South	+	-	+	-	+
Patani	++	+	+	-	++
Sapele	-	++	+	++	++
Udu	+	-	++	-	+
Ughelli North	+	+	+	++	++
Ughelli South	+	-	++	-	++
Ukwani	+	+	+	-	++
Uvwie	+	-	+	-	+
Warri North	+	+	+	-	++
Warri South	++	++	+	-	++
Warri South West	+	-	+	++	++

Hints: “++” indicate high presence, “+” moderate present and “- “indicates absence.

property of flavonoids present in the *Vernoniaa mygdalina* may act in synergy with other phytochemicals present to produce the medicinal benefits.

Conclusion

The results obtained from the analysis carried out on the comparison of phytochemical screening of *V. amygdalina* collected from Delta and Edo States of Southern Nigeria have clearly showed the presence of alkaloids, which was observed in all local government areas of Delta was absent in Ovia South West LGA (Edo State), Burutu and Uvwie LGAs (Delta State). Akoko Edo, Owan East and Egor (Edo State); Isoko North and Ughelli North (Delta

State) showed high presence of alkaloids.Tannin was absent in Akoko Edo, Etsako East, Etsako West, Oredo, Owan East and Uhunmwonde (Edo State) and Aniocha North, Bomadi, Okpe, Oshimili South, Uvwie, Warri South and Warri South West LGAs (Delta State). High presence of tannins was observed in Esan South East, Igueben and Ovia North East (Edo State) and Ika South as well as Ughelli North (Delta State). Ika South, Ughelli South and Uvwie LGAs showed high presence of saponins while the absence of saponins was observed in Aniocha North, Burutu, Isoko South, Patani, Ughelli North, Warri North and Warri South West LGAs (Delta State). Flavonoids and phenols were highly present in Uhunmwonde LGA (Edo State), Ika South, Isoko South, Oshimili North, Patani and Sapele LGAs (Delta State) and Akoko Edo, Esan Central, Etsako East LGAs (Edo State), Ethiope East, Ndokwa East and Sapele LGAs (Delta State); respectively. The results of this comparative study further confirmed that *Vernonia amygdalina* can be used as an active anticancer, antibacterial, antimalarial and antiparastic agent due to the presence of complex bioactive components that are applied pharmacologically.

REFERENCES

Alabi, D. A. and Amusa, N. A. (2005). Chemicals and Nutritional Composition of Four Botanicals with Fungi Toxic Properties. *World Journal of Agricultural Sciences.* **1(1):** 84–88.

Bajai A Meyers. Effect of Natural extract of pineapple on disstibility, performance traits and nitrogen balance of broiler chicks. *Australian Journal of Basic and applied Sciences,* **5(20):** 2001: 10-30

Challand, S. and M. Willcox, 2009. A Clinical trial of the traditional medicine *V. amygdalina* in the treatment of uncomplicated malarial. *J. Altern. Com. Med.,* **15(11):** 1231-1237.

Edeoga, H.O., Omobuna, G. and Uche, L.C. (2006). Chemical composition of Hyotissu aveoleus and *Ocimum gratissium* hybrids from Nigeria. *African Journal of Biotechnology*. 5 (910): 892-895.

Harbone, J.B. (1973). Phytochemical Methods London. Chapman and Hall Ltd, pp. 49-188.

Ibrahim, G., E.M. Abdurahman, H. Ibrahim and N.O. Ibrahim, 2010. Comparative cytomormological studies on the studies of *V. amygdalina* Del. and V Kotschyama. *Nig. J. Botany*, 23(1): 133-142.

Igile, G.O., Wieslaw, O., Jurzysta, M., Stanislaw, B and Fasanmade A. (1994). Flavonoids from *Vernonia amygdalina* and their antioxidant activities. *Journal of Agricultural and Food Chemistry.* 42: 2445–2448.

Izevbigie, E.B., Bryan,J.L., and Walker A. (2004). A novel natural inhibitor of extracellular signal regulated kinases and human breast cancer cell growth. *Experimental Biology Medical* (Maywood). 229(2):163-169.

Kittakoop, P. Mahidol, C. and Ruchirawat, S. (2014). “Alkaloids as important scaffolds in therapeutic drugs for the treatments of cancer, tuberculosis, and smoking cessation,” Current Topics in Medicinal Chemistry, vol. 14, no. 2, pp. 239–252, 2014.

Li H, Wang Z and Liu Y. Review in the studies on tannins activity of cancer prevention and anticancer. Zhong-Yao-Cai 26(6); 2003: 444-448.

Luo, X., Jiang, Y., Fronczek, F.R., Lin, C., Izevbigie, E.B, Lee, S and Lee, K.S. (2017). Isolation and Structure Determination of a Sesquiterpene Lactone (Vernodalinol) from *Vernonia amygdalina* Extracts. *Pharmaceutical Biology.* 49(5): 464–470.

Okoli, R.S., O. Aigbe, S.O. Ohafu-Obode and S.K. Mensah, 2007. Medicinal herbs used for managing some common ailments among. ES a people Edo state, Nigeria. *Pak. J. Nutr.*, 6(5): 470-490.

Okwu, D.E. (2012). Evaluation of the chemical composition of indigenous spices and flavoring agents. *Global Journal of Pure and Applied Sciences*. 7(3): 455-459.

Okwu, D.E. and Emenike, I.N. (2006). Evaluation of the phytonutrients and vitamin contents of citrus fruits. *International Journal of Molecular Medicine and Advance Science*. 2: 1–6.

Omale, J. and Okafor, P. (2008). Comparative antioxidant capacity, membrane stabilization, polyphenol composition and cytotoxicity of the leaf and stem of *Cissus multistriata*. *Afr. J. Biotechnol.,* 7(17): 3129-3133.

Owu, D. U., Ben, E. E., Antai, A. B., Ekpe, E. A. and Udia, P. M. (2008). Stimulation of Gastric Acid Secretion and Intestinal Motility by *Vernonia amygdalina* Extract. Fitoterapia. 79(2): 97–100.

Preethi, R.M., Devanathan, V.V and Loganathan M. (2010). Antimicrobial and antioxidant efficacy of some medicinal plants against food borne pathogens. *Advance Biology Research*. 4: 122-125.

Swee, K., Y. Wan, B. Ho, K.H. Boo, S.L. Woon, K. Huyunh, H. Abdul, Y. Naoman and B.A. Noorjaham, 2010. *V. amygdalin*a: an ethno-veterinary used green vegetables with multiple bioactivities. J. Med. Plant Res, 4(25): 2787-2812.

Tapsell, G., 2006. Health benefits to herbs and spices: the past, the present and future. *Med. J. Aust.*, 1: 170-190.

Yedjou, C., E. Izevbigie and P. Tchounwou, (2008). Preclinical assessment of *V. amygdalina* leaf extracts as DNA damaging anti-cancer agent in the management of breast cancer. IJERPH, 5: 337-341.