Bayero Journal of Pure and Applied Sciences, 6(1): 101 – 104
Received: May 2013
Accepted: June 2013
ISSN 2006 – 6996

MEDICINAL, PHARMACOLOGICAL AND PHYTOCHEMICAL POTENTIALS OF *ANNONA COMOSUS* Linn. PEEL - A REVIEW

***Lawal, D.**
Department of Biological Sciences, Federal University Dutse, P.M.B 7156, Dutse, Jigawa State-Nigeria.
lawaldanjuma278@yahoo.com

ABSTRACT
Therapeutic plants, and the drugs derived from them, are the most important and readily available source of health-care medicines to rural people in Africa. In Africa, many natural resources are used for obtaining pharmaceuticals that have a high national and international economic value.Various parts of Annonacomosus have been used as anti-inflammatory, proteolytic and antihelmithic agent, also as treatment to: diarrhea, indigestion, pneumonia, bronchitis, arthritis, pain, heart disease, diuretic, to expedite labour, arbortion, intestinal worms, venereal diseases, edema, hemoorrhoids, purgative, emmenogogue and vermifuge.The plant is reported to contain alkaloids, flavonoids, saponins, tannins, steroids, triterpenoids and phytosterols. This review was aimed at describing the medicinal uses, pharmacological and phytochemical components and other important aspects of the plant.
Keywords: Antimicrobial, Antioxidant, Anti-inflammatory, immune support, Annonacomosus

INTRODUCTION

The efficacy of many medicinal plants has been validated by scientists abroad, from Europe to the orient. Thanks to modern technology, science can now identify some of the specific properties and interactions of botanical constituents. With this scientific documentation, we now know why certain herbs are effective against certain conditions (Chong, 2003). Herbalists, however; consider that the power of a plant lies in the interaction of all its ingredients. Plants used as medicines offer synergistic interactions between ingredients both known and unknown. This review was design to provide information on the ethnomedicinal, pharmacological andphytochemical potentials of *Annonacomosus* Linn. Peel.

History

Although thought to have originated in South America, *A. comosus* were first discovered by Europeans in 1493 on the Caribbean island that came to be known as Guadalupe. When Columbus and other discoverers brought *A. comosus* back to Europe, attempts were made to cultivate the sweet, prized fruit until it was realized that the fruit's need for a tropical climate inhibited its ability to flourish in this region. By the end of the 16th century, Portuguese and Spanish explorers introduced *A. comosus* into many of their Asian, African and South pacific colonies, countries in which the *A. comosus* is still being grown today. In the 18th century, *A. comosus* began to be cultivated in Hawaii, the only state in U.S. in which they are still grown. In addition to Hawaii, other countries that commercially grow pineapple include Thailand, the Philippines, China, Brazil and Mexico (Oxford, 2005).

Ethonomedicinal Uses of *Annonacomosus*(L)

Annonacomosus (L) Peel:Is derived from the fruit of *Annonacomosus*, the English name is pineapple and is commonly known asAbarba (Hausa). The root and fruit are either eaten or applied topically as an anti – inflammatory and as a proteolytic agent. It is traditionally used as an antihelminthic agent in the Philippine. A root decoction is used to treat diarrhea (Oxford, 2005). This fruit contains sugar, vitamin C, and bromelain, a proteolytic enzyme that breaks down protein. It is also low in sodium and rich in potassium; however, *A. comosus* was not recognized as having any medicinal benefits for many years. This fruit also has anti – inflammatory and digestive properties. The bromelain in *A. comosus* helps fight infections by dissolving layers of slough and bacteria – rich surfaces. The fruit can also be used to aid in digestion. It can clear bronchial passages in those suffering with pneumonia and bronchitis (Oxford, 2005).

The anti – inflammatory properties in the fruit help reduce the symptoms of arthritis, and help reduce pain after surgery and sport injuries. *A. comosus* is currently being studied for its effectiveness in preventing heart disease. *A. comosus* juice is taken as a diuretic and to expediatelabour, also as a gargle in cases of sore throat and as an antidote for sea sickness. The flesh of very young (toxic) fruits is deliberately ingested to achieve abortion (a little with honey on 3 successive mornings); also to expel intestinal worms; and as a drastic treatment for venereal diseases. In Africa the dried, powdered root is a remedy for edema. The crushed rind is applied on fractures and the rind decoction with rosemary is applied on hemorrhoids. Indians in panama use the leaf juice as a purgative, emmenogogue and vermifuge (Oxford, 2005).

Profile of the Plant
***Annonacomosus* (L)**

English name:	**pineapple**
Native name (Hausa)	Abarba
Classification	
Kingdom	plantae
Division	spermatophyte
Sub-division	Angiospermae
Class	Dicotyledonae
Sub-class	Magnoliales
Order	Annonales
Family	Annonaceae
Genus	*Annona*
Species	*comosus*

Description of *Annonacomosus*

Annonacomosus (L) belongs to the Bromeliaceae family, from which one of its most important health-promoting compounds, the enzyme bromelain, was named. The Spanish name for pineapple, pina, and the root of its English name, reflects the fruit's visual similarity to the pinecone. *A. comosus* are actually not just one fruit but a composite of many flowers whose individual fruit lets fuse together around a central core. Each fruit let can be identified by an 'eye,' the rough spiny marking on the *A. comosus* surface. *A. comosus* have a wide cylindrical shape, a scaly green, brown or yellow skin and a regal crown of spiny, blue-green leaves. The fibrous flesh of *A. comosus*is yellow in color and has a vibrant tropical flavor that balances the testes of sweet and tart. The area closer to the base of the fruit has more sugar content and therefore a sweeter taste and more tender texture (Oxford, 2005).

The *A. comosus* is known as the fruit of kings, and it was available only to natives of the tropics and to wealthy Europeans. Despite the fact that this fruit had become familiar to almost the whole world, it is still a true exotic, because it is a member of the bromeliad family, in which edible fruits are rare. *A. comosus* starts out as a stalk of a hundred or more flowers that shoots up from a plant about three feet tall. Each flower develops a fruit that forms one of the scales on the outside of the *A. comosus*. The more scales or marks on *A. comosus*, the stronger the tropical taste will be. *A. comosus* with fewer and larger scales will have a milder but sweeter flavor and more juice. The fruit was spread from native Paraguay to throughout South and Central America when the Guarani Indians took *A. comosus* on sea voyages as provisions and to prevent scurvy. When Columbus found the fruit in 1493 called it pina, because he thought it looked like a pincone. The hybrids known today first appear, when the Dutch improved the fruit by crossbreeding, around 1700. The cuttings of the plants were sold to English, who grew them as pot-house plants (Oxford, 2005).

The *A. comosus* is a tropical plant and fruit (multiple), native to Uruguay, Brazil, Puerto Rico, or Paraguay. It is a medium tall (1-1.5m) herbaceous perennial plant with 30 or more trough-shaped and pointed leaves 30-100cm long, surrounding a thick stem. *A. comosus* is an example of a multiple fruit: multiple, spirally-arranged flowers along the axis each produce a fresh fruit that becomes pressed against the fruits of adjacent flowers, forming what appears to be a single fleshy fruit. *A. comosus* are the only bromelaid fruit in widespread cultivation. It is one of the most commercially important plants. The fruit lets of *A.comosus* are arranged in two interlocking spirals, eight spirals direction, thirteen in the other; each being a Fibonacci number. Pollination is required for seed formation; the presence of seeds negatively affects the quality of the fruit (Oxford, 2005).

Pharmacological Potentials

Antibacterial Properties of *A. comosus* peel extract

The methanolic extract of *A. comosus* peel was inactive to *B. subtilis*, *E. coli* at a concentration of 50mg/ml (50,000ug/ml), but it shows activity on *S. typhi* at a concentration of 100mg/ml (100,000ug/ml) (Ishii *et al.*, 1984). The chloroform extracts of *A. comosus* (Linnaeus) Merr. peels showed activity against *Staphlococcusaureus* ATCC 29737 with inhibition zone of 11mm, *Corynebacteriumrubrum* ATCC14898 with inhibition zone of 9mm, *Klebsiella pneumonia* NCIM2719 with inhibition zone of 12.7mm, *S. typhimurium* ATCC23564 with inhibition zone of 9.3mm but showed no activity against *S. subflava* NCIM2178, *Enterobacteraerogenes* ATCC1304 and *Proteus mirabilis* NCIM2241 (Chanda*et al.*, 2010). The acetone extract of *A. comosus*peel showed activity on *S. aureus* with inhibition zone of 11mm, *S. subflava* with inhibition zone of 10mm, *E. aerogenes* with inhibition zone of 9mm, *K. pneumoniea* with inhibition zone of 10mm, *P. Mirabilis* with inhibition zone of 9mm, *S. typhimurium* with inhibition zone of 9mm (Chanda*et al.*, 2010). The methanolic extract of *A. comosus* peel showed activity against *S. aureus* with inhibition zone of 12mm, *K. Pneumoniea* with inhibition zone of 9mm, while no activity against *S. subflava,E. aerogenes*, *P. Mirabilis* and *S. typhimurium*(Chanda*et al.*, 2010). The hexane extract of *A. comosus* peel showed activity against *S. subflava*, *S. typhimurium*, but no activity against *S. aureus*, *E. aerogene*, *K. pneumoniea* and *P. Mirabilis*(Chanda*et al.*, 2010).Taura*et al.*, 2005 also reported that the ethanolic extract of *A. comosus* (Linnaeus) Merr. peel has activity on *S.typhi* at 100mg/cm^3 with inhibition zone of 15mm in diameter and MIC of 80mg/cm^3.Lawal*et al* (2011) reported that the ethanolic extract of *A.comosus* peel showed antibacterial activity against *A. hydrophila* and *Salmonella species.*

Antiviral Properties of the Extract
The juice has antiviral activity and the undiluted juice was found to have activity on polio virus 1 (Konowalchuk and Speirs 1978).

Antifungal Properties*A. comosus* peel extract
The chloroform extracts of *A. comosus* (Linnaeus) Merr. peels showed activity against *Candida albican* ATCC 2091 with inhibition zone of 9.5mm, *C. tropicalis* ATCC4563 with inhibition zone of 10mm, *C. glabrata* NCIM3448 with inhibition zone of 10.5mm, *Cryptococcus luteolus* ATCC32044 with inhibition zone of 9.5mm (Chanda*et al*., 2010). The acetone extract of *A. comosus*peel showed activity on *C. rubrum* with inhibition zone of 9mm, *C. albican* with inhibition zone of 10.5mm, *C. tropicalis* with inhibition zone of 9.5mm, *C. glabrata* with inhibition zone of 11mm and *C. luteolus* with inhibition zone of 10mm in diameter (Chanda*et al*., 2010). The methanolic extract of *A. comosus* peel showed no activity against*C. rubrum*(Chanda*et al*., 2010). The hexane extract of *A. comosus* peel showed activity against *C. tropicalis*, *C. luteolus,* but no activity against *C. rubrum* and *Cryptococcus* (Chanda*et al*., 2010).

Antiparasitic Properties of the Extract
The aqueous extract was active against *Ascaris lumbricoides* and some microscopic worms (Asenjo, 1940). The ethanolic extract of leaves of *A. comosus*has antifilarial and taenicidal activity (Suresh and 1990, Feroz*et al*, 1982).

Anti-Inflammatory Properties of the Extract
Sucheta*et al*(2011) reported theanti-inflammatory activity of *A. comosus*leaf extract against carrageenan induced acute paw oedema in rats,the methanol extract was found to be the most potent followed by the chloroform extract after 4 hours of treatment, whereas the reference drug indomethacin was found to be the most potent when compared with the saline control group.

Potential Anti-Inflammatory and Digestive Benefits
Bromelain is a complex mixture of substances that can be extracted from the stem and core fruit of the *A. comosus.* Among dozens of compounds known to exist in this crude extract, the best studied components are a group of protein-digested enzymes (called cysteine proteinases). Original, researchers believed that these enzymes provided the key health benefits found in bromelein, a popular dietary supplement containing these *A. comosus* extracts. In addition, researchers believed that these benefits were primarily limited to help with digestion in the intestinal tract. However, further studies have shown that bromelain has a wide variety of health benefits, and that many of these benefits may not be related to the different enzymes found in the extract. Excessive inflammation, excessive coagulation of the blood and certain types of tumor growth may all be reduced by therapeutic doses of bromelain when taken as a dietary supplement. Studies are not available, however, to show these same potential benefits in relation to normal intake of *A. comosus* within a normal meal plan (Oxford, 2005).
Bromelain extract can be obtained from both the fruit and stems of *A. comosus*. Potentially important chemical differences appear to exist between extracts obtained from the stem versus the core fruit. However, the practical relevance of these differences is not presently understood. Most of the laboratory research on bromelain has been conducted using stem-based extract, however. Although healthcare practioners have reported improved digestion in their patients with an increase in *A. comosus* as their 'fruit of choice within a meal plan, there is no published studies that document specific changes in digestion following consumption of the fruit (versus supplementation with the purified extract. However, expectation is that the core fruit will eventually turn out to show unique health-supportive properties, including possible digestion-related and anti-inflammatory benefits (Oxford, 2005).

Antioxidant Protection and Immune Support
Vitamin C is the body's primary water-soluble antioxidant, defending all aqueous areas of the body against free radicals that attack and damage normal cells. Free radicals have been shown to promote the artery plaque build-up of atherosclerosis and diabetic heart disease, caused the airway spasm that leads to asthma attacks, damage the cells of the colon so they become colon cancer cells, and contribute to the joint pain and disability seen in osteoarthritis and rheumatoid arthritis. This would explain why diets rich in vitamin C have been shown to be useful for prevention or reducing the severity of all these conditions. In addition vitamin C is vital for the proper function of immune system, making it a nutrient to turn to for the prevention of recurrent ear infections, colds, and flu (Oxford, 2005).

Manganese and Thiamin (Vitamin B1) for Energy Production and Antioxidant Defenses
*A. comosus*is an excellent source of the trace mineral manganese, which is an essential cofactor in a number of enzymes important in energy production and antioxidant defenses. For example, the key oxidative enzyme superoxide dismutase, which disarm free radicals produced within the mitochondria (the energy production factories within our cells), requires manganese. Just one cup of fresh *A. comosus* supplies 128% of DV for this very important trace mineral. In addition to manganese, *A. comosus* is a good source of thimine**,** a B vitamin that acts as a cofactor in enzymatic reactions central to energy production (Oxford, 2005).

Phytochemistry of *Annonacomosus*(L)
The Malaysian *A. comosus* juice contains the following compounds : Acetaldehyde, Acrylic acid, Ethyl ester, Iso butyrate: Ethyl, Iso-butyrate; Ethyl, Iso propyl,-Iso-butyrate; Methyl-Iso butyrate; Ethyl Acetate; Gamma-Eudesmol (a sesquiterprene); Iso-butyl formate; methyl formate, N-butyl-formate; N-propyl formate; Formic acid and Histidine (Howard and Hoffman 1967).

Pineapple contains Acetone, Alanine, 2-3 Dimethyl, Butan -2 ol; Sesquiterpene:- adinene; Ethyl caproate; Methyl and Ethyl esters of caproic acid; Methyl Ethyl ester of Beta-Acetoxycaproic acid and Gamma caprolactone; Decanoic acid and their esters,Ferulic acid (phyrylpropanoid); and the alkanalalkanone derivatives of hexone(Muller and Willham 1971).

A. comosus leaf contains: Phenylalanine, Allylhexanoate, Argenine, Atpase; Isoleucine; Lysine, Methionine; Tyrosine and Glycine (Yeoh*et al.*, 1986). Tsuchiya *et al.* (1999) indicated the presence of indole alkaloid like Haumalol, Haumine, Haumol, and Hemicellulose in the fruit of *A. comosus*. *A. comosus* stem contains proteolytic enzyme Papain-like enzyme (Vongsinudom, 1977); Bromelain (Shiraishi*et al.*, 1975); Alkaloids (Sofowora, 1978); Phenylpropaniods such as Cinnamic Acid, Coumaric and Ferulic acid (Tawata*et al.,* 1996). Khamviwat, (1984) isolated bromelain in the peel of the unripe fruit in Thailand. Volatiles lipid compounds such as the Ethyl and Methyl esters of Nonanoic acid, the Methyl and Ethyl Esters of Oct-Cis-4-enoic acid and even the Methyl and Ethyl Esters of Oct-trans-4-enoic acid have been isolated from the fruit of *A. comosus* (Muller and Willham 1971). The plant also contain sulphur compounds like methyl Mercaptan (Muller and Willham 1971); Essential oils such as Butan-1-ol and their derivatives (Flath, 1970); a Triterpene-Annanasic acid (a new steroidal trihydroxtriterpene carboxylic acid from the stem) (Takata, 1976); Pentosans (Muller and Willham 1971), Flavonoids from the leaf (Muller and Willham 1971).Lawal*et al.* (2011) reported that the ethanolic extract of *A.comosus*peel contains photochemical like alkaloids, flavonoids, saponins, tannins, triterpenoids and phytosterols.Sucheta*et al.*(2011) reported that *A. comosus* leaf extract containstriterpenoids and steroids in the petroleum ether extract; alkaloids and steroids in the chloroform extract; and alkaloids, steroids, saponins, glycosides and carbohydrates in the methanol extract.

CONCLUSION

Annonacomosus possess antimicrobial properties and so can be utilized in the cure and prevention of infectious diseases after standardization.

REFERENCES

Asenjo, C.F. (1940): A Preliminary Study of the Antihelmintic. Review of Scientific studies on Antihelmintics from plants. *J. Sci. Res. PL. Med.***3**:6-12.

Chanda, S., Baravalia, Y., Kaneria, M. and Rakholiya, K. (2010): Current Research Technology and Education Topics in Applied Microbiology and Microbial Biotechnology. *A. Mendez-Vilas* (Ed). Pp 444 - 450.

Chong,L.J. (2003):History of Herbal medicine.*Chong's Health care enterprise*.INC. 40IN.

Garfield Ave, Suit 1, Alhamba, C A 91801 USA.http://www.cljhealth.com.

Feroz, H., Khare, A.K. and Srivastana. M.C. (1982): Review of scientific studies on Antihelmintics from plants. *J.Sci.Res.Pl.Med.* **3**:6-12.

Flath, R. K., (1970): Volatile components in smooth cayenne pineapple. *Journal of Agriculture and Food Chemistry***182**:528.

Howard, G.E. and Hoffman, A. (1967): A study of the Volatile flavouring constituents of canned Malayan Pineapple. *Journal of Science in Food Agriculture***18**: 106-109.

Ishii, R., Yoshikawa, K., Minakata, H. andKada, T. (1984): Specificities of Bio-Antimutagens in plant Kingdom. *J. Agr. Biol. Chem.***4810**: 2587-2591.

Khanviwat.V. (1984): The study of proteolytic Activity of pineapple Bromelain in Thailand.*Absrt.10th Conference of Science and Technology*, Thailand.Chiangmai Univ. 1984: 432-433.

Konowalchuk, J., Speirs. J. I. (1978): Antiviral effects of commercial juices and beverages. *Journal of Applied Environmental Microbiology***35**: 1219.

Lawal, D., Mukhtar, M.D., Taura, D.W. and Bukar, A. (2011).Phytochemical screening and

invitro anti-bacterial studies of the ethanolic extract of *A. comosus* (Linn) Merr. Peels on *Aeromonashydrophila* and *Salmonella species*.Bayero*Journal of Pure and Applied Sciences*.**4(1)**: 168-172.

Muller, R. andWillham, B. (1971): On the Volatile constituents of pineapple. *Helv.ChimActa***54**: 1880-1885.

Oxford (2005):Oxford Journal Copyright © 2005.Oxford University Press. Online ISSN 1741 – 4288 – print ISSN 1741 – 427 X.

Shiraishi, Y., Shiratori, T. andTakabatake, E. (1975): Determination of Polycyclic Aromatic Hydrocarbons in Food V. 3-4-Benzopyrene in Fruit ShakubinEiseigakiZasshi**16**:187-190.

Sofowora, A. (1978): *Medicinal plant and traditional medicine in Africa*. Spectrum books, Ltd. Second edition, Pp: 100 – 117.

Suresh, M. and Rai, R.K. (1990): Cardol: The antifilarial principle from *Anrcordiumoccidentale*. *Curr. Sci.* **599**:477-479.

Sucheta, M., Sanjib, B., Pandey, J. and Moulisha, B. (2011):Evaluation of acute anti-

inflammatoryeffect of*Ananascomosus*leaf extracts in rats. *Pharmacologyonline* **3**: 1312-1315.

Takata, R. A. andShever, P.J. (1976): Isolation of Elyceryl ester of caffeic and P-coumaric acids from pineapple stems. *Lloydia***396**:409-412.

Tawata, S., Taira S., Kobamato, N., Zhu, J., Ishihara.M., Toyama. S. (1996): Synthesis and Antifungal activity of cinnamic acid esters. *Journal of Bio.Sci.Biotech.Biochem.***605**:909-910.

Taura, D.W., Okoli, A.C. and Bichi, A.H. (2005): In-vitro Antibacterial Activities of Ethanolic Extracts of AnnonaComosus L. Allium Sativum L. And Aloe Barbadensis L. in Comparison With Ciprofloxacin.*BEST Journal***1(1)**: 36-41.

Tsuchiya, H., Hayashi, H., Sato, M., Shimizu. H. (1999): Qualitative analysis of all types of B-carboline alkaloids in Medicinal plants by High performance liquid Chromatography. *Journal of Phytochemical Analysis***105**:247-253.

Vongsinudom. K., (1977): Isolation and characterization of Papain-like enzyme of Pineapple. *M.Sc. Thesis*, 1977.

Yeoh, H., Wee, Y.C., Watson.L. (1986): Taxonomic variation in Total leaf protein amino acid compositions of monocotyledonous plants. *Journal of Biochemistry and Systemic Ecology*.**141**: 91-96.