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Studies of Phytochemicals, Heavy metals and N.P.K analysis of crude leaf extract of Breadfruit (*Artocarpus altilis*)

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Abstract: The study was designed to the phytochemicals, heavy metals (Cu, Ca, Cr, Ni, Zn, Mn, Fe and Mg) and N.P.K analysis of crude leaf extract of Breadfruit (*Artocarpus altilis*) Linn Moraceae. Phytochemical screening of the ethyl acetate, ethanol, methanol and aqueous extracts of the leaf, obtained by the cold maceration method, indicated the presence of alkaloids, flavonoids, saponins, phenols, steroids, tannins, triterpenoids, glycosides, carbohydrates, phlobatannins, thiols, anthroquinone, protein and amino acids, resins, fixed oils & fats, and phytosterols. Qualitative estimation of phytochemicals was performed in different solvent extracts, namely ethyl acetate, ethanol, methanol and aqueous extracts. The results were represented as '+' for the presence and '–'for the absence of phytochemicals. N.P analyses were done by total Kjeldahl digests by UV-VIS spectrophotometry, and K analysis was done in Kjeldal digests by Flame photometry method. The result of breadfruit crude leaves extracts revels that the highest amounts was that of Ca (57690.19 mg/kg), followed by Mg (4358.51mg/kg**),** whereas the least amount was that of Cu (3.17 mg/kg). GC/MS did not detect Ni. N.P.K. analysis shows the highest percentage was that of potassium in *A. altilis* leaves, followed by Nitrogen, the least percentage of Phosphorus.
Keywords: *Artocarpus altilis*, heavy metals, phytochemicals, ethanol, methanol, aqueous extract, leaf extract,breadfruit

INTRODUCTION

Breadfruit (*Artocarpus altilis*) is a species of flowering tree in the mulberry and jackfruit family (Moraceae) originating in the South Pacific and eventually spreading to the rest of Oceania. British and French navigators introduced a few Polynesian seedless varieties to Caribbean islands during the late 18th century, and today it is grown in some 90 countries throughout South and Southeast Asia, the Pacific Ocean, the Caribbean, Central America and Africa. (Morton, & Julia F.,1987). Its name is derived from the texture of the moderately ripe fruit when cooked, similar to freshly baked bread and having a potato-like flavor (Tropical Plant Research, Education, and Conservation. 2017; Board of Trustees of the Royal Botanic Gardens UK, 2017) .

According to DNA fingerprinting studies, breadfruit has its origins in the region of Oceania from New Guinea through the Indo-Malayan Archipelago to western Micronesia (Zerega, N. J. C *et al*., 2004). The trees have been widely planted in tropical regions, including lowland Central America, northern South America, and the Caribbean (Salmond, Anne 2010; O'Brian, Patrick., 1997). In addition to the fruit serving as a staple food in many cultures, the light, sturdy timber of breadfruit has been used for outriggers, ships, and houses in the tropics.

Breadfruit trees grow to a height of 26 m (85 ft) (Janick, Jules; Paull, Robert E., 2008). The large and thick leaves are deeply cut into pinnate lobes. All parts of the tree yield latex (Balick, Michael J.; Cox, Paul Alan 1997). which is useful for boat caulking (Apé Lamā Lōkaya:1950).

In Belize, the Mayan people call it *masapan*. In Puerto Rico, breadfruit is called *panapen* or *pana*, for short. In some inland regions it is also called *mapén*. *Pana* is often served boiled with a mixture of sauteed *bacalao* (salted cod fish), olive oil and onions. It is also served as *tostones* or *mofongo*. A popular dessert is also made with sweet ripe breadfruit: *flan de pana* (breadfruit custard). In the Dominican Republic, it is known by the name *buen pan* or "good bread". In Barbados, breadfruit is boiled with salted meat and mashed with butter to make breadfruit coucou. It is usually eaten with saucy meat

dishes. In Jamaica, breadfruit is boiled in soups or roasted on stove top, in the oven or on wood coal. It is usually eaten with the national dish ackee and salt fish. The ripe fruit is used in salads or fried as a side dish.

Artocarpus altilis (family Moraceae), commonly known as breadfruit, originated from New Guinea and now extensively grows in the southern parts of India. Breadfruit (*A. altilis* (Parkinson) Fosberg) is a multipurpose agroforestry tree crop that is primarily used for its nutritious. Starchy fruit, which is a rich source of carbohydrates, calcium, and phosphorus (Jones, A. M. P *et al.*, 2012). The multifarious importance of breadfruit includes food, medicine, clothing material, construction material, and animal feed. Other species of Artocarpus have also been studied for their antimicrobial activity (Rogone, D. 1997; Consolacion, Y. R *et al.*, 2004).

The medicinal value of *A. altilis* has gained immense importance in countries like Trinidad and Bahamas, where different parts of the plant are used for the treatment of various ailments such as tongue thrush, skin infections, sciatica, diarrhea, low blood pressure, and asthma. The juice of its leaves is used as eardrops. A powder of roasted leaves is used as a remedy for enlarged spleen (Shanmugapriya, K *et al.*, 2001). The chromatographic study of breadfruit has revealed high content of amino acid, fatty acids, and carbohydrates (Moeton, J. F. (1987).

This study might be the first one to investigate the potentiality of different leaf extracts of breadfruit for their antimicrobial properties. To the best of our knowledge, this is the first study on the screening of phytochemical constituents and assessment of antimicrobial activity, using different solvent extracts of *A. altilis* leaves

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MATERIALS AND METHODS

Plant material

Fresh leaves of *A. altilis* (Parkinson) Fosberg, growing in natural condition in Guyana, leaves were collected from Village Tain, Corentyne, Berbice Region 6, Guyana, South America. The fresh leaves washed with tap water for serval times and dried 12 days in shadow conditions. Air dried leaves is grounded into powder using Model 4E, Grinding Mill, Quaker City Mill, Philadelphia, USA at Johns Science Center Laboratory, Department of Agriculture, Faculty of Agriculture and Forestry, University of Guyana, Berbice Campus, Tain, Guyana. The grounded powder were extracted with methanol, ethyl acetate, ethanol extract incubated for 72 hours in shaker, whereas the aqueous extract was prepared by incubating for overnight in shaker and it was boiled for 15 to 30 minutes till the volume was reduced to half its original. The solvents was then removed by filtration. The extracts were condensed using rotary vacuum evaporator and stored at 4^{o} C in brown bottle. The aqueous extracts was dissolved in water and used for further purpose whereas concentrated extract of ethanol and methanol was suspended in 0.25% dimethyl sulphoxide (DMSO) to the concentration of 100mg/ml and was used for experiments.

Phytochemical screening

The aqueous, ethanol, methanol, ethyl acetate extracts of *A. altilis* were analysis for the presence of secondary metabolites using the stranded procedure. Different phytochemicals, viz. alkaloids, flavonoids, phenolics, glycosides, phytosterols, steroids, tannins, terpenoids, fats, oils, and gums and resins, were screened in the laboratory as per the standard methods with little modification (Golden, K. D., Willams, O. J., 2001; Harbone, J. B., 1998; Raaman, N., 2006). The crude extracts were stored in desiccators for a maximum of 6 days and were later preserved in deep freezer (−20◦C) for further use. The preliminary qualitative phytochemical studies were performed for testing the different chemical groups present in 3 different solvent extracts of leaves. The all test was carryout in Agriculture Research Station, Guyana Sugar Corporation Inc. LBI, Guyana, South America.

Heavy metals and N.P.K analysis

Breadfruit crude leaves powder was analysis of heavy metals was done by using Gas Chromatography/Mass Spectrometry (GC/MS), and N.P analyses was done by total Kjeldahl digests by UV-VIS spectrophotometry, and K analysis was done in Kjeldal digests by Flame photometry method in Central Agriculture Laboratory, Guyana Sugar Corporation Inc. LBI, Guyana .

RESULTS AND DISCUSSION

Results Qualitative screening of phytochemicals

Crude leaves extracts of Breadfruit the qualitative screening of phytochemicals showed the presence of a wide range of phytochemicals/secondary metabolites. All the necessary secondary metabolites such as steroids, phenols, tannins, phytosterols, gums and resins, and terpenoids (but except resins, Phlobatannins and Anthroquinone) were found in the methanol leaf extracts of *A. altilis*. Similar results were noted in the ethyl acetate leaf extracts with the exception of absence of tannins and presence of flavonoids (Table-1).

Table-1: Phytochemical analysis in the leaves of Breadfruit (*A. altilis)*

Plant Name	Phytochemicals Names	Aqueous	Ethyl acetate	Methanol	Ethanol
Breadfruit (*Artocarpus altilis*)	Alkaloids	+	+	+	+
	Flavonoids	+	+	+	+
	Tannins	+	-	-	-
	Thiols	+	-	+	-
	Amino acids	+	+	+	+
	Carbohydrates	+	+	+	+
	Phenols	+	+	+	+
	Phytosterols	+	-	+	-
	Glycosides	+	-	-	+
	Triterpenoids	+	-	+	-
	Fixed oils, fats	+	+	+	-
	Proteins	+	+	+	+
	Saponins	+	-	+	-
	Steroids	+	+	-	-
	Phlobatannins	-	-	-	-
	Anthroquinone	-	-	-	-
	Resins	-	-	-	-

+ = Presence, - = Absence

Heavy metal analysis was done in leaves of *A. altilis* by using Gas Chromatography/Mass Spectrometry (GC/MS). It shows the highest amounts was that of Ca (57690.19 mg/kg), followed by Mg (4358.51mg/kg**),** whereas the least amount was that of Cu (3.17 mg/kg). GC/MS did not detect Ni. (Table-2).

N.P.K. analysis shows the highest percentage was that of potassium in *A. altilis* leaves, followed by Nitrogen, the least percentage of Phosphorus.(Table-3).

Table-2: Heavy metal analysis in Breadfruit *(A. altilis)* leaves in mg/ kg

Name of plant	Used part	Parameter	Mg/kg
Breadfruit (*Artocarpus altilis*)	Leaves	Zn	21.62
		Cu	3.17
		Ni	Nd
		Mn	54.21
		Fe	1330.64
		Ca	57690.19
		Mg	4358.51
		Cr	6.05

Nd = Not detected

Table-3: N.P. K. analysis in Breadfruit (*A. altilis)* leaves in percentage (%)

Name of plant	Used part	Parameter	(%)
Breadfruit (*Artocarpus altilis*)	Leaves	N	2.05
		P	0.28
		K	1.43

CONCLUSION

The antioxidant and antimicrobial activity of *A. altilis* leaves has been reported worldwide, but it has not been possible to establish a relationship with the chemical composition due to the scanty information availed. In this study, we detected eight components of heavy metals (Cu, Ca, Cr, Ni, Zn, Mn, Fe and Mg) not previously reported, and confirmed the high Ca and Mg presence in *A. altilis* leaves. In addition high percentage of nitrogen and some useful phytochemicals are available in *A. altilis* leaves. This information give light to the present intention to find chemical proof that supports the pharmacological activities of *A. altilis* leaves

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REFERENCES

1. *Artocarpus altilis* (Parkinson ex F.A.Zorn) Fosberg – The Plant List". The Plant List. Retrieved 2016-01-12.
2. Morton, J. F. (1987). "Breadfruit; In: Fruits of Warm Climates". NewCROP, the New Crop Resource Online Program, Center for New Crops and Plant Products, Department of Horticulture and Landscape Architecture, Purdue University, West Lafayette, IN. 50–58. Archived from the original on 5 January 2015.
3. National Tropical Botanical Garden. (2017). Tropical Plant Research, Education, and Conservation.
4. *Artocarpus altilis* (breadfruit)". (2017). Board of Trustees of the Royal Botanic Gardens, Kew Gardens, Richmond, Surrey, UK. 2017.
5. Zerega, N. J., Ragone, D., & Motley, T. J. (2004). Complex origins of breadfruit (Artocarpus altilis, Moraceae): implications for human migrations in Oceania. *American Journal of Botany*, *91*(5), 760-766.
6. Salmond, A. (2010). Aphrodite's Island. Berkeley: University of California Press, 307-308.
7. O'Brian, P. (1997). *Joseph Banks: a life*. University of Chicago Press.
8. Janick, J., & Paull, R. E. (Eds.). (2008). *The encyclopedia of fruit and nuts*. CABI.
9. Balick, M. J., & Cox, P. A. (1996). *Plants, people, and culture: the science of ethnobotany*. Scientific American Library.
10. Apé, L. L. (1950). Chapter 31 (Vijitha Yapa Publications) ISBN 978-955-665-250-5.
11. Little, J., Elbert, L., & Roger, G. S. (1989). "'Ulu, breadfruit"(PDF). United States Forest Service. Archived from the original (PDF) on 30 October 2014.
12. Jones, A. M. P., Klun, J. A., Cantrell, C. L., Ragone, D., Chauhan, K. R., Brown, P. N., & Murch, S. J. (2012). Isolation and identification of mosquito (Aedes aegypti) biting deterrent fatty acids from male inflorescences of breadfruit (Artocarpus altilis (Parkinson) Fosberg). *Journal of agricultural and food chemistry*, *60*(15), 3867-3873.
13. Ragone, D. (1997). *Breadfruit: Artocarpus altilis (Parkinson) Fosberg-Promoting the conservation and use of underutilized and neglected crops. 10*. Bioversity International.
14. Ragasa, C. Y., Jorvina, K., & Rideout, J. A. (2004). Antimicrobial compounds from Artocarpus heterophyllus. *Philippine Journal of Science*, *133*(2), 97.
15. Shanmugapriya, K., Saravana, P. S., Payal, H., Mohammed, S. P., & Bennai, W. (2011). A comparative study of antimicrobial potential and phytochemical analysis of Artocarpus heterophyllus and Manilkara zapota seed extracts. *J Pharm Res*, *4*(8), 2587-2589.
16. Moeton, J. F. (1987). Breadfruit. In: Fruits of warm climates. Miami (FL): Florida Flair Books, 50-58.
17. Golden, K. D., & Williams, O. J. (2001). Amino acid, fatty acid, and carbohydrate content of Artocarpus altilis (breadfruit). *Journal of chromatographic science*, *39*(6), 243-250.
18. Harbone, J. B. (1998). Phytochemical methods: a guide to modern techniques of plant analysis. 3rd ed. London: Chapman & Hall, 279.
19. Raaman, N. (2006). Phytochemical techniques. New Delhi: News India Publishing Agency, 306.