Study on Nutritional Values of Leaves of *Sonneratia apetala* Buch.-Ham and Its Antimicrobial Activity

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Abstract

The medicinal plant, *Sonneratia apetala* Buch.-Ham., belongs to the family Lythraceae. Vernacular name of this plant is Pinlel-zeethee in Myanmar, Ponlel zathee in Rakhine. *Sonneratia apetala* Buch.-Ham. was collected from Sittway Township, Rakhine State. In the traditional systems, medicines such as Ayurveda and Unani, *Sonneratia apetala* Buch.-Ham.possess antioxidant, anti-inflammatory, anti-bacterial, anti-fungal, anthelmintic, cytotoxic/anticancer, anti-diarrheal, analgesic, anti-diabetic, and anti-hyperlipidemic activities. *Sonneratia apetala* Buch.-Ham. may be a potential source of nutrients, minerals and vitamins, and biologically-active lead compounds. In this paper, nutritional values and antimicrobial activity of the selected plant had been described. The nutritional contents in the powdered leaves of *Sonneratia apetala* Buch.-Ham. were determined according to the procedure of Willian, 1980. The moisture, ash, protein, fiber and fat contents were detected. In antimicrobial activity, various solvents extracts of leaves of *Sonneratia apetala* Buch.-Ham. were tested on six pathogenic microorganisms by using paper disc diffusion method. The results showed that different solvent extract of leaves exhibit against on all tested organisms.

Key words: *Sonneratia apetala* Buch.-Ham., nutritional value, antimicrobial activity, pathogenic microorganisms

Introduction

There are about 80 different species of mangrove trees. All of these trees grow in area with low-oxygen soil, where slow-moving water allows fine sediments to accumulate. Mangrove forests only grow at tropical and subtropical latitudes near the equator because they cannot withstand freezing temperatures. Mangrove forests stabilize the coastline, reducing erosion from strong surges, currents, waves and tides. The intricate roots system of mangroves also make these forests attractive to fish and other organisms seeking food and shelter from predators. They grow luxuriantly in the places where freshwater mixes with seawater and where sediment is composed of accumulated deposits of mud.

Mangrove wetland is a multiple used ecosystem. It is considered as thebest form of coastal bioshield since it plays a critical role in reducing the impact of cyclonic storms, hurricanes and tsunami on human lives and properties (Danielsen *et al*., 2005; Selvam, 2005). It also avoids or reduces soil erosion. It enhances fishery productivity of the adjacent coastal waters by acting as a nursery ground for commercially important fish, prawn and crabs and supplying organic and inorganic nutrients. They are also rich in biodiversity and act as habitats for wildlife.

The selected mangrove plant, *Sonneratia apetala* Buch.-Ham., belongs to the family Lytharaceae. *Sonneratia apetala* Buch.-Ham. was collected from Sittway Township, Rakhine State in 2019. Sittwe is a small coastal city situated in Rakhine State, in north western part of Myanmar. Vernacular name of this plant is Pinlel-zeethee in Myanmar and Ponlel-zathee in Rakhine. *Sonneratia apetala* Buch.-Ham. is introduced as a fast-growing tree for reforestation of mangrove communities. It is evergreen tree with a columnar crown; it can grow up to 15 metres tall with occasional specimens to 20 metres. The tree produces pneumatophores (vertical roots

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arising above the ground from shallow, horizontal roots) up to 1.5 meters tall. This specie is common through most of its range, but there are increasing threats to mangrove swamps in general, mainly from human activities. Consequently, the tree has been classified as 'Least Concern' in the IUCN Red List of Threatened Species (2010).

Sonneratia apetala Buch.-Ham., a native of India, Bengal and Sri Lanka, was introduced in 1985 to Dong Zhaigang Mangrove Nature Reserve in Hainan Island from Bengal. It has then been introduced into other places since 1991. The mangrove fruit *Sonneratia apetala* Buch.-Ham., known as keora, is abundantly grown in the world largest mangrove forest, the Sundarbans and also along the coastal areas in Bangladesh, India, Myanmar, Malaysia, China, Papua New Guinea, and some parts of Africa. People in coastal Bangladesh, India, and Myanmar extensively consume the fruit by cooking and through other preparations. The ripe fruits are eaten by people from Africa to the Malayas and Javanese, and are said to taste like cheese. Stem is used for paper pulp, matches, and as poles, leaves as fodder and fruits are used as vegetable. In many regions, the fruits are also processed to produce sour sauce which is marketed. Fermented juice of this fruit is useful in arresting haemorrhage.

Nowadays, food insecurity is one of the major causes of hunger and malnutrition in tropical coastal population. To fulfill food security and primary health care, it is essential to explore wild food plants and for the tropical coastal countries, edible mangrove fruits could be an attractive source in this regard since they could easily be planted in vast saline water intruded areas outside the coastal embankments. Therefore, the current study was undertaken nutritional values and antimicrobial activity of leaves of *Sonneratia apetala* Buch.-Ham.

Fruits of *Sonneratia apetala* Buch.-Ham. in Sittway market

Materials and Methods

Analysis of nutritional contents

Determination of nutritional contents in the powdered leaves of *Sonneratia apetala* Buch.-Ham.

The nutritional contents in the powdered leaves of *Sonneratia apetala* Buch.-Ham. were determined according to the procedure of Willian, 1980. The experiments were conducted at 137 (A), Ministry of Agriculture, Livestock and Irrigation, Small Scale Industries Department, Thudama Main Road, North Okkalapa,, Yangon, Myanmar. The moisture, ash, protein, fat and fiber contents were detected.

Antimicrobial activity of leaves of *Sonneratia apetala* Buch.-Ham.

Antimicrobial activities of leaves of *Sonneratia apetala* Buch.-Ham. were investigated with six different solvents extracts on six pathogenic microorganisms by using paper-disc diffusion method (Curickshank et.al., 1975) at the Department of Botany, University of Yangon.

Table. Types of microorganisms, diseases and their respective code numbers

No.	Test Organisms	Diseases	Source
1.	*Aspergillus flavous*	Pathogenic fungus, mainly attacks the respiratory system, but can also affect the eyes and ear canals.	-
2.	*Bacillus subtilis*	Pathogenic group, anthrax in animals and fever	JAP-0225215
3.	*Escherichia coli*	Cholera, diarrhea and vomiting, urinary tract infections, septic wounds and bed-sores.	ATCC-25922
4.	*Candida albicans*	Pathogenic fungus, skin infection, vaginal candidiasis, alimentary tract infections	IFO-1060
5	*Pseudomonous flourescens*	Bacteria for leaf blight	-
6.	*Xanthomonas oryzae*	Bacteria for leaf blight	-

Paper Disc Diffusion Assay

Isolated bacterial and fungal strains grown on nutrient agar were isolated into 50 ml conical flasks containing 10 ml of sterile growth medium. Then, they were inoculated at 30º C for 72 hours on a reciprocal shaker at 200 rpm.

Test organisms: *Aspergillus flavous, Bacillus subtilis, Escherichia coli, Candida albicans, Pseudomonous flourescens, Xanthomonas oryzae* were used in this experiment. 0.3 ml of test organisms were added to assay medium, then poured into plates. After solidification, paper disc impregnated with broth samples were applied on the test plates and these plates were incubated for 24-26 hours at 30º C. After those clear zones (inhibitory zones), surrounding test discs indicated the presence of bioactive compounds which inhibited the growth of test organisms.

Assay medium (SY)
Agar - 2.0 g
Sucrose - 1.0 g
Yeast extract - 0.3 g
NaCl - 0.1 g
Distilled water - 100 ml
pH - 7.0

Results

Diagnostic featurses of *Sonneratia apetala* Buch.-Ham.

Scientific Name - *Sonneratia apetala* Buch.-Ham.
Common Name - Sonneratia Mangrove
Family - Lythraceae
Myanmar Name - Pinlel-zeethee
Rakhine Name - Ponlel-zethee

Evergreen tree, leaves simple, opposite, short petiolate, decussate, elliptic - oblong, obovate, apex tapering, base attenuate, 4-10x23cm, coriaceous, glaucous on both sides. Inflorescence axillary, 1-3 flowered cymes. Flowers large, regular, bisexual, white or yellowish white, 1.5 - 5 cm across; calyx 4-lobed, reflexed,slightly connate with ovary;petal absent; stamens numerous, filamen ts bent inwards in bud; ovary 2-20 celled, stigma large, umbrella shaped. Fruits globose berry seated on the flattened calyx-tube, 2 - 2.5 cm across, many seeded. Pneumatophores 60 – 150 cm long, arising from horizontal roots, corky, forked twice or thrice, associated with anchor roots and nutrition roots.

Figure 1 Habit of *Sonneratia apetala* Buch.-Ham.

Figure 2 Leaves

Figure 3 Flower

Figure 4 Close up view of flower

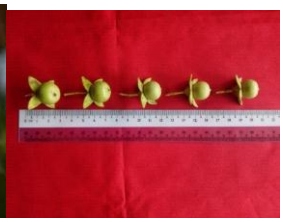


Figure 5 Fruits

Analysis of nutritional contents in leaves of *Sonneratia apetala* Buch.-Ham.

The determinations of percentages of moisture, ash, proteins, fat and fibre contents of dried powdered leaves were carried out according to Willam, 1980 and Myanmar Traditional Medicine Formulary, 1989. As a result, it was found that proteins and fibers were present as major nutrient in the samples of leaves.

Table 1 Analysis of nutritional content in leaves of *Sonneratia apetala* Buch.-Ham.

No	Constituents	Nutritional value in leaves (%)
1	Moisture	24.01
2	Ash	9.08
3	Proteins	9.06
4	Fats	2.25
5	Fibers	10.96

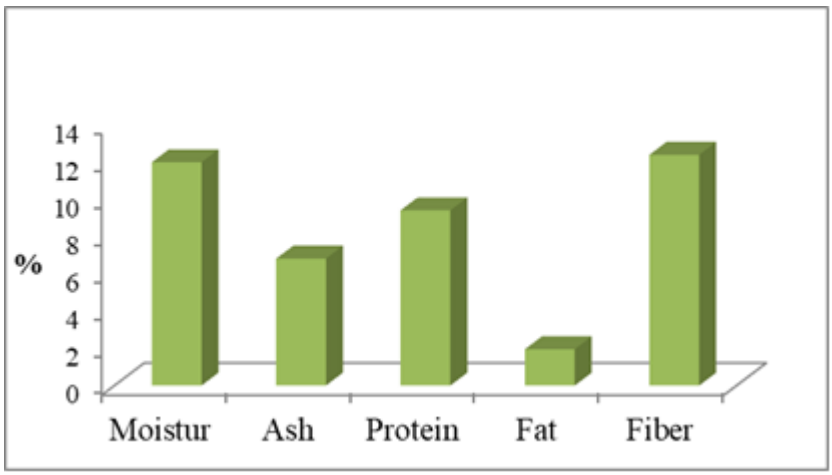


Figure 6 Nutritional values of *Sonneratia apetala* Buch.-Ham.

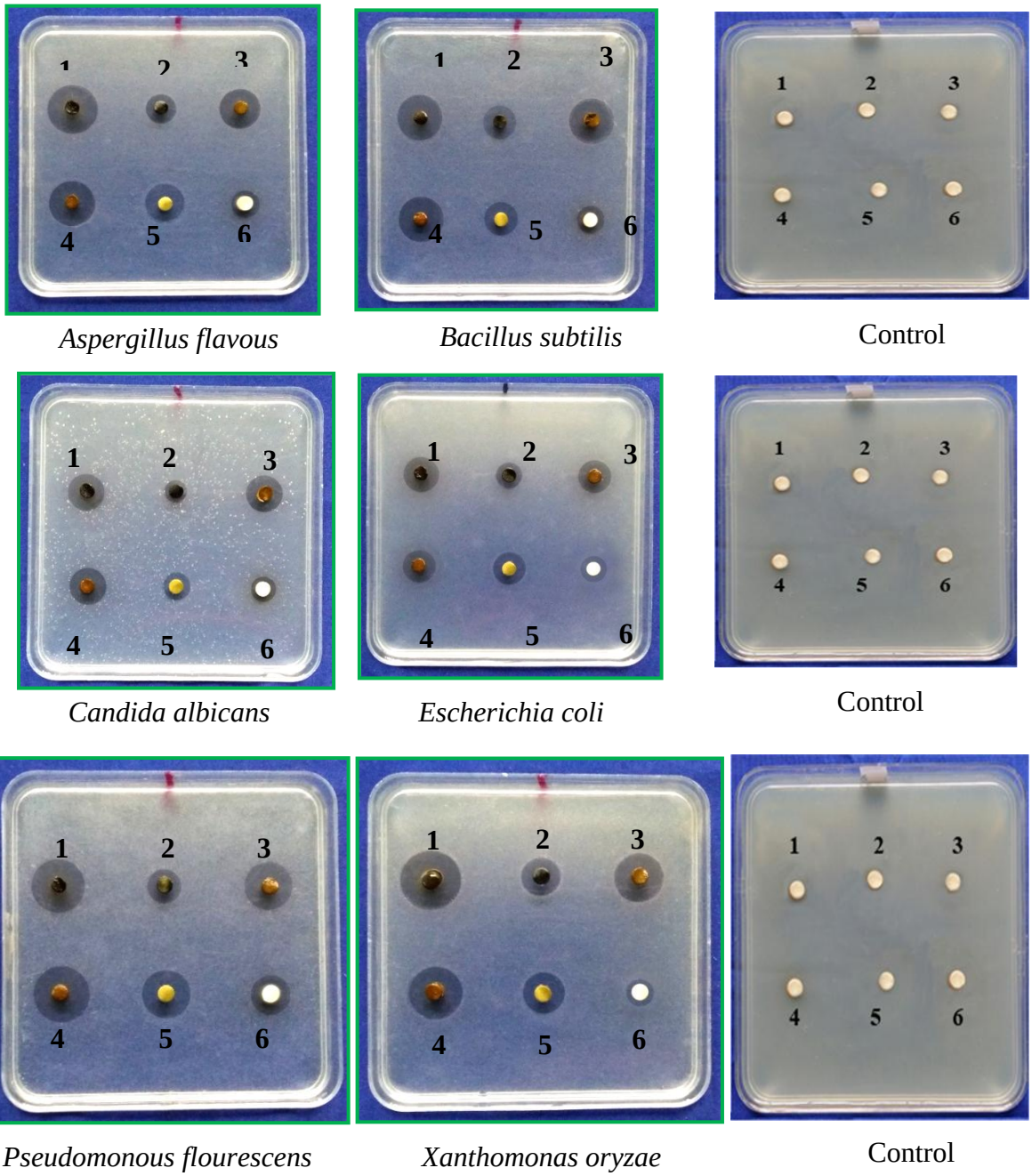
Antimicrobial activities of various solvent extracts from leaves of *Sonneratia apetala* Buch.-Ham.

The results of the screening of the antimicrobial activities of six different solvent extracts from leaves of *Sonneratia apetala* Buch.-Ham. were shown in the following table.

Table 2 Antimicrobial activities of various solvent extracts from leaves of *Sonneratia apetala* Buch.-Ham.

No.	Microorganism	Inhibition Zone (mm)					
		Acetone	Ethyl acetate	Ethanol	Methanol	Pet-ether	Water
1.	*Aspergillus flavous*	14	10	14	14	12	10
2.	*Bacillus subtilis*	18	14	18	18	14	10
3.	*Candida albicans*	22	12	16	18	16	12
4.	*Escherichia coli*	22	12	18	18	16	12
5.	*Pseudomonous flourescens*	14	10	14	14	14	12
6.	*Xanthomonas oryzae*	22	14	16	20	14	10

Paper disc size = 6 mm



1. Acetone
2. Ethyl Acetate
3. Ethanol
4. Methanol
5. Pet-ether
6. Water

Figure 7 Antimicrobial activities of various solvents extracts from leaves of *Sonneratia apetala* Buch.-Ham.

Discussion

In this research, the selected mangrove plant is verified by the available literatures and it is identified as *Sonneratia apetala* Buch.-Ham. Both vegetative and reproductive parts of the specimens were used for identification. Nutritional values and antimicrobial activity of *Sonneratia apetala* Buch.-Ham. were carried out to contribute the knowledge of health care for local people who consume this plant as vegetable.

In nutritional values of *Sonneratia apetala* Buch.-Ham., protein, crude fiber and crude fat were significantly found in leaves. According to the results, the content of fiber was high in samples. Fiber helps to regulate the body's use of sugars, helping to keep hunger and blood sugar in check. Children and adults need at least 20 to 30 grams of fiber per day for good health, but most Americans get only about 15 grams a day. Fiber appears to reduce the risk of developing various conditions, including heart disease, diabetes and constipation.

Proteins were present in leaves of *Sonneratia apetala* Buch.-Ham. Proteins are the building blocks that grow and repair the body. Proteins are needed not only for muscle but also for hair, skin and internal organs. Some proteins travel around the body in the blood as hormones, enzymes and red blood cells. Protein is unique because it is the only food source of nitrogen, which is essential to all plant and animal life.

Fat content was little amount in the powdered leaves of *Sonneratia apetala* Buch.-Ham. Low-fat diets, in which calories from fat sources are cut dramatically, were once considered the best way to reduce body fat and lower the risk of heart disease and even cancer. Necessary nutritional values were required in diet to maintain good health. Hence, the results confirmed the use of the plant in traditional medicine.

In the screening of antimicrobial activity, acetone, ethyl acetate, chloroform, ethanol, methanol and aqueous extracts exhibited antimicrobial activity on all test organisms. Among them, Acetone extract significantly showed antimicrobial property against all test organisms. Methanolic extracts indicated high antimicrobial activity on four test organisms: *Bacillus subtilsi, Candida albicans, Escherichia coli* and *Xaanthomonas oryzae* with the inhibition zone ranged between 18-20 mm. Aqueous extract exhibited least antimicrobial activity on all test organisms. The results indicated that *Sonneratia apetala* Buch.-Ham. can be used as remedy for urinary retention, urinary bladder stones, gastrointestinal problem, anthrax in animals, leaf blight in plants and rheumatism. Therefore, *Sonneratia apetala* Buch.-Ham. can be used for the preparation of effective antimicrobial and antifungal sources.

Conclusion

In conclusion, the results showed that *Sonneratia apetala* Buch.-Ham. possesses nutritional values for human health and leaves extracts have beneficial effect in antimicrobial activity such as antibacterial and antifungal activity. Local people used this plant by eating fruits as a vegetable. So *Sonneratia apetala* Buch.-Ham. is saved to be used as both medicinal plant and nutritious vegetable which has nutritional values and possesses antipathogenic activity and it can be used as a folk medicine not only for local people but also for animals and plants. Therefore, the medicinal plant, *Sonneratia apetala* Buch.-Ham. can be used as medicine not only for folkloric use but also widely used for traditional medicine. So other bioactive

compounds should be isolated from the various plant parts of *Sonneratia apetala* Buch.-Ham. for further study.

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