

Morphological characters, nutritional values and antimicrobial activities of leaves of *Anacardium occidentale* L.

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Abstract

The medicinal plants *Anacardium occidentale* L. belong to the family Anacardiaceae which is known as Thi-ho in Myanmar. These plants are collected from Dawei University Campus. After collection, the specimens are identified according to the available literature. In this paper, morphological characters, nutritional values and antimicrobial activity of leaves extract of *Anacardium occidentale* L. are conducted. There are morphological characters of *Anacardium occidentale* L. It is a small tree. Leaves are crowded on twig species. Inflorescences are corymbs finely appressed. Flowers crowded. Fruit is a drupe. Seeds are non-endospermic. According to nutrition facts, leaves are shown as having fiber, protein, fat and carbohydrate. In the result of antimicrobial tests, various leaves extract of *Anacardium occidentale* L. were tested against different microorganisms by using agar well diffusion method. These were found that pet-ether, ethyl acetate and methanol extracts were more sensitive against on *E. coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Therefore, the result from this study would be assumed to be valuable for human health and economically products.

1. INTRODUCTION

The plant *Anacardium occidentale* L. is a medicinal plant, belonging to the family Anacardiaceae. The family Anacardiaceae consists of 70 genera and about 875 species. The plant of this family is mainly found in tropical regions, although a few members are found in Southern Europe. In our country, the family is represented by very important genera such as *Anacardium occidentale* L. (Cashew nut) is cultivated in Myanmar for its edible fruits (Maunda and Tegnass, 2005).

The Anacardiaceae comprises approximately 78 genera and more than 700 species. In tropical America, there are approximately 33 genera and 170 species. The Anacardiaceae are native to the western Hemisphere. The family is found in dry to moist mostly lowland habitats. The Neotropics are the typical habitat of *Anacardium*. The Anacardiaceae are placed in the spindales by Crownquist and this is supported by recent molecular phylogenetic analyses. A single ovule within each locule distinguishes the Anacardiaceae. The family has traditionally been divided into five tribes: the Anacardieae with 8 genera (Mitchell, 2004).

The family Anacardiaceae comprises about 77 genera and 600 species mainly distributed in tropical, subtropical and temperate regions of the world: 16 genera and 50 species in China, 4 genera and 6 species in Hong Kong (Leung Chi- Wing, 2008).

The irritant chemicals may be distributed throughout the plant body or concentrated in particular organs. e.g. in the fruit wall of the cashew nut. In *Anacardium occidentale* Linn, the hypocarp subtending the drupe is enlarged and edible. Classification of chemical constituents is based on biosynthetic origin, solubility properties and the presence of certain key function group (Harbone, 1984).

Many parts of the plants are used in the traditional medicine. They grind the seeds into a poultice for treating snakebites, apply nut oil to cracked heels or as an antifungal agent, and use the fruits, bark, and leaves for many other purposes including antifungal activity, for sores and rashes, or as an antipyretic, and for antidiarrhoeal applications. The leaf extracts with petroleum ether and ethanol inhibited growth several species of bacteria and fungi. The fats and oils in cashew nut are 54% monounsaturated fat (18:1), 18% polyunsaturated fat and 16% saturated fat (9% palmitic acid (16 : 0) and 7% stearic acid (18:0). cashews, as with other tree nuts,

are a good source of antioxidants. Alkyl phenols, in particular, are abundant in cashews. Cashews are also a source of dietary trace minerals copper, manganese, magnesium and phosphorus (Koehler's, 1887).

Old leaves of *Anacardium occidentale* L. are applied to skin afflictions and burns. Leaf decoction gargled for sore throat, sore gums and toothache. The plant exhibits hypoglycemic activity. Decoction of the astringent bark is given for severe diarrhoea, thrush, sore gums and toothache. The plant exhibits hypoglycemic activity. Decoction of the astringent bark is given for severe diarrhoea, thrush, asthma, colds and congestion. Juice of the fruit is used for hemoptysis. Sap discutient, fungicidal, repellent (Johnson, 1973).

For these facts, in this research, morphological of fresh specimens and dried powder, physicochemical characterization, examination of nutrient content, and antimicrobial activity were carried out. The aims of the present study are to identify the plant *Anacardium occidentale* L., to determine the physicochemical properties, to examine the nutrient content and to study the antimicrobial activities of the crude drug from leaves.

MATERIALS AND METHODS

Botanical studies

Collection and Identification of *Anacardium occidentale* L.

The plant specimens of *Anacardium occidentale* L. were used in this study were collected from Dawei University Campus, Tanintharyi Region, especially during the flowering period which was from November to January, fruiting period from December to March, 2013-2014

After the collection, the specimens were identified in the department of Botany, Dawei University, genus and species with the help of available literatures such as (Hooker, 1885; Hundley and Chit Ko Ko 1961, Backer 1968, A key to the families of flowering plants 1998 and Kress 2003).

Examination of nutrient contents in the leaves of *Anacardium occidentale* L.

The protein fat, fiber and carbohydrate content in the leaves of *Anacardium occidentale* L. were examined according to Willan (1980) and Myanmar Traditional Medicine Formulary (1969). The experiments were conducted at the food Industries Development Supporting laboratory (FIDSL).

Determination of soluble matter content in different solvents

Five grams of dried powder was placed in a conical flask. It was shaken with 50 ml of water in a closed flask for 24 hours, shaking frequently during 6 hours and allowed to stand for 18 hours, Then it was filtered rapidly and the filtrate was evaporated in a weighted container on boiling water-bath until it was completely dry. This procedure was repeated until a constant weight was obtained. Determination of chloroform, acetone, pet-ether, ethyl acetate, ethanol soluble matter was tested in the same procedure of water soluble matter.

Antimicrobial Activities of different solvent extracts from leaves of *Anacardium occidentale* L.

The dried powder samples of leaves were extracted with pet ether, chloroform, ethyl acetate, acetone, ethanol, methanol and water by percolation method. These extracts of various solvents of leaves were tested on six pathogenic microorganisms such as *Bacillus pumalis*, *Bacillus subtilis*, *Candida albicans*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The test organisms used in this study were obtained from the Development Centre for Pharmaceutical Technology for investigation of the antimicrobial activities.

RESULTS

Botanical study

| | | |
|-----------------|---|----------------------------------|
| Scientific Name | - | <i>Anacardium occidentale</i> L. |
| Myanmar Name | - | Thiho |
| Common Name | - | Cashew-nut |
| Family | - | Anacardiaceae |
| Part Used | - | Fruit, Leaves |

Morphological Characters of *Anacardium occidentale* L.

A small evergreen trees, resin canals are present in the wood. Leaves are crowded on twig- apices, alternate, simple, obovate- oblong, apex rounded to slightly emarginated, base cuneate, coriaceous, petiolate, exstipulate and aromatic. Inflorescences are dichasial, and hairy. Flowers crowded, unisexual or bisexual, pentamerous; calyx 5, synsepalous, nearly unequal, acuminate at the apex, ovate-lanceolate, imbricate aestivation ; Corolla 5, apopetalous, ligulate, often halfway reflexed, imbricate aestivation, at first white, soon turning red; rounded at the tip, actinomorphic; Stamens in male flowers 8-10, bisexual 6-7 and staminodes 2-4 ; ovary superior connate with disc, ovoid or obcordate, glabrous, ovule anatropous, pendulous, style 1 , stigma simple, capitate. Fruit is a drupe or fleshy hypocarp; hypocarp pyriform drupe reniform, indehiscent. Seed non-endospermic or possess very little endosperm. Embryo bears fleshy cotyledons.

Anacardium occidentale L.



Fig.1 Habit of *Anacardium occidentale* L.



Fig.2 Leaves of *Anacardium occidentale* L.



Fig.3 In florescences with fruits of *Anacardium occidentale* L.



Fig.4 Flowers of *Anacardium occidentale* L.



**Fig.5 Fruits of
Anacardium occidentale L.**



**Fig.6 Products of
Anacardium occidentale L.
(Cashew nut)**

Examination of nutrient content in the powdered leaves of *Anacardium occidentale* L.

The determination of nutrient content such as fiber, protein, fat and carbohydrate from powdered leaves of *Anacardium occidentale* Linn. was carried out according to the method described by Willan, 1980 and Myanmar Traditional Medicine Formulary, 1989.

Table 1. Examination of nutrients content in the powdered leaves of *Anacardium occidentale* L.

| No | Test Parameter | Result (%) |
|----|----------------|------------|
| 1. | Fiber | 22.09 |
| 2. | Protein | 8.89 |
| 3. | Fat | 1.81 |
| 4. | Carbohydrate | 57.15 |

Physicochemical properties of leaves of *Anacardium occidentale* L.

In physicochemical properties include moisture content, total ash, acid insoluble and water soluble ash and solubility in different solvents of leaves of *Anacardium occidentale* Linn. These results were shown in Table (2).

Table 2. Physicochemical Properties of leaves of *Anacardium occidentale* L.

| No. | Physicochemical properties | Percentage (%) |
|-----|-----------------------------------|----------------|
| 1. | Moisture content | 8.62 |
| 2. | Total ash | 3.13 |
| 3. | Acid insoluble ash | 32.27 |
| 4. | Water soluble ash | 52.72 |
| 5. | Ethanol soluble extractive | 7.30 |
| 6. | Methanol soluble extractive | 6.47 |
| 7. | Pet-ether soluble extractive | 1.22 |
| 8. | Ethyl- acetate soluble extractive | 2.88 |
| 9. | Chloroform soluble extractive | 3.311 |
| 10. | Acetone soluble extractive | 2.09 |
| 11. | Water soluble extractive | 13.74 |

According to this result the powder of leaves were soluble in ethanol, methanol, pet-ether, ethyl-acetate, chloroform, acetone and water. Among them the

powder of leaves were most soluble in water and moderately soluble in ethanol and methanol.

Antimicrobial activity of various crude extracts of leaves of *Anacardium occidentale* L.

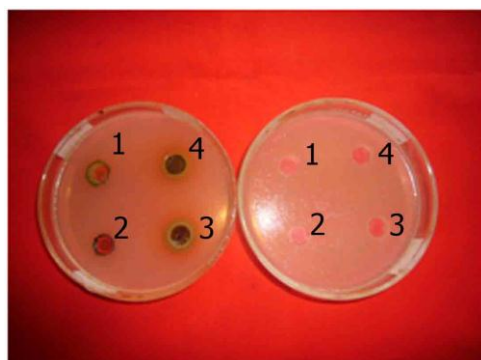
In this experiment, antimicrobial activity of various extracts were carried out by using solvents such as pet- ether (60-80)°C, chloroform, ethyl acetate, acetone, ethanol, methanol and water.

The results were shown in Table (3).

Table 3. Antimicrobial activities of crude extracts from the leaves of *Anacardium occidentale* L.

| No | Extracts | organisms | | | | | |
|--|---------------|---|--------------------------|-------------------------|---------------|-------------------------------|------------------------------|
| | | <i>Bacillus pumalis</i> | <i>Bacillus subtilis</i> | <i>candida albicans</i> | <i>E.coli</i> | <i>Pseudomonas aeruginosa</i> | <i>Staphylococcus aureus</i> |
| 1 | Pet-ether | 17mm (++) | - | - | 15mm (++) | 18mm (++) | 16mm (++) |
| 2. | chloroform | - | - | - | 14mm (+) | 13mm (+) | 12mm (+) |
| 3. | Acetone | - | - | - | 18mm | 17mm | 17mm |
| 4. | Ethyl acetate | 14mm (+) | 15mm (++) | - | 20mm (++) | 18 mm (++) | 22m (+++) |
| 5. | Ethanol | - | - | - | 14mm (+) | 14mm (+) | 25mm (++) |
| 6. | Methanol | - | - | - | 20mm (++) | 18mm (++) | 22 mm |
| 7. | Water | - | - | - | 18mm (++) | 18mm (++) | 17mm (++) |
| Agar well-10mm 10mm~14mm(+) 15mm~19mm(++) 20mm above(+++) | | * organisms * (1) <i>Bacillus subtilis</i> (N.C.T.C-8236) (2) <i>Staphylococcus aureus</i> (N.C.P.C-6371) (3) <i>Psuedomonas aeruginosa</i> (6749) (4) <i>Bacillus pumalis</i> (N.C.I.B – 8982) (5) <i>Candida albican</i> (6) <i>E-coli</i> (N.C.I.B – 8134) | | | | | |

In this experiment, different extracts of the leaves showed effective antimicrobial activity against *E. coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Among then methanol and ethyl acetate extract showed more sensitive against *staphylococcus aureus* and *E. coli*.

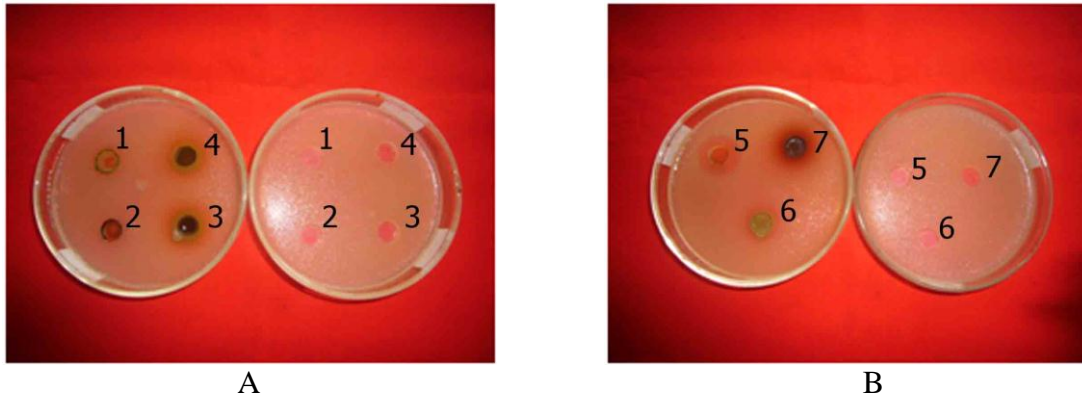


A

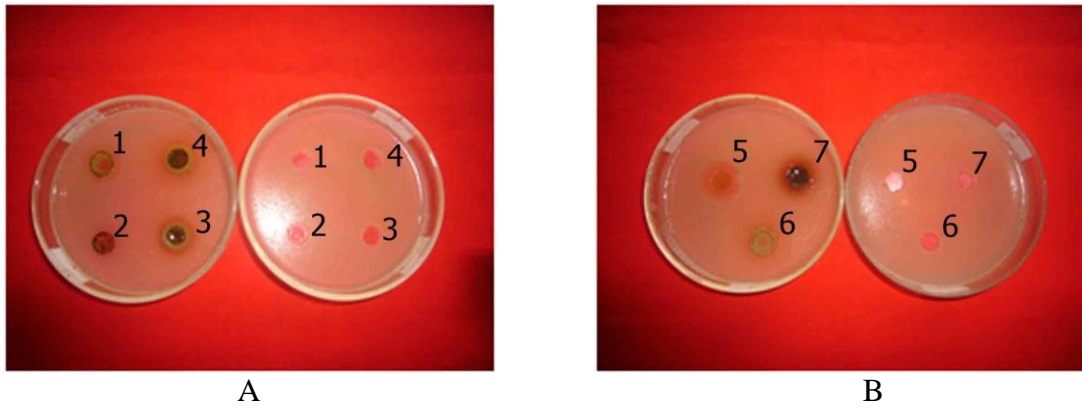


B

Bacillus subtilis



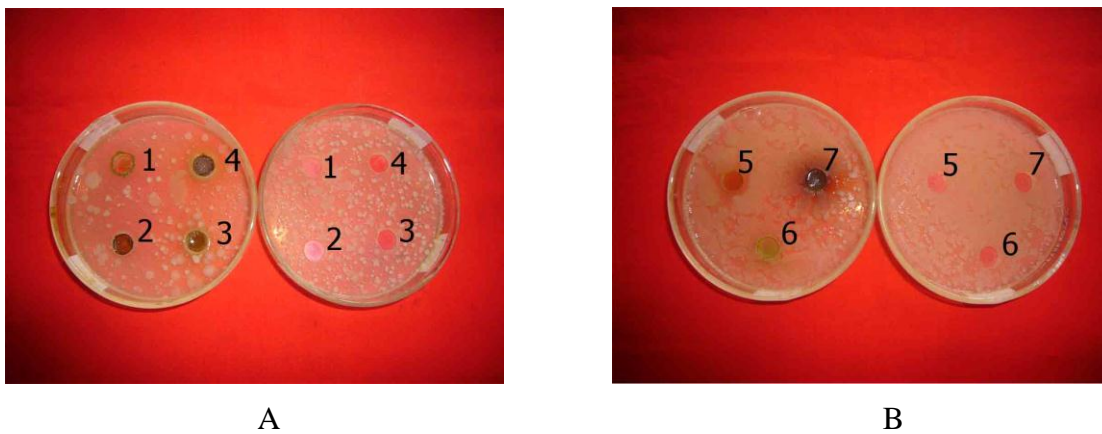
Staphylococcus aureus



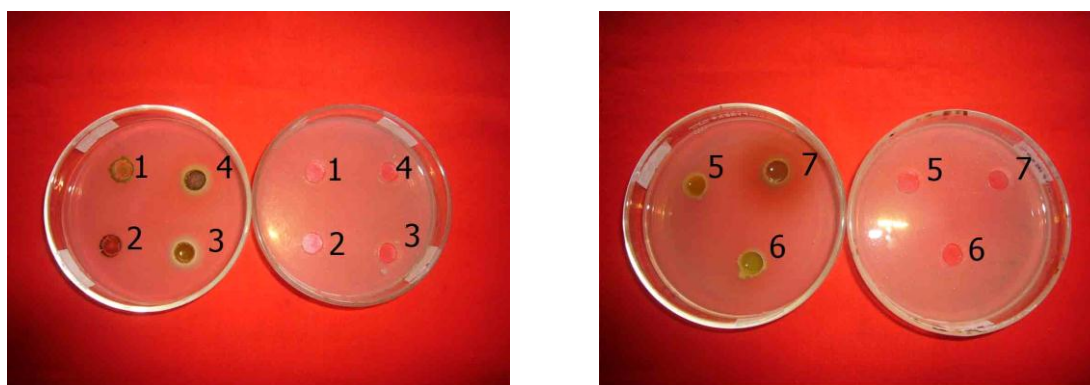
Pseudomonas aeruginosa

Fig.7 Antimicrobial Activities from leaves of *Anacardium occidentale* L.

- (1) Pet-ether
- (2) Chloroform
- (3) Methanol
- (4) Acetone
- (5) Ethyl-acetate
- (6) Ethanol
- (7) Water
- A-Extract
- B-Control

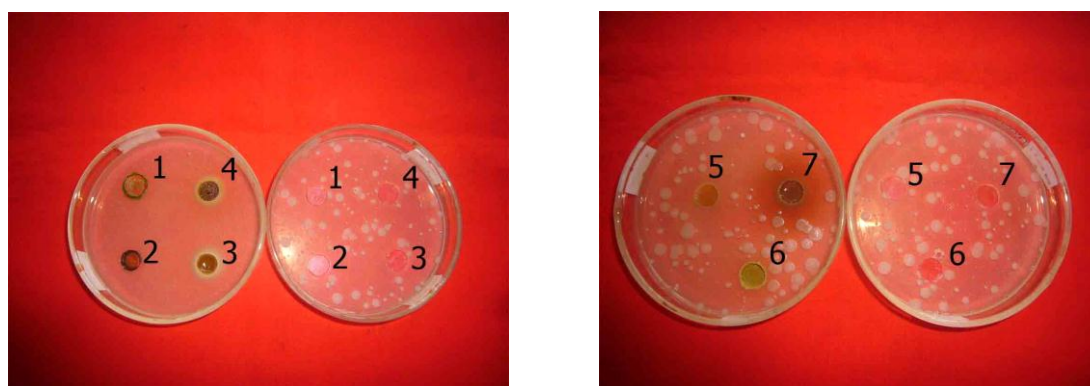


Bacillus pumilus



A

B

Candida albicans

A

B

*E. coli***Fig.8 Antimicrobial Activities from leaves of *Anacardium occidentale* L.**

- | | | |
|---------------|-------------------|--------------|
| (1) Pet-ether | (2) Chloroform | (3) Methanol |
| (4) Acetone | (5) Ethyl-acetate | (6) Ethanol |
| (7) Water | | |
| A-Extract | B-Control | |

DISSCUSSION AND CONCLUSION

The medicinal plant *Anacardium occidentale* Linn. was collected from Dawei University Campus. Thanintharyi Region.

In this research, morphological studied, physicochemical properties, nutrients content and antimicrobial activity were carried out.

Myanmar name, Thi-ho is ever green small trees, branched, and woody. Resin cannals are present. Leaves are crowded on twig-apices, alternate, simple, obovate-oblong, apex rounded to slightly emarginated petiolate, exstipulate and aromatic. Inflorescences are dichasial. Flowers are crowded, at first white, soon turning red, rounded at the tip, ovary superior connate with disc, ovoid or obcordate, ovule anatropus, stigma capitates. The fruit is usually a drupe and fruit pedicel yellow. The seed is non-endospermic. Embryo bears fleshy cotyledons. These characters are agreement with those described by Hooker 1885, Koehler's 1887, Bailey 1939, Backer 1965, Maundu and Tegnans 2005. The cashew nut of *Anacardium occidentale* L. is edible for favourable food and valuable in economic market.

The determination nutrient content from leaves of *Anacardium occidentale* L. was presented fiber, protein, fat and carbohydrate.

In the physicochemical investigation, leaves of *Anacardium occidentale* L. were more soluble in polar solvent.

The antimicrobial activity of crude extracts from leaves of *Anacardium occidentale* L. was tested on six microorganisms. Among them methanol and ethyl acetate extract showed more sensitive against on *Staphylococcus aureus* and *E. coli*.

Therefore, the results from this study could be assumed to be valuable for human health and economically products.

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