

Phytochemical Studies, Antimicrobial activities and Nutritional Values on Fruits of *Careya arborea* Roxb.

Yi Lay Myint¹, Khin Mar Kyu², Win Pa Pa Hlaing³, Khin Thandar⁴

Abstract

Careya arborea Roxb. is a medium sized deciduous tree belonging to the family lecythidaceae. It is also known as Bumbwe in Myanmar and wild guava in English. The plants were collected from West Yangon University and its vicinity. The ripe fruits are edible and have antimicrobial activity and decoction of it is given to promote digestion. In phytochemical screening, the presence of alkaloid, glycoside, saponin, phenolic compound, flavonoid, carbohydrate, steroid, terpenoid, tannin and reducing sugar were investigated. In the physicochemical properties, the powdered fruits are the most soluble in aqueous extract. The element analysis of powdered sample was determined by using Energy Dispersive X-ray fluorescence spectrophotometer. It was observed that the potassium was principal element. Antimicrobial activities of plant extracts were tested with six types of microorganisms by using agar well diffusion method. The pet ether extracts showed most significant activity against on *Bacillus pumilus*, *Candida albicans* and *Escherichia coli*. Test for nutritional values was also carried out according to Association of Official Analytical Chemist (AOAC) method. Fruits of *Careya arborea* Roxb. contain 89 kcal of energy, 2 gm of protein, 0.1 gm of fat and 20 gm of carbohydrate.

Keyword : phytochemical screening , antimicrobial activity , nutritional values

Introduction

The medicinal plant *Careya arborea* Roxb. is a deciduous tree with broadly obovate leaves. The leaves turn red in the cold season and flowers are yellowish-white. The fruit is berry, large and green colored with persistent style and calyx. This plant was collected from West Yangon University and its vicinity. Several parts of those plant have been used as medicinal and timber. Among them, the ripe fruit of *Careya arborea* is edible and it has several medicinal properties (Mahapatra and Pandra, 2009). Nayak and Basak 2015 reported that the fruits of *Careya arborea* are nutritionally very rich and of great medicinal value. The fruits also exhibit antimicrobial activity against the bacteria like *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Candida albicans* and *Escherichia coli* (Navya and Anitha, 2018). In India, the fruit is eaten by jungle tribes and is reported as eaten langkawi; but the seeds are said to be more or less poisonous (Fern, 2014). Traditional uses of this fruits are for cold and cough (Kapoor and Kapoor, 1980).

These plants were distributed in Afghanistan, Pakistan, India, Srilanka, Nepal, Myanmar, Thailand, Laos, and Malaysia (Fern, 2014). The chemical constituents of this plant are phenolic compounds; gallic acid 3, 4-dihydroxybenzoic acid, quercetin and kaempferol (Ariyaratna *et al.*, 2007).

Therefore, the plant was chosen for this study to inform the medicinal value and nutritional value of its fruit. To achieve this aim, the objectives were to detect the phytochemical and physicochemical tests for the presence or absence of chemical constituents in the fruits, to test the antimicrobial activity of the crude extracts by using agar-well diffusion method and to analyse the nutritional values of the fruits.

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Materials and Methods

Sample Collection of *Careya arborea* Roxb.

The plant materials were collected from West Yangon University Campus, the plants were classified and identified by using Dassanayake (1981), Hooker (1879) and Kress *et.al.* (2003).

The fruit was washed with water and then cut into small pieces and air dried at room temperature for three weeks. When constant weight was obtained, the dried samples were pulverized by grinding machine and stored in air tight bottles for further use.

Preliminary phytochemical investigation on fruit of *Careya arborea* Roxb.

In this investigation, the powder of *Careya arborea* Roxb. fruits was tested to find out the presence or absence of chemical constituents such as alkaloids, α -amino acid, carbohydrate, flavonoid, glycoside, phenolic compounds, protein, reducing sugars, saponin, starch, steroids, tannins and terpenoid compounds. Preliminary phytochemical tests of fruits were carried out at the Pharmaceutical Research Department (PRD) according to the methods of British Pharmacopoeia (1968), Central Council for Research in Unani Medicine (1987). The results were shown in Table (1).

Physicochemical analysis on fruit of *Careya arborea* Roxb.

Physicochemical properties which include moisture content, total ash, acid insoluble ash, water soluble and solubility of nonpolar and polar solvents such as petroleum ether, chloroform, ethyl-acetate, acetone, ethanol, methanol and water soluble matter contents of *Careya arborea* Roxb. fruits were carried out by the methods of British Pharmacopoeia (1968).

Elemental analysis on fruits of *Careya arborea* Roxb.

Element analysis was performed by EDXRF (Energy Dispersive X-ray Fluorescence Spectrophotometer) at Chemistry department, West Yangon University. The EDX-700 spectrophotometer SHIMADZU Co. Ltd., Japan is used for determination of element. The results were shown in Table (3) and Figure (1).

Antimicrobial screening of different solvent extracts from fruits of *Careya arborea* Roxb.

Extraction

The powdered samples of fruits (five gram) were soaked in 95% ethanol, methanol, distilled water, petroleum ether (60-80° C), chloroform, and acetone for about 3 weeks and then filtered (British Pharmacopoeia 1968). The solvents were then evaporated by using water bath to obtain a paste.

Test Organisms

The different solvents extracts were tested against six tested microorganisms by using agar well diffusion method. The six microorganisms were *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Escherichia coli* and *Candida albicans* obtained from Central Results Development Centre. (N.C.T.C-8236), (N.C.P.C-6371), (6749), (N.C.I.B-8982), (N.C.I.B – 8134)

The extracts of antimicrobial activity was measured from the diameter zone of inhibition. The results were shown in Table (4) and Figure (2-7).

Procedure

Nutrient agar was prepared according to the method of Cruickshank, 1975. Nutrient agar was boiled and 20 - 25 ml of the medium was poured into a conical flask and plugged with cotton wool and autoclaved at 121° C for 15 minutes. Then the tubes were cooled down to 30 - 35° C and poured into sterilized petridishes and 0.1 - 0.2 ml of test organisms were also added into the dishes. The agar was allowed to set

for 2 - 3 hours. After that, 10 mm plate agar-well made with the help of sterilized agar well cutter. About 0.2 ml of sample was introduced into the agar-well and incubated at 37 °C for 24 - 48 hours. The inhibition zone appeared around the agar well, indicated that the presence of antibacterial activity. This antimicrobial activity test was conducted in CRDC (Central Research Development Centre).

Nutritional Values of the Powdered Samples of fruits

The nutritional values of the powdered fruits of *Careya arborea* Roxb. were determined by using AOAC method (FIDSL). The results were shown in Table (5,6).

Results

**Table (1) Preliminary phytochemical investigation on fruits of
Careya arborea Roxb.**

No	Chemical Constituents	Extract	Reagent Wed	Observation	Results
1	Alkaloid	1% HCL	1 Mayer's reagent 2 Dragendorff's reagent 3 Wagner reagent	White ppts Orange ppts Yellow ppts	Present
2	Glycoside	H ₂ O	10% Lead acetate solution	White ppts	Present
3	Saponin glycoside	H ₂ O	Distilled water	Frothing	Present
4	Cyanogenic glycoside	H ₂ O	Conc H ₂ SO ₄ acid+Sodium Picrate solution	No change in colour	Absent
5	Phenolic Compound	H ₂ O	FeCl ₃ Solution	Brown colour	Present
6	Flavonoid	MEOH	Mg turing +Conc HCl	Pink Colour	Present
7	Carbohydrate	H ₂ O	10% α naphathol+ Conc H ₂ SO ₄	Red Ring	Present
8	Steroid	PE	Acetic Anhydride+Conc H ₂ SO ₄ acid	Pale Pink Colour	Present
9	Terpenoid	EtOH CHCl ₃	Cone H ₂ SO ₄ acid	Reddish brown	Present
10	Tannin	CHCl ₃	10% Gelatin solution	White ppts	Present
11	Amino acid	H ₂ O	Ninhydrin	No change in colour	Absent
12	Acid/Base/Nutral	H ₂ O	Bromocresol green	Green	Nutral
13	Reducing Sugar	H ₂ O	1. Benedicts Solution 2. Fehling Solution	Red ppts	Present

Table (2) Physicochemical analysis of *Careya arborea* Roxb. fruits

No	Physico chemical properties	Yield percent (%)
1	Moisture content	6.92%
2	Total ash	1.33%
3	Acid insoluble ash	4.40%
4	Water soluble ash	38.42%
5	Ethanol soluble matter content	3.31%
6	Methanol soluble matter content	3.36%
7	Petroleum ether soluble matter content	1.11%
8	Ethyl acetate soluble matter content	1.41%
9	Chloroform soluble matter content	1.26%
10	Acetone soluble matter content	2.35%
11	Aqueous soluble matter content	10.84%

Table (3) Elemental analysis on fruits of *Careya arborea* Roxb. by using EDXRF

Elements	Average %
Potassium (K)	1.860
Sodium (Na)	0.220
Phosphorus (P)	0.204
Calcium (Ca)	0.088
Iron (Fe)	0.031
Titanium (Ti)	0.004
Manganese (Mn)	0.003
Zinc (Zn)	0.002
Copper (Cu)	0.003
Rubidium (Rb)	0.001
Strontium (Sr)	0.000
COH balance	97.585

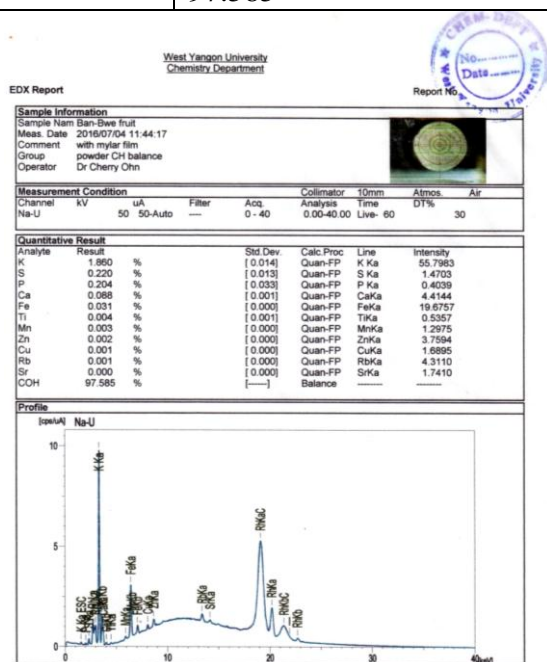
**Figure 1. Elemental analysis of *Careya arborea* Roxb. fruits**

Table (4) Antimicrobial activity from the different solvent extracts on fruits of *Careya arborea* Roxb.

Test Organisms	Solvents							
	Control	Pet-ether	Methanol	Chloroform	Acetone	Ethyl acetate	Ethanol	Aqueous
<i>Bacillus subtilis</i>	-	12 ml (+)	18 mm (++)	-	-	-	14 mm (+)	12 mm (+)
<i>Staphylococcus aureus</i>	-	18 ml (++)	16 mm (++)	13 ml (+)	12 mm (+)	14 mm (+)	14 mm (+)	-
<i>Pseudomonas aeruginosa</i>	-	-	20 mm (+++)	-	-	-	-	11 mm (+)
<i>Bacillus pumilus</i>	-	20 ml (+++)	18 mm (++)	14 mm (+)	15 mm (++)	17 mm (++)	15 mm (++)	12 mm (+)
<i>Candida albicans</i>	-	20 ml (+++)	15 mm (++)	14 mm (+)	15 mm (++)	14 mm (+)	14 mm (+)	-
<i>Escherichia coli</i>	-	20 ml (+++)	17 mm (++)	14 mm (+)	14 mm (+)	15 mm (++)	14 mm (+)	11 mm (+)

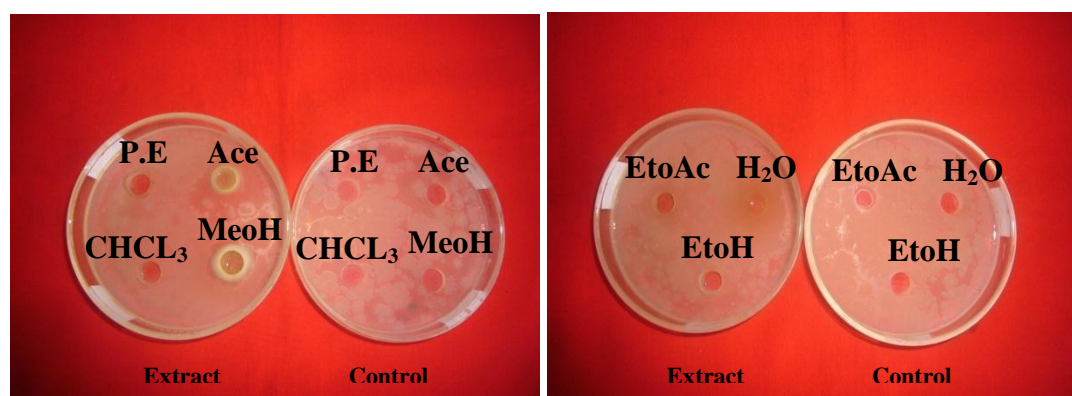
Agar well – 10 mm

10 mm ~ 14 mm (+)

15 mm ~ 19 mm (++)

20 mm above (+++)

Organisms

(1) *Bacillus subtilis* (N.C.T.C.-8236)(2) *Staphylococcus aureus* (N.C.P.C-6371)(3) *Pseudomonas aeruginosa* (6749)(4) *Bacillus pumilus* (N.C.I.B-8982)(5) *Candida albicans*(6) *E-coli* (N.C.I.B-8134)Fig. 2 Antibacterial activity of the crude extract on *Bacillus subtilis*

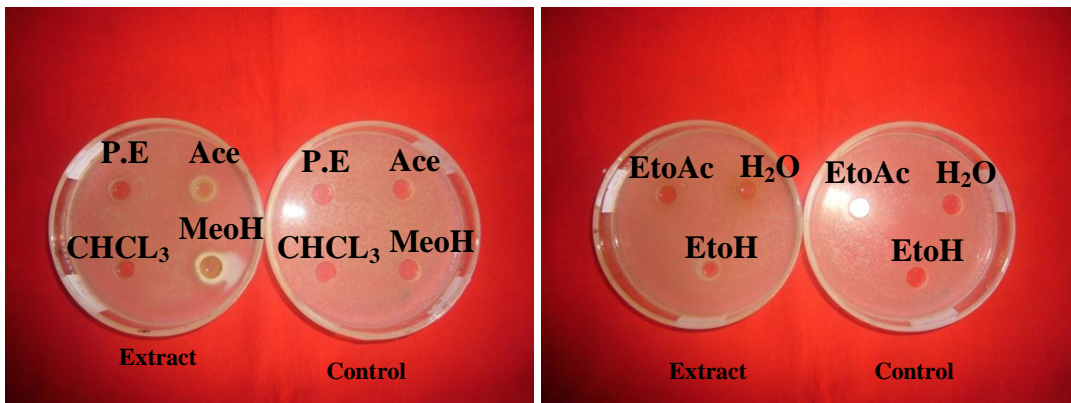


Fig. 3 Antibacterial activity of the crude extract on *Staphylococcus aureus*



Fig. 4 Antibacterial activity of the crude extract on *Pseudomonas aeruginosa*

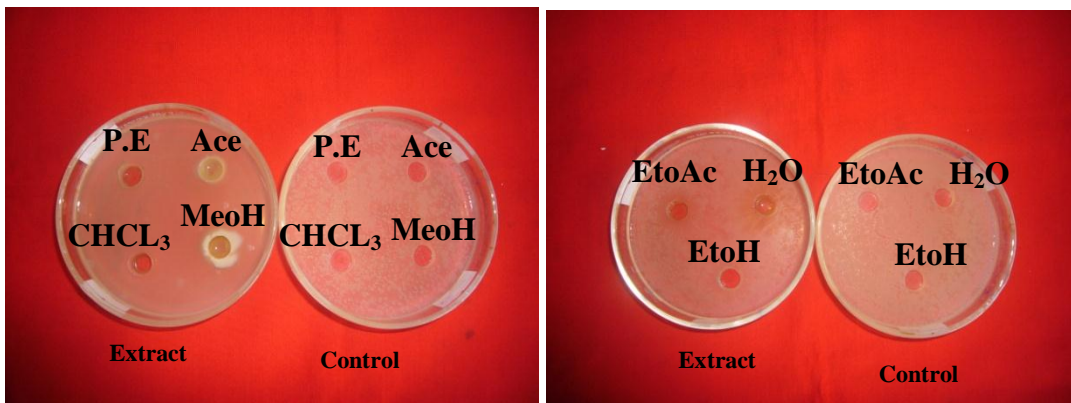


Fig. 5 Antibacterial activity of the crude extract on *Bacillus pumilus*

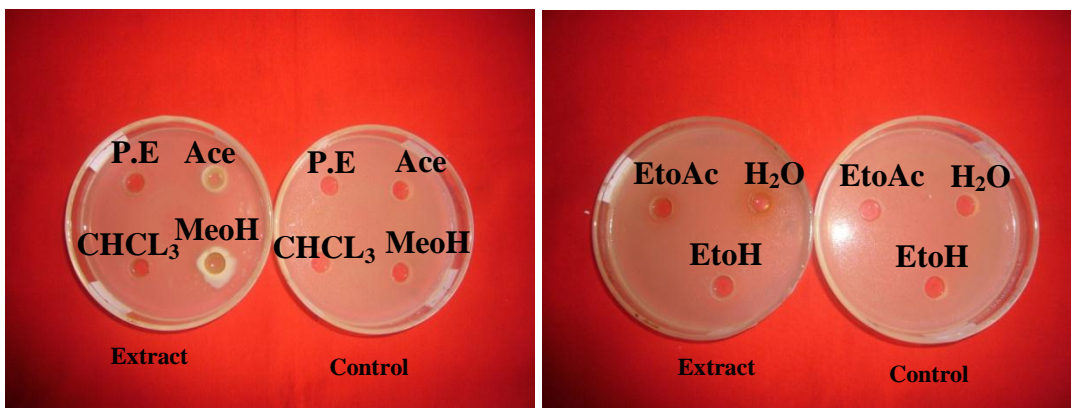


Fig. 6 Antifungal activity of the crude extract on *Candida albicans*

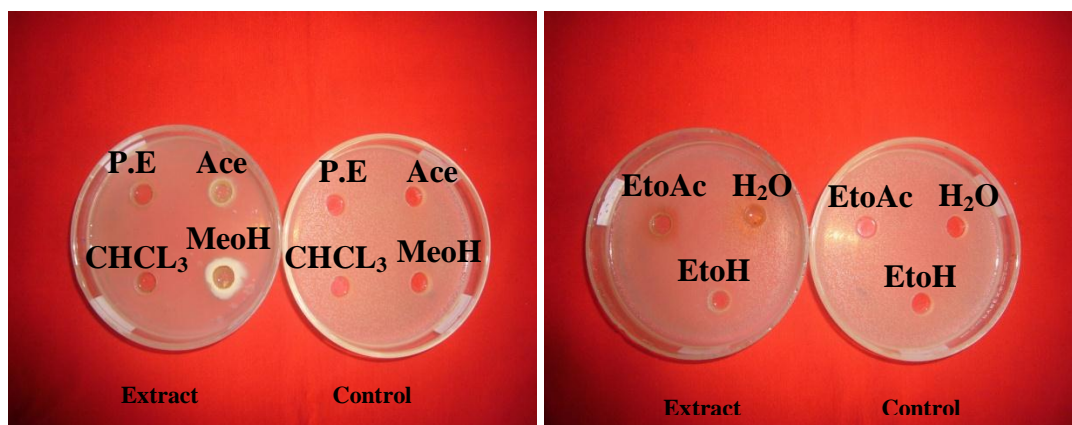


Fig. 7 Antibacterial activity of the crude extract on *Escherichia coli*

Table 5. Nutritional Values of *Careya arborea* Roxb. fruits

Sr. No	Test Parameter	Test Method	Result
1	Moisture	AOAC-2000 (934.01)	73.87 %
2	Ash	AOAC-2000 (940.26)	1.14 %
3	Protein	AOAC-2000 (920.103) (Kjeldahl Method)	2.13 %
4	Crude Fibre	AOAC-2000 (978.10) Fiber Cap Method	3.05 %
5	Ether Extract	AOAC (Ether Extract)	0.11 %
6	Carbohydrate	By difference	19.70 %
7	Energy Value (Kcal/100 g)		89

Table 6. Nutritional Facts of *Careya arborea* Roxb. fruits

Nurrition Facts (100) g		
Energy	89	Kcal
Protein	2	gm
Fat	0.1	gm
Carbonhydrate	20	gm

Myanmar Food Processors and Exporters Association (MFPEA)
 Food Industries Development Supporting Laboratory (FIDSL)
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 Lanmadaw Township, Yangon, Myanmar

LABORATORY ANALYSIS REPORT

FIDSL - 06- 1271/16
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1 Company's Name : Daw Khin Mar Kyu
 2 Address : West Yangon University
 3 Phone No. : 09-5143310
 4 Date Received : 10.5.2016
 5 Sample Number : 1070/16
 7 Product Name : Ban Pwe Fruit
 8 Type of Test : Nutrition Package
 9 Date of Issue : 20.5.2016
 10 Results

(This Laboratory analysis report is based solely on the sample(s) submitted by the customer.)

Sr. No	Test Parameter	Test Method	Result
1	Moisture	AOAC-2000(934.01)	73.87%
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Remarks

Nutrition Facts (100 gm)	
Energy	89 Kcal
Protein	2 gm
Fat	0.1 gm
Carbohydrate	20 gm

Tin Hsing Win
Manager
FIDSL

Figure 8. Nutritional Values of *Careya arborea* Roxb. fruits

Discussion and Conclusion

Plants or plants products were used as the therapeutic agents in treating various ailments by virtue of their phytoconstituents (Chalia *et al.*, 2009). Since ancient times plants have served human beings as a natural source of treatments and therapies, among them medicinal herbs have gain attention because of its wide use and less side effects. Wargovich (2000) stated that, the Wild fruits played a significant role in human nutrition, especially as sources of carbohydrates, proteins, vitamins, minerals, dietary fiber as enormous medicinal potential. The fruit of *Careya arborea* has great medicinal and nutritional value.

In the present research, phytochemical analysis of air dried fruit of *Careya arborea* Roxb. showed the presence of many important secondary metabolites of phytoconstituents like alkaloid, glycoside, saponin, phenolic compound, flavonoid, carbohydrate, steroids, terpenoids, tannin and reducing sugar. Cyanogenic glycoside and amino acid are absent in fruit. These characters were similar to those of Navya and Anitha (2018).

As the results of the physicochemical investigation, the most soluble in aqueous soluble was 10.84%. It was higher than those of other solvents and the least soluble in petroleum ether was 1.11%. Elemental analysis was to determine the amount of elements in *Careya arborea* Roxb. fruits. Potassium was found as principal element and rubidium (Rb), zinc (Zn) and copper (Cu) are trace element in *Careya arborea*. In antimicrobial activities, petroleum ether extract of fruit showed higher activity than the other ones and most effective in *Bacillus pumulus*, *Candida albicans*, and *Escherichia coli*. These characters were in agreement with those mentioned by Khaliq (2016). In the determination of nutritional values of the fruits, 89 kcal of energy, 2 gram of protein, 0.1 gram of fat and 20 gram of carbohydrate were observed.

The quantitative phytochemical investigation gave valuable information about the different phytoconstituents that is present in the powdered extract for which are beneficial for further research in isolation of active compounds. The results of Energy Dispersive X-ray Fluorescence (EDXRF) showed that the presence of potassium, sodium and phosphorus. Potassium supports blood pressure, cardiovascular health, bone strength, and muscle strength. Potassium is also available in supplements, but dietary sources are most healthful. The extract of fruit also showed that the antimicrobial activities of the different solvent extracts of fruit against all of *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumilus*, *Escherichia coli* and fungus *Candida albicans*.

Therefore, this research will be highlight for the benefits of medicinal uses in order to know the scientifically knowledge for the local people.

Acknowledgement

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