



## CHAPTER I INTRODUCTION

Medicinal plants are plants containing biological active constituents. They have especially pharmacological active principle which can be used as therapeutic drugs or herbal medicine. Moreover, they are used in agriculture e.g. insecticides, fungicides, antibacteria and in industry e.g. perfume. Medicinal plants have little side effect in contrast to synthetic drugs, as shown by literature (1). Besides, they are cheap and easily available. Ngiu (*Bombax malabaricum* or *Bombax ceiba* Linn.) (2,3) is an interesting medicinal plants because of its known uses in therapeutic drugs, for example, the woods which can be used in therapeutic drugs, the leaves as a treatment for inflammation and the bark is used to treatment of diarrhea. The above mentioned properties of Ngiu (*Bombax malabaricum* or *Bombax ceiba* Linn.) is the important motivation to search for the biological substances that can be used. As far as literature surveys no biological substances from Ngiu (*Bombax malabaricum* or *Bombax ceiba* Linn.) (4) have been investigated. Therefore, it is the main objective of this research to investigate the biological substances that may be used to treat inflammation.

*Bombax malabaricum* (*Bombax ceiba* Linn.) (5) is the plant in the family of Bombacaceae. It is a large perennial tree found in Thailand, Laos and Combodia. In Thailand, it is commonly known as Ngiu which is used as herbal medicine. There are two kinds of this plants ; Ngiu paa ; Koei (Karen-Mae Hong Son) ; Kai (Karen-Northem) (*Bombax anceps* Pierre) and Ngiu baan (Genneral) ; Ngiu daeng (Kanchanaburi): Ngiu pong, Ngiu pong daeng, Sa-nem ra-kaa (Chong-Chanthaburi) ; Kapok Tree, Cotton Tree, Red Cotton Tree, Shaving Brush, Silk Cotton Tree (*Bombax malabaricum* or *Bombax ceiba* Linn.)



จุฬาลงกรณ์มหาวิทยาลัย

Figure 1 The bark, leaf and flower of *Bombax malabaricum*

### 1.1 Research studies in chemical constituents on the plants in *Bombax malabaricum* (*Bombax ceiba* Linn.)

From literature surveys, two species in this genus have been studied. The chemical constituents of *Bombax malabaricum* (*Bombax ceiba* Linn.) have been studied since 1943. Many new compounds were isolated from crude extracts of these plants.

In 1943, C. Venkata Rao, M. Narasinga Rao and A. Venkateswarlu (6) investigated the oil from the seeds of *Bombax malabaricum* (*Bombax ceiba* Linn.). It contained 94.8% of insoluble mixed fatty acids composed of 57 % of solid acids and 43% of liquid acids. The composition of the fatty acids was found to be 1.2% myristic acids, 23.6 % palmitic acid, 2.8 % arachidic acids, 64.9% oleic acids and 7.5 % linoleic acid. Oleic and linoleic acids were further identified by bromination by the method of Eibner and Muganthalter and this indicated the absence of linolenic acid since no hexabromide could be isolated.

In 1969, N.A.M. Saleh, N.A.M. EL Sherbeing and H.I. EL Sissi (7) studied on local plants as potential sources of tannins in Egypt. The leaf and bark materials of investigated plants were studied with respect to the presence of free sugars and phenolic components separated after acid hydrolysis.

In 1971, Seshadri, V., Batta, A.K. and Rangaswami, S. (8) investigated on phenolic components of *Bombax malabaricum* from the stem bark and root bark and isolated four compounds which were identified as lupeol,  $\beta$ -sitosterol,  $\beta$ -sitosterol-D-glucoside from the stem bark, naphthoquinone containing an O-hydroxyaldehyde, an isopropyl and a methoxyl group on the aromatic ring. It analysed for  $C_{16}H_{16}O_5$  ( $M^+288$ ). gave an orange color with  $FeCl_3$ , a dark-red solution with conc.  $H_2SO_4$  and a violet color with dilute aq. sodium hydroxide.

In 1972, G.D. Agrawal, S.A.I. Rizvi, P.C. Gupta and J.D. Tewari (9) studied of a polysaccharide from the stamens of *Bombax malabaricum* flowers by paper chromatographic.

In 1973, V. Seshadri, A.K. Batta and S. Rangaswami (10) isolated a new naphthoquinone from Phenolic Components of *Bombax malabaricum*. The isolation from *Bombax malabaricum* is reported of a naphthol which seems to be of significance. (i) for the biosynthesis of gossypol, the characteristic pigment of *Gossypium* species, and (ii) for the taxonomic relationship between Malvaceae and Bombacaceae.

In the same year, G.S. Niranjana and P.C. Gupta (11) studied on Anthocyanins from the flowers of *Bombax malabaricum* and isolated two compounds which were identified as Anthocyanin A, an orange-red compound, hygroscopic in nature and Anthocyanin B, a red (hygroscopic) solid.

In 1976, D.N. Dhar and R.C. Munjal (12) studied on chemical investigation from Chemical examination of the seeds of *Bombax malabaricum*. It contains n-hexacosanol, palmitic acid, octyl palmitate, gallic acid, tannic acid, 1-galloyl- $\beta$ -glucose, ethyl gallate, tocopherols, carotenoids and an unidentified terpene.

In the 1980, J.S. Chauhan, M. Sattan and S.K. Srivastava (13) investigated on Constituents from *Salmalia malabarica* (*Bombax malabaricum*) and has resulted in the isolation and identification n-triacontanol,  $\beta$ -sitosterol and a new glycoside which was characterized as 5,7,3,4'-tetrahydroxy-6-methoxyflavan-3-O- $\beta$ -D-glucopyranosyl- $\alpha$ -D-xylopyranoside.

In 1981, Akella V.B. Sankaram, Narreddi S.R. and James N.S. (14) isolated a new sesquiterpenoids from extracts of the root bark of *Bombax malabaricum* and identified as Hemigossypol -6- methyl ether, isohemigossypol -1- methyl ether, isohemigossypol -1,2- dimethyl ether, 8-formyl -7- hydroxyl

-5- isopropyl -2- methoxy -3- methyl -1,4- naphthaquinone, 7- hydroxycadalene and unidentified phenolic compound. Long range couplings in the  $^1\text{H}$  NMR spectrum of isohemigossol -1- methy ether have been established by decoupling experiments.

In 1982, R.D. Soad, K.A. Suri and C.K. Alal (15) isolated a new cadalane type sesquiterpenoid. Methanol extract from *Salmalia malabarica* (*Bombax malabaricum*) and its structure was established as 1,6-dihydroxy -3- methyl -5-(1-methylethyl) -7- methoxy -8- carboxylic acid (8  $\rightarrow$  1 lactone).



สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย

1.2 Chemical constituents of plants in *Bombax malabaricum*  
(*Bombax Ceiba* Linn.)

From the literature surveys ,chemical constituents of plants in *Bombax malabaricum* have been investigated and are summarized in table 1.1

Table 1.1 Chemical constituents of plants in *Bombax malabaricum*

Plant parts	Isolated Compounds	Extracts	References
stamens	polysaccharides	acetic acid	9
flowers	pelargonidin 5- $\beta$ -D-glucopyranoside [11]	acetic acid	11
	cyanidin-7-methyl ether-3- $\beta$ glucopyranoside [10]	acetic acid	
seeds	n-hexacosanoal	benzene	6,12
	palmitic acid	petroleum ether	
	octyl palmitate	chloroform	
	tannic acid	benzene	
	1-galloy- $\beta$ -glucose	ethyl acetate	
	ethyl gallate	ethyl acetate	
	carotenoids	petroleum ether	
	terpene	chloroform	

Table 1.1 (continued)

Plant parts	Isolated Compounds	Extracts	References
	$\beta$ -tocopherols [14]	petroleum ether	
	arabinose [1]	petroleum ether	
	myristic acid [2]	ethanol	
	linoleic acid [3]	petroleum ether	
	caffeic acid [4]	petroleum ether	
	gallic acid [12]	ethanol	
leaves	waxy materials	ethanol	11
stem-bark	lupeol [5]	ethanol	8
	$\beta$ -sitosterol [6]	ethanol	
root-bark	lupeol	ethanol	8,13,14,15
	$\beta$ -sitosterol	ethanol	
	8-carboxaldehyde-7-hydroxy-5-isopropyl-6-methoxy-3-methyl-1,4-naphtho quinone [7]	ethanol	
	8-carboxaldehyde-6,7-hydroxy-5-isopropyl-3-methyl-1,4-naphtho quinone [8]	ethanol	
	hemigossypol [9]	ethanol	
	1-galloyl- $\beta$ -glucose [13]	ethanol	

Table 1.1 (continued)

Plant parts	Isolated Compounds	Extracts	References
	isohemigossypol-2-methyl ether [15]	ethanol	
	isohemi gossypolone [16]	ethanol	
	isohemigossypolone-3-methyl ether [17]	ethanol	
	5,7,3,4-tetrahydroxy-6-methoxyflavan -3-O- $\beta$ -D-glucopyranosyl-&-D- xylopyranoside [18]	ethanol	
	7-hydroxycadalene [19]	ethanol	
	isohemigossypol-1-methyl ether [20]	ethanol	
	isohemigossypol-1,2-dimethyl ether [21]	ethanol	
	8-formyl-7-hydroxy-5-isopropyl-2- methoxy-3-methyl-1,4-noptha quinone [22]	ethanol	
	6-hydroxy-3-methyl-5- (1-methylethyl)-7-methoxy -8-carboxylic acid ester [23]	ethanol	



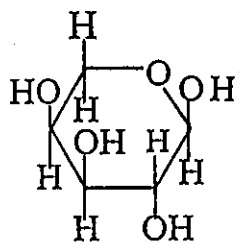
### 1.3 The target of this research

The target of this research can be summarized as follow :

1. To extract and isolate some chemical constituents from the bark of *Bombax malabaricum*.
2. To identify the chemical structures of compounds which were isolated.

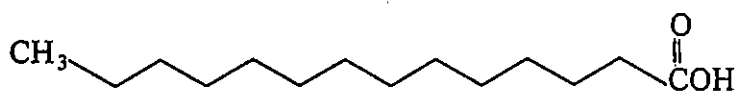


สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย



Arabinose

[1]



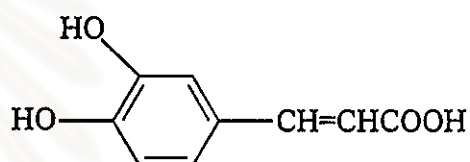
Myristic acid

[2]



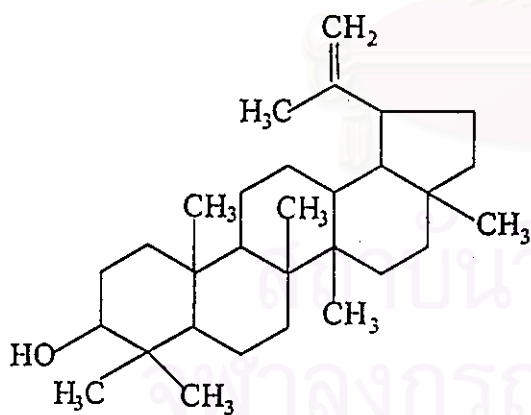
Linoleic acid

[3]



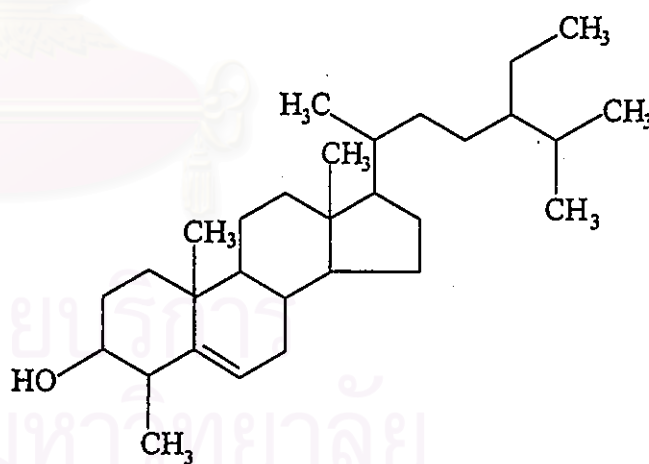
Caffeic acid

[4]



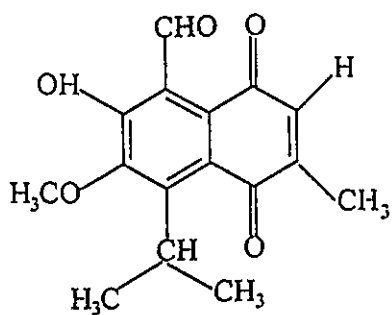
Lupeol

[5]

 $\beta$ -Sitosterol

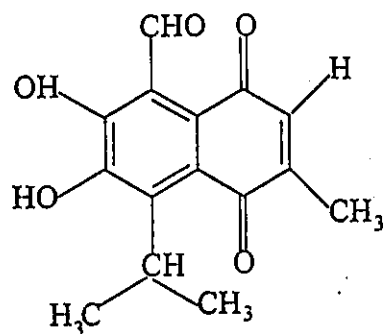
[6]

Figure 2 The Structure some chemical constituents of *Bombax malabaricum*



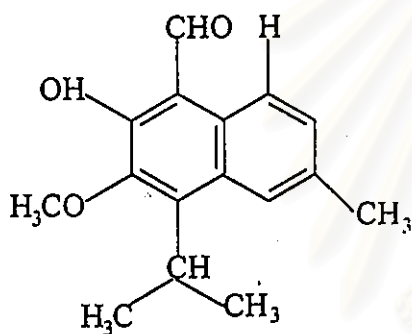
8-carboxaldehyde-7-hydroxy-5-isopropyl  
-6-methoxy-3-methyl-1,4-naphthoquinone

[7]



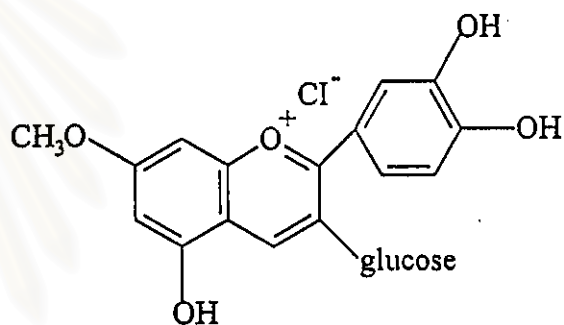
8-carboxaldehyde-6,7-dihydroxy-5-isopropyl-3-  
methyl-1,4-naphthoquinone

[8]



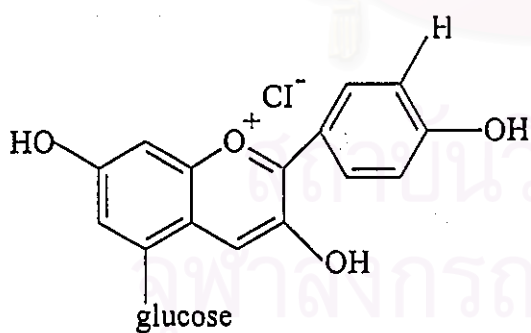
Hemigossypol

[9]



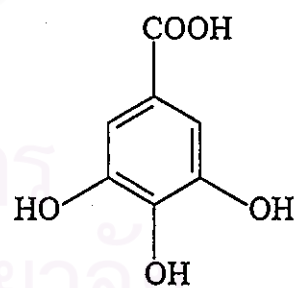
Cyanidin 7-methyl ether-3- $\beta$ -glucopyranoside

[10]



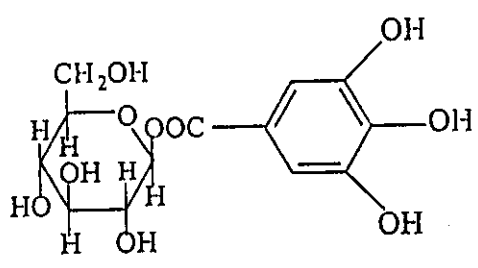
Pelargonidin 5- $\beta$ -D-glucopyranoside

[11]



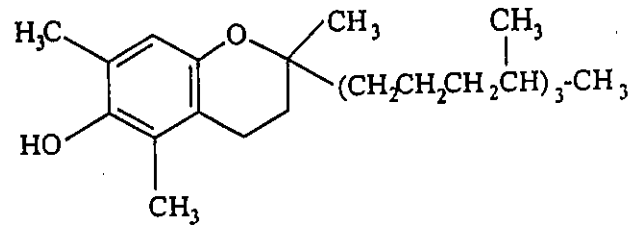
Gallic acid

[12]



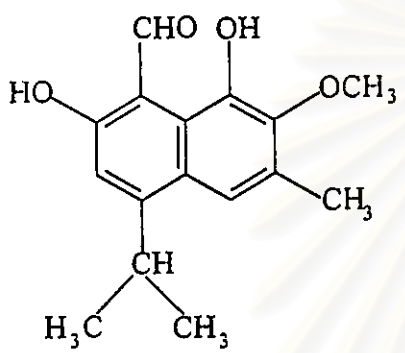
1-Galloyl- $\beta$ -glucose

[ 13 ]



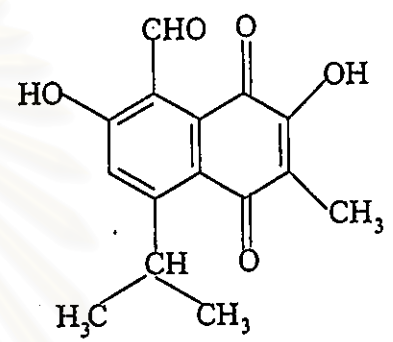
$\beta$ -Tocopherol

[ 16 ]



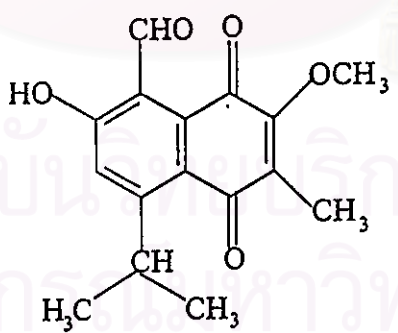
Isohemigossypol-2-methyl ether

[ 15 ]



Isohemigossypolone

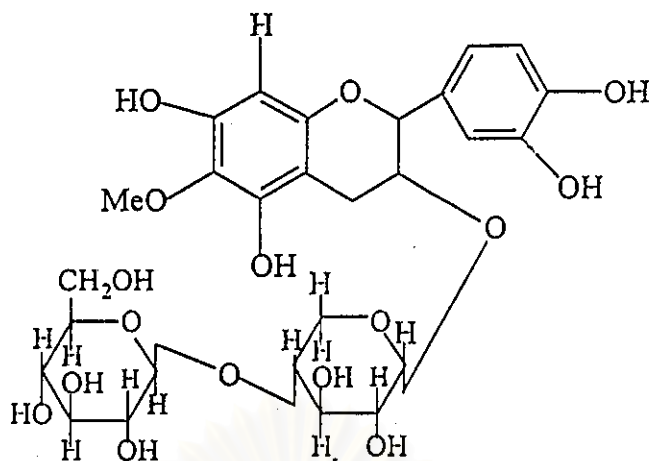
[ 16 ]



Isohemigossypolone-3-methyl ether

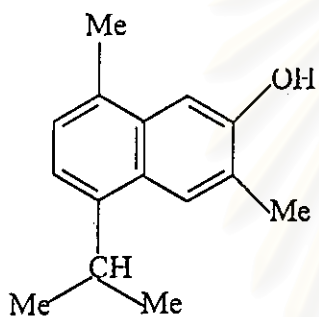
[ 17 ]

Figure 2 (continued)



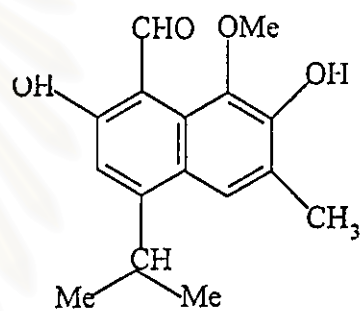
5,7,3',4'-tetrahydroxy-6-methoxyflavan-3-O- $\beta$ -D-glucopyranosyl- $\alpha$ -D-xylopyranoside

[ 18 ]



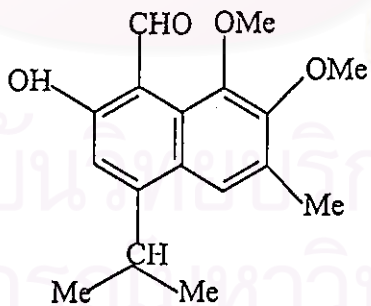
7-Hydroxycadalene

[ 19 ]



Isohemigossypol-1-methyl ether

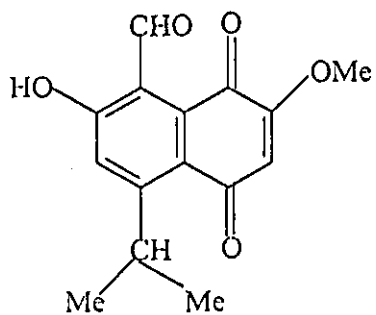
[ 20 ]



Isohemigossypol-1,2-dimethyl ether

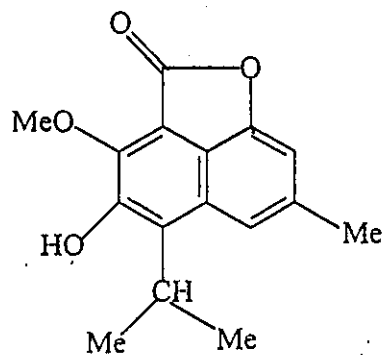
[ 21 ]

Figure 2 (continued)



8-Formyl-7-hydroxy-5-isopropyl-2-methoxy-3-methyl-1,4-naphthaquinone

[ 22 ]



6-hydroxy-3-methyl-5-(1-methylethyl)-7-methoxy-8-carboxylic acid ester

[ 23 ]

สถาบันวิทยบริการ  
จุฬาลงกรณ์มหาวิทยาลัย