

1 INTRODUCTION

1.1 Introduction

Morinda elliptica Ridl. is a plant belonging to the Rubiaceae family. It is found in Malay Peninsula: Singapore, Malacca, Pahang, Selangor, Penang and Trangganu (Ridley, 1967). In Thailand, it is known as Yaw Pa (ยอป่า) (จุลฑิ, 2540). *M. elliptica* is a small tree usually about 15 ft. tall with white bark. Leaves narrow-elliptic or oblanceolate shortly acuminate and long narrowed to base; nerves about 7 pairs, 8 in. long, 1.25 in. wide; petioles 0.4 in. long. Peduncles slender, 1.25 in. long. Heads oblong, 0.25 in. long. Corolla-tube cylindric, lobes sub-acute, all white, 0.5 in long. Fruit-head oblong, green, hardly pulpy, 0.5 in. long. *Hab.* It is one of the commonest trees in the open cleared ground, especially in Lalang fields and rocks by the sea (Ridley, 1967).



Figure 1 *Morinda elliptica* Ridl.
(จุลฑิ, 2540)

1.2 Chemical constituents from *Morinda* genus

According to the information from NAPRALERT database developed by University of Illinois at Chicago and Chemical abstracts, several types of compounds have been reported in the genus *Morinda*, such as benzenoids, flavones, flavonols, iridoid monoterpenes, quinoids, steroids and triterpenes. Chemical constituents isolated from the genus *Morinda* are presented in Table 1.

Table 1 Compounds isolated from *Morinda* genus

- a** : benzenoids **d** : iridoid monoterpenes **g** : triterpenes
b : flavones **e** : quinoids **h** : miscellaneous
c : flavonols **f** : steroids

Scientific name	Compound	Structure	Bibliography
1. <i>M. angustifolia</i> leaves leaves + stembark	morindone	1e	Rao, <i>et al.</i> , 1978
	rutin	11c	
	β -sitosterol	1f	
	ursolic acid	1g	
	aloe emodin	8e	
	morindone	1e	
	rhein	18e	
2. <i>M. citrifolia</i> bark	alizarin	31e	Schermerhorn and Quimby, 1962
	β -carotene	1h	Aalbersberg, <i>et al.</i> , 1993

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
	ruberythric acid	23e	
	mono- ethoxy rubiadin	45e	
	anthraquinones	6e	Zenk, <i>et al.</i> , 1975
	apigenin	1a	Tiwari and Singh, 1977
flowers	asperuloside	1d	Inouye, <i>et al.</i> , 1988
fruit	asperulosidic acid	3d	Wang, <i>et al.</i> , 1999
	deacetyl asperulosidic acid	2d	
	caproic acid	3h	Levand and Larson, 1979
	caprylic acid	4h	
	β -carotene	1h	Aalbersberg, <i>Et al.</i> , 1993
	rutin	11c	Legal, <i>et al.</i> , 1994
fruit juice	asperulosidic acid	3d	Liu, <i>et al.</i> , 2001
fruit pulp	asperuloside	1d	Levand and Larson, 1979
heartwood	morindone	1e	Srivastava and Singh, 1993
	physcion	17e	
	physcion-8- <i>O</i> - α -L- arabinopyran	22e	
leaves	asperuloside	1d	Sang, <i>et al.</i> , 2001
	asperulosidic acid	3d	
	β -carotene	1h	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
	citrifolinin A	5d	
	citrifolinoside A	6d	
	gentisic acid	1a	Griffiths, 1959
	monotropein	4d	Inouye, <i>et al.</i> , 1988
	β -sitosterol	1f	
	ursolic acid	1g	
root	damnacanthal	52e	Rusia and Sriva- stava, 1989
	nordamnacanthal	35e	Hasegawa and Koyano, 1996
root bark	morindin	26e	Simonsen, 1920
	mono-methoxy rubiadin	44e	
suspension culture	alizarin	31a	Leistner, 1975
	1,5,6-trihydroxy anthraquinone	3e	
	3,5,6-trihydroxy-2-methyl anthraquinone	5e	Inoue, <i>et al.</i> , 1981
	2-methyl-3,5,6-trihydroxy- anthraquinone-6- β - primeveroside	11e	
	nordamnacanthal	35e	Elshagi and Schulte, 1975
	lucidin	36e	Brodelius, <i>et al.</i> , 1979

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
	5,6-dihydroxylucidin	4e	
	5,6-dihydroxylucidin- 3- <i>O</i> - β -D-primeveroside	25e	
	lucidin-3- <i>O</i> - β -D- primeveroside	24e	
	lucidin- ω -ethyl ether	38e	
	Morindone	1e	
	Morindone-3-hydroxy	2e	
	Morindin	26e	
	Rubiadin	34e	
	β -sitosterol	1f	
3. <i>M. elliptica</i> root	Alizarin-1-methyl ether	48e	Ismail, <i>et al.</i> , 1997
	1-hydroxy-2-methyl anthraquinone	28e	Ali, <i>et al.</i> , 2000
	2-formyl-1-hydroxy anthraquinone	29e	
	Damnacanthol	53e	
	Nordamnacanthol	35e	
	lucidin- ω -methyl ether	42e	
	Morindone	1e	
	Morindone-5-methyl ether	7e	
	Rubiadin	34e	
	Rubiadin-1-methyl ether	51e	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography		
suspension	soranjidiol	12e	Lajis, <i>et al.</i> , 2000		
culture	alizarin-1-methyl ether	48e	Abdullah, <i>et al.</i> , 1998		
	anthragallol-1,2-dimethyl ether	49e			
	anthraquinones	6e			
	nordamnacanthal	35e			
	lucidin- ω -methyl ether	42e			
	morindone	1e			
	purpurin-1-methyl ether	50e			
	rubiadin	34e			
	soranjidiol	12e			
	4. <i>M. longiflora</i> root	longifloroside		7d	Paris and Abiusso, 1958
rubiadin-1-methyl ether		51e			
5. <i>M. lucida</i> heartwood	2-carbaldehyde-3-hydroxy anthraquinone	63e	Demagos, <i>et al.</i> , 1981		
	lucidin	36e			
	morindone-5-methyl ether	7e			
	leaves	munjistin methyl ester		40e	
		root		oruwacin	8d
	alizarin-1-methyl ether			48e	Rath, <i>et al.</i> , 1995

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
stem	1-hydroxy-2-methyl anthraquinone	28e	Adesida and Adesogan, 1972 Adesogan, 1973
	3-hydroxy-2-hydroxy methyl anthraquinone	62e	
	2-carbaldehyde-3-hydroxy anthraquinone	63e	
	Damnacanthal	52e	
	Damnacanthol	53e	
	Morindone	1e	
	Rubiadin-1-methyl ether	51e	
	Soranjidiol	12e	
	Saranjidiol-1-methyl ether	13e	
	Tectoquinone	57e	
	Alizarin-1-methyl ether	48e	
	1-hydroxy-2-methyl anthraquinone	28e	
	1,2-dimethylantraquinone	55e	
	2-formylantraquinone	59e	
	Damnacanthal	52e	
	Nordamnacanthal	35e	
	Oruwal	7h	
	Oruwalol	8h	
	Rubiadin	34e	
	Rubiadin-1-methyl ether	51e	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
stem bark	soranjidiol	12e	Koumaglo, <i>et al.</i> , 1992
	digitolutein	30e	
6. <i>M. morindoides</i> leaves	apigenin	1b	Cimanga, <i>et al.</i> , 1997
	chrysoeriol	2b	
	chrysoeriol 7- <i>O</i> - neohesperidoside	3b	
	cosmosiin	4b	
	cynaroside	5b	
	kaempferol	1c	
	kaempferol 3- <i>O</i> -rhamnoside	6c	
	kaempferol 3- sophoroside- 7-rhamnosyl	8c	
	morindaoside	9c	
	nicotiflorin	10c	
	quercetin	2c	
	quercetin 7,4'-dimethyl ether	5c	
	quercitrin	7c	
	rutin	11c	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography	
7. <i>M. officinalis</i>	entire plant	rubiadin	34e	Li, <i>et al.</i> , 1991
		β -sitosterol	1f	Yoshikawa, <i>et al.</i> , 1995
	root	alizarin-1-methyl ether	48e	Yang, <i>et al.</i> , 1992
		1,4-dihydroxy-2-methyl anthraquinone	20e	
		1,6-dihydroxy-2,4-dimethoxy anthraquinone	15e	
		1,6-dihydroxy-2-methoxy anthraquinone	14e	
		1-hydroxy-2,3-dimethyl anthraquinone	43e	
		1-hydroxy-2-methyl anthraquinone	28e	
		1-hydroxy-3-hydroxymethyl anthraquinone	46e	
		1-hydroxyanthraquinone	27e	
		2-hydroxy-1,4-dimethoxy anthraquinone	21e	
		lucidin- ω -methyl ether	38e	Cai, <i>et al.</i> , 1996
		morindone	1e	
		nystose	2h	
		physcion	17e	
		rotungenic acid	2g	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
7. <i>M. officinalis</i>			
	entire plant		
	rubiadin	34e	Li, <i>et al.</i> , 1991
	β -sitosterol	1f	Yoshikawa, <i>et al.</i> , 1995
root	alizarin-1-methyl ether	48e	Yang, <i>et al.</i> , 1992
	1,4-dihydroxy-2-methyl anthraquinone	20e	
	1,6-dihydroxy-2,4-dimethoxy anthraquinone	15e	
	1,6-dihydroxy-2-methoxy anthraquinone	14e	
	1-hydroxy-2,3-dimethyl anthraquinone	43e	
	1-hydroxy-2-methyl anthraquinone	28e	
	1-hydroxy-3-hydroxymethyl anthraquinone	46e	
	1-hydroxyanthraquinone	27e	
	2-hydroxy-1,4-dimethoxy anthraquinone	21e	
	lucidin- ω -methyl ether	38e	Cai, <i>et al.</i> , 1996
	morindone	1e	
	nystose	2h	
	physcion	17e	
	rotungenic acid	2g	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
root bark	rubiadin	34e	Li, <i>et al.</i> , 1991
	rubiadin-1-methyl ether	51e	
	β -sitosterol	1f	
	7-oxo- β -sitosterol	4f	
	tectoquinone	57e	
	1-methylanthraquinone	55e	
	24-ethylcholesterol	3f	
	officinalisin	6h	
	β -sitosterol	1f	
8. <i>M. parvifolia</i>			
entire plant	alizarin-1-methyl ether	48e	Chang and Lee, 1984
not specified	2-hydroxymethyl anthraquinone	60e	Lee, 1984
	lucidin- ω -methyl ether	38e	
	morindaparvin A	19e	
	morindaparvin B	9e	
	1,3-dihydroxy-2-methoxy-methylanthraquinone	37e	
	2-hydroxy-methyl anthraquinone	60e	
	digiferruginol	30e	
	morindaparvin A	19e	
	morindaparvin B	9e	

Table 1 (continued)

Scientific name	Compound	Structure	Bibliography
rhizome + root	alizarin-1-methyl ether	48e	Chang and Lee., 1984
	1-hydroxy-6-hydroxy- methylantraquinone	16e	
	2-hydroxymethyl anthraquinone	60e	
	igiferruginol	30e	
	lucidin- ω -ethyl ether	38e	
	lucidin- ω -methyl ether	42e	
	morindaparvin A	19e	
	morindaparvin B	9e	
10. <i>M. tinctoria</i>			
heartwood	damnacanthal	52e	Murti, <i>et al.</i> , 1959
	nordamnacanthal	35e	
	morindone	1e	
	tinctomorone	41e	
leaves	kaempferol	1c	Eswaran, <i>et al.</i> , 1978
	morindonen	1e	
	quercetin	2c	Abraham, <i>et al.</i> , 1988
	quercetin 3'-4'-dimethoxy	4c	
root	quercetin 4'-methoxy	3c	Mishra and Gupta, 1982
	damnacanthal	52e	

Table 1 (continued)

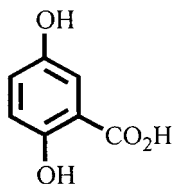
Scientific name	Compound	Structure	Bibliography
root bark	nordamnacanthal	35e	Balakrishna. <i>et al.</i> , 1960
	morindone	1e	
	β -sitosterol	1f	
	morindin	26e	
11. <i>M. tintoria</i> <i>var. tomentosa</i>			
leaves	ursolic acid	1g	Rao and Rao, 1983
root bark	anthragallol-2,3-dimethyl ether	49e	Rao and Reddy, 1977
	morindin	26e	
	morindone	1e	
stem bark	morindone-6- β - primeveroside	10e	
	soranjidiol	12e	
	alizarin-1-methyl ether	48e	
	rubiadin	34e	
12. <i>M. umbellata</i>			
leaves	asperuloside	1d	Inouye, <i>et al.</i> , 1988
	monotropein	4d	Hui and Yee, 1967
	β -sitosterol	1f	
	stigmasterol	2f	
	alizarin	34e	

Table 1 (continued)

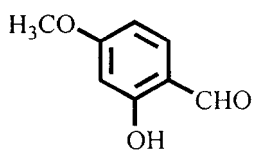
Scientific name	Compound	Structure	Bibliography	
root	alizarin-1-methyl ether	48e	Burnett and Thomson, 1968	
	alizarin-2-methyl ether	32e		
	1-hydroxy-2-methyl anthraquinone	28e		
	1-methoxy-2-methyl anthraquinone	47e		
	2-hydroxyanthraquinone	61e		
	2-methoxyanthraquinone	58e		
	lucidin	36e		
	munjistin	39e		
	xanthopurparin	33e		
	stem	alizarin		31e
		alzarin-1-methyl ether		48e
alizarin-2-methyl ether		32e		
1-hydroxy-2-methyl anthraquinone		28e		
1-methoxy-2-methyl anthraquinone		47e		
2-methylanthraquinone		57e		
xanthopurpurin		33e		
13. <i>M. whitel</i>				
root	2-hydroxy-4-methoxy-benzaldehyde	2a	Kuob and Kinst-Hori, 1999	

Structures of compounds from *Morinda* genus

a. Benzenoids

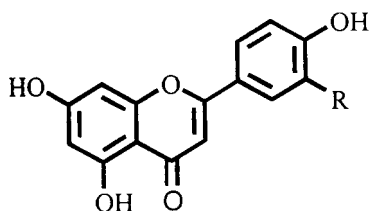


1a : gentisic acid



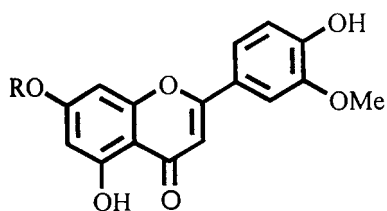
2a : 2-hydroxy-4-methoxybenzaldehyde

b. Flavones

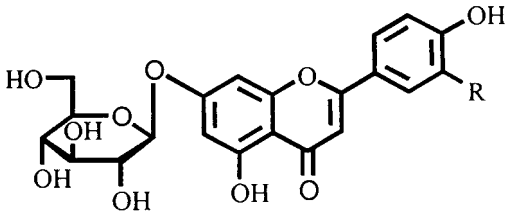


1b : R = H : apigenin

2b : R = OH : chrysoeriol



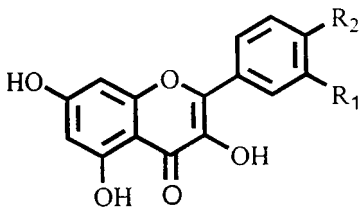
3b : R = Rha-(1→2)-glc : chrysoeriol 7-O-neohesperidoside



4b : R = H : cosmosin

5b : R = OH : cynaroside

c. Flavonols



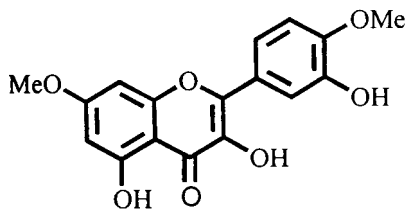
R₁ R₂

1c : H OH : kaempferol

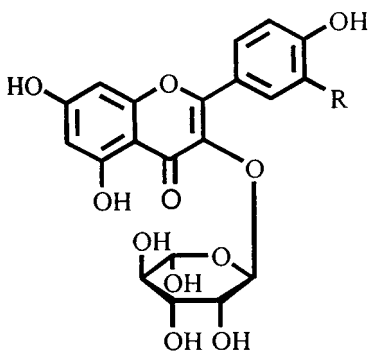
2c : OH OH : quercetin

3c : OH OMe : quercetin 4'-methoxy

4c : OMe OMe : quercetin 3',4'-dimethoxy

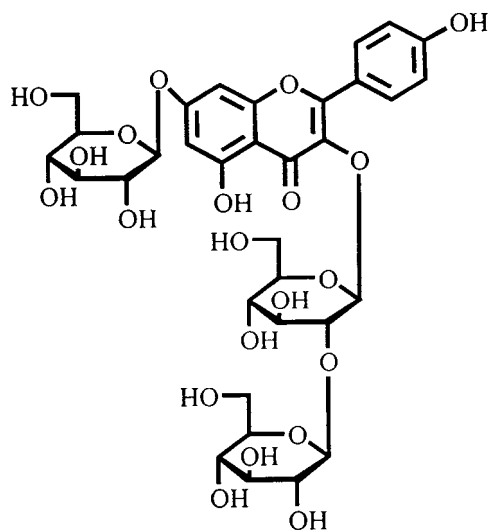


5c : quercetin 7,4'-dimethyl ether

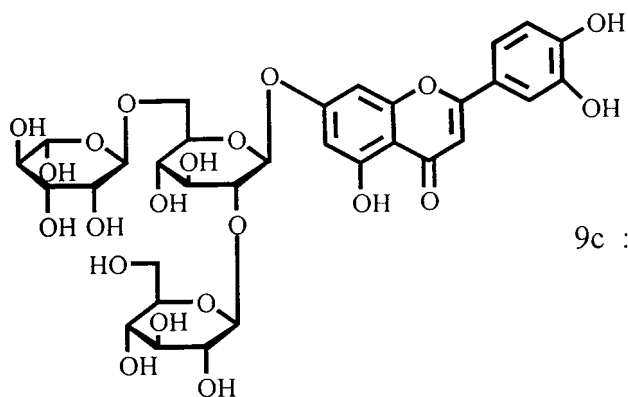


6c : R = H : kaempferol 3-O-rhamnoside

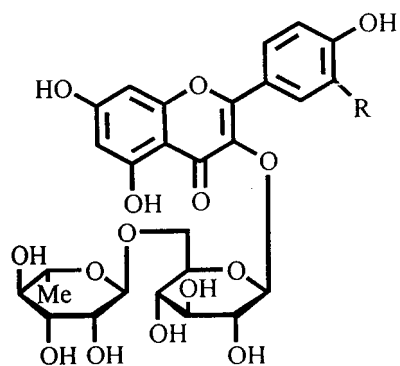
7c : R = OH : quercitrin



8c : kaempferol 3-sophoroside-7-rhamnoside



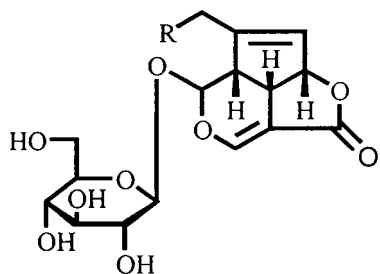
9c : morindaoside



10c : R = H : nicotiflorin

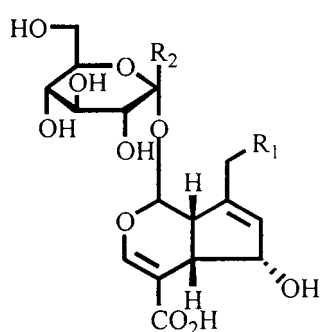
11c : R = OH : rutin

d. Iridoid monoterpenes



1d : R = OH : asperuloside

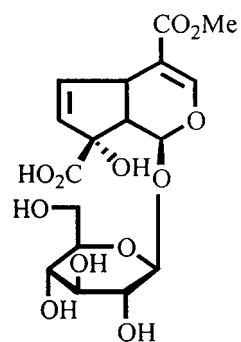
2d : R = OAc : deacetyl asperulosidic acid



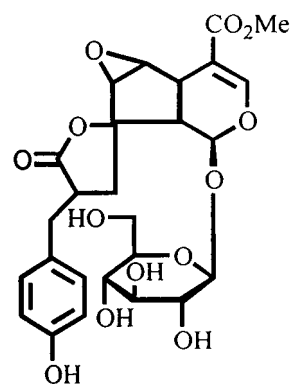
R₁ R₂

3d : OAc H : asperulosidic acid

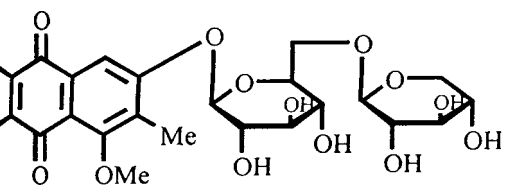
4d : OH OH : monotropein



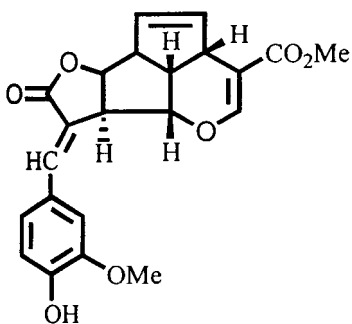
5d : citrifolinin A



6d : citrifolinin A

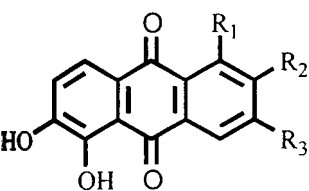


7d : longifloroside



8d : oruwacin

e. Quinoids



	R ₁	R ₂	R ₃	
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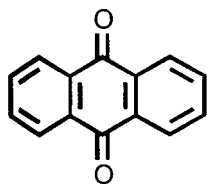
1e :	OH	Me	H	: morindone
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2e :	OH	Me	OH	: morindone-3-hydroxy
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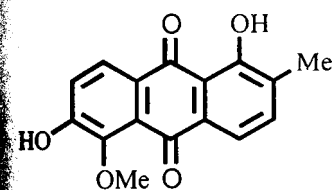
3e :	OH	H	H	: 1,5,6-trihydroxyanthraquinone
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4e :	OH	CH ₂ OH	OH	: lucidin-5,6-dihydroxy
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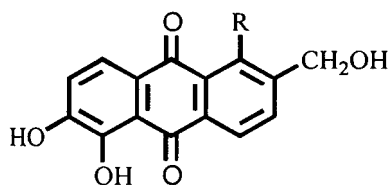
5e :	H	Me	OH	: 3,5,6-trihydroxy-2-methylantraquinone
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6e : anthraquinone

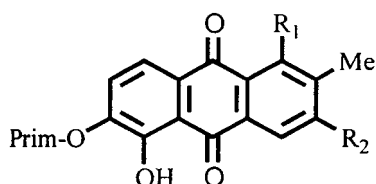


7e : morindone-5-methyl ether



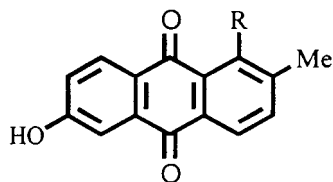
8e : R = H : aloe emodin

9e : R = OH : morindaparvin B



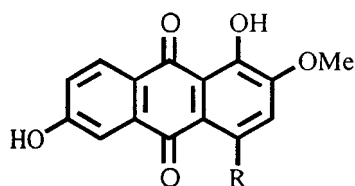
	R ₁	R ₂	
10e :	OH	H	morindone-6- β -primeveroside

11e :	H	OH	2-methyl-3,5,6-trihydroxyanthraquinone-6- β -primeveroside
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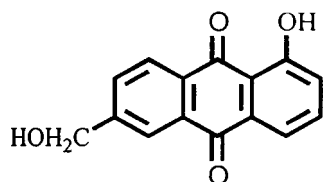
12e : R = OH : soranjidiol

13e : R = OMe : soranjidiol-1-methyl ether

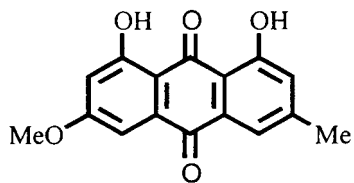


14e : R = H : 1,6-dihydroxy-2-methoxyanthraquinone

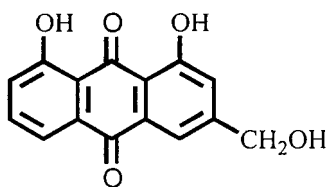
15e : R = OMe : 1,6-dihydroxy-2,4-dimethoxyanthraquinone



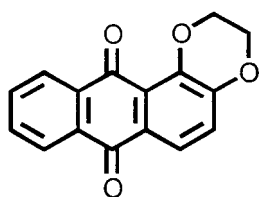
16e : 1-hydroxy-6-hydroxymethylantraquinone



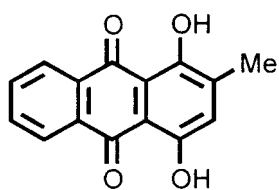
17e : physcion



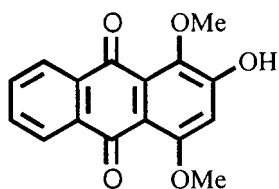
18e : rhein



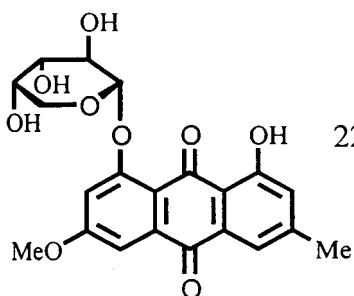
19e : morindaparvin A



20e : 1,4-dihydroxy-2-methylanthraquinone

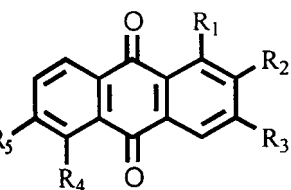


21e : 2-hydroxy-1,4-dimethoxyanthraquinone

22e : physcion-8-*O*- α -L-arabinopyranoside

	R ₁	R ₂	R ₃	R ₄	R ₅
23e :	H	<i>O</i> - β -prim	H	H	H

: ruberythric acid



24e :	OH	CH ₂ OH	<i>O</i> - β -prim	H	H
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: lucidin-3-*O*- β -D-primeveroside

25e :	OH	CH ₂ OH	<i>O</i> - β -prim	OH	OH
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: 5-6-dihydroxylucidin-3-*O*- β -D-primeveroside

26e :	OH	<i>O</i> - β -prim	H	OH	Me
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: morindin

27e : R = H : 1-hydroxyanthraquinone

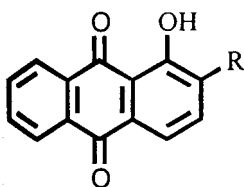
28e : R = Me : 1-hydroxy-2-methylanthraquinone

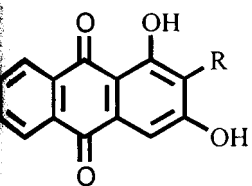
29e : R = CHO : 2-formyl-1-hydroxyanthraquinone

30e : R = CH₂OH : digiferruginol

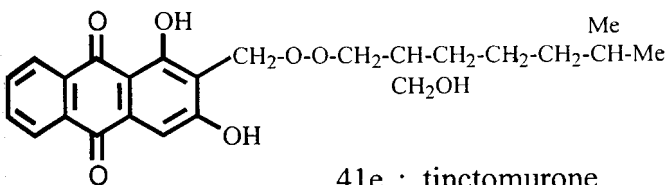
31e : R = OH : alizarin

32e : R = OMe : alizarin-2-methyl ether

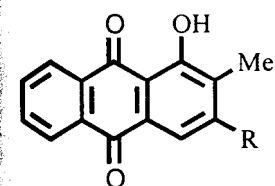




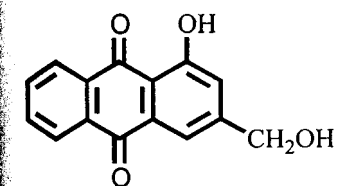
- 33e : R = H : xanthopurparin
 34e : R = Me : rubiadin
 35e : R = CHO : nordamnacanthal
 36e : R = CH₂OH : lucidin
 37e : R = CH₂OMe : 1,3-dihydroxy-2-methoxymethylantraquinone
 38e : R = CH₂OEt : lucidin- ω -ethyl ether
 39e : R = CO₂H : munjistin
 40e : R = CO₂Me : munjistin methyl ester



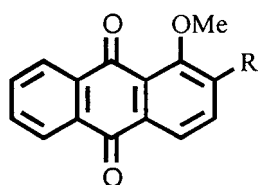
41e : tinctomurone



- 43e : R = Me : 1-hydroxy-2,3-dimethylantraquinone
 44e : R = OMe : mono-methoxy rubiadin
 45e : R = (CH₂)₂OH : mono-ethoxy rubiadin



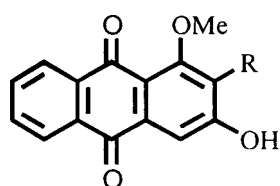
46e : 1-hydroxy-3-hydroxymethylantraquinone



47e : R = Me : 1-methoxy-2-methylantraquinone

48e : R = OH : alizarin-1-methyl ether

49e : R = OMe : anthragallol-1,2-dimethyl ether



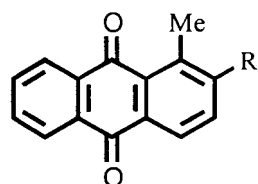
50e : R = H : purpurin-1-methyl ether

51e : R = Me : rubiadin-1-methyl ether

52e : R = CHO : damnacanthal

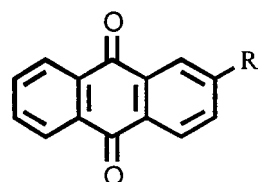
53e : R = CH₂OH : damnacanthol

54e : R = OMe : anthragallol-2,3-dimethyl ether



55e : R = H : 1-methylantraquinone

56e : R = Me : 1,2-dimethylantraquinone



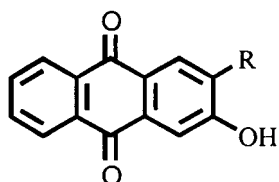
57e : R = Me : techtoquinone

58e : R = OMe : 2-methoxyanthraquinone

59e : R = CHO : 2-formylantraquinone

60e : R = CH₂OH : 2-hydroxymethylantraquinone

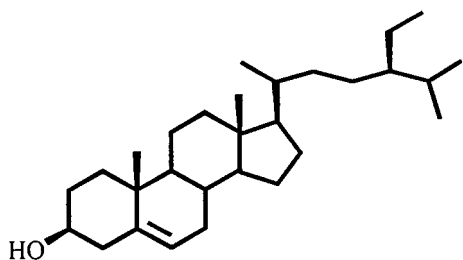
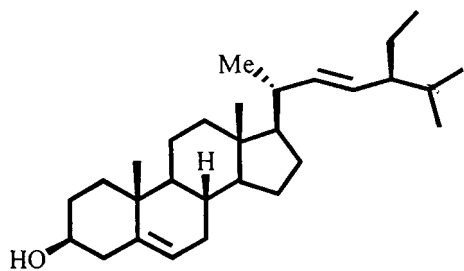
61e : R = OH : 2-hydroxyanthraquinone



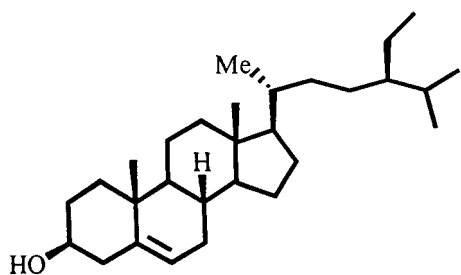
62e : R = CH₂OH : 3-hydroxy-2-hydroxymethylantraquinone

63e : R = CH₂CHO : 2-carbaldehyde-3-hydroxyanthraquinone

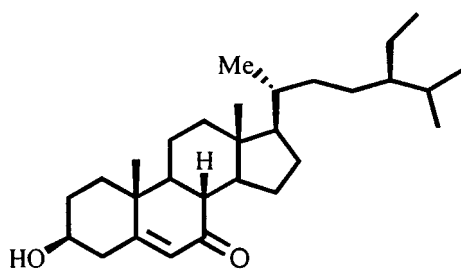
f. Steroids

1f : β -sitosterol

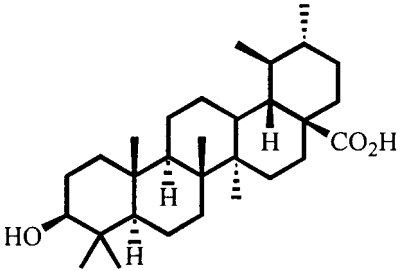
2f : stigmasterol



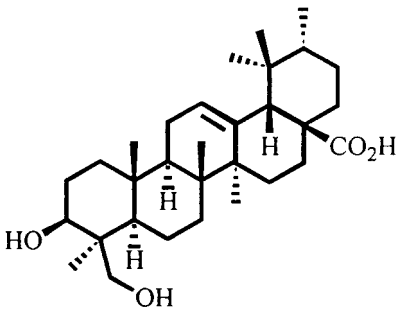
3f : 24-ethylcholesterol

4f : 7-oxo- β -sitosterol

g. Triterpenes

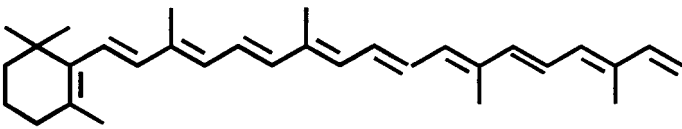


1g : ursolic acid

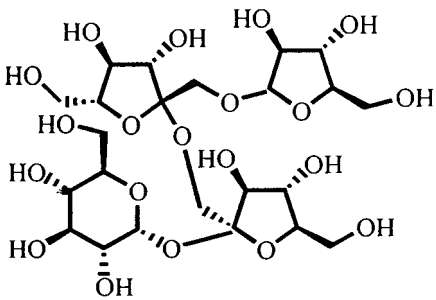


2g : rotungenic acid

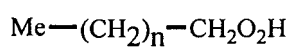
h. Miscellaneous



1h : β -carotene



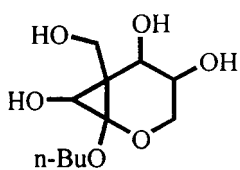
2h : nystose



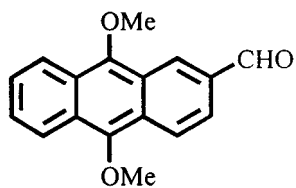
3h : n = 4 : caproic acid

4h : n = 6 : caprylic acid

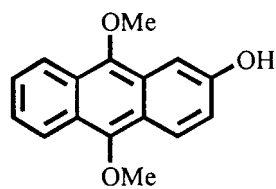
5h : n = 24 : hexacosanoic acid



6h : officinalisin



7h : oruwal



8h : oruwalol

1.3 Biological Activities of *Morinda elliptica*

M. elliptica (Rubiaceae) has been used in the folk medicine for various purposes. Different parts of the plant are used for the treatment of several health problems, ailments including loss of appetite, headaches, cholera, diarrhea, fever and hemorrhoids (Burkill, 1966). Ten percent aqueous methanolic extract of root (fresh) has been reported to show strong anticrustacean activity (Mackeen, *et al.*, 2000). The pure compounds, 2-formyl-1-hydroxyanthraquinone, 1-hydroxy-2-methylantraquinone, nordamancanthal, damancanthal, lucidin- ω -methyl ether, rubiadin, rubiadin-1-methyl ether, soranjidiol, morindone, morindone-5-methyl ether and alizarin-1-methyl ether) isolated from the roots (Ismail, *et al.*, 1997) have been reported to have anti-HIV, cytotoxic and antimicrobial activities (Ali, *et al.*, 2000).

1.4 Objective

This research involved isolation, purification and structure elucidation of chemical constituents isolated from the stems of *M. elliptica* collected in Pattani province, Southern part of Thailand.