

CHAPTER II

Historical

1. Chemical Constituents of the Genus *Fissistigma*

The chemical constituents of plants in the genus *Fissistigma* are mainly isoquinoline alkaloids although flavonoids are also present in lesser amount (Table 1). Only six species of *Fissistigma* have been chemically studied.

Table 1 Distribution of chemical constituents in the genus *Fissistigma*

Plant species	Chemical constituent	Category	Part	Reference
<i>Fissistigma balansae</i>	Columbamine (1)	protoberberine	twig	Chia, Chang, Li <i>et al.</i> , 1998
	Dehydrodiscretamine (2)	protoberberine	twig	Chia, Chang, Li <i>et al.</i> , 1998
	Fissilandione (3)	p-quinonoid aporphine	twig	Chia, Chang and Wu, 1998
	Fissisaine (4)	protoberberine	twig	Chia, Chang, Li <i>et al.</i> , 1998

Table 1 Distribution of chemical constituents in the genus *Fissistigma* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	Kikemanine (5)	tetrahydro- protoberberine	twig	Chia, Chang, Li <i>et al.</i> , 1998
	Norfissilandione (6)	p-quinonoid aporphine	twig	Chia, Chang and Wu, 1998
	Thaipetaline (7)	tetrahydro- protoberberine	twig	Chia, Chang, Li <i>et al.</i> , 1998
<i>F. glaucescens</i>	(-)-Asimilobine (8)	aporphine	stem bark	Lu <i>et al.</i> , 1985
	Atherosperminine (9)	phenanthrene	stem wood root bark	Lu <i>et al.</i> , 1985 Wu <i>et al.</i> , 1990
	Atherosperminine <i>N</i> - oxide (10)	phenanthrene	root bark	Wu <i>et al.</i> , 1990
	(-)-Crebanine (11)	aporphine	stem wood stem bark	Lu <i>et al.</i> , 1985 Lu <i>et al.</i> , 1985

Table 1 Distribution of chemical constituents in the genus *Fissistigma* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	(-)-Discretamine (12)	tetrahydro protoberberine	stem wood stem bark	Lu <i>et al.</i> , 1985 Lu <i>et al.</i> , 1985
	Fissicesine (13)	phenanthrene	root bark	Wu <i>et al.</i> , 1990
	Fissicesine <i>N</i> -oxide (14)	phenanthrene	root bark	Wu <i>et al.</i> , 1990
	Kaufumine (15)	oxoaporphine	not specified root bark	Wu <i>et al.</i> , 1987 Wu <i>et al.</i> , 1990
	Liriodenine (16)	oxoaporphine	stem wood root bark	Lu <i>et al.</i> , 1985 Wu <i>et al.</i> , 1990
	<i>N</i> -methylathero- sperminium (17)	phenanthrene	stem wood stem bark	Lu <i>et al.</i> , 1985 Lu <i>et al.</i> , 1985
	<i>N</i> -norathero- sperminine (18)	phenanthrene	stem wood	Lu <i>et al.</i> , 1985
	(-)-Norannura- dhapurine (19)	aporphine	stem wood stem bark	Lu <i>et al.</i> , 1985 Lu <i>et al.</i> , 1985

Table 1 Distribution of chemical constituents in the genus *Fissistigma* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	Oxocrebanine (20)	oxoaporphine	stem wood root bark	Lu <i>et al.</i> , 1985 Wu <i>et al.</i> , 1990
<i>F. kwangsiense</i>	8-Hydroxy-5,6,7-trimethoxy-flavanone (21) [kwangsienin A]	flavanone	stem bark	Shang <i>et al.</i> , 1994
<i>F. lanuginosum</i>	Dihydropedicin (22)	chalcone	leaf	Alias <i>et al.</i> , 1995
	6,7-Dimethoxy-5,8-dihydroxy-flavone (23)	flavone	leaf	Alias <i>et al.</i> , 1995
	Fissistin (24)	chalcone	leaf	Alias <i>et al.</i> , 1995
	Isofissistin (25)	chalcone	leaf	Alias <i>et al.</i> , 1995
	Pedicin (26)	chalcone	leaf	Alias <i>et al.</i> , 1995
<i>F. oldhamii</i>	(-)-Anolobine (27)	aporphine	stem wood	Lu <i>et al.</i> , 1985
	Anonaine (28)	aporphine	not specified	Xu <i>et al.</i> , 1982

Table 1 Distribution of chemical constituents in the genus *Fissistigma* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	(-)-Calycinine (29) (Fissoldine)	aporphine	not specified	Xu <i>et al.</i> , 1982
			not specified	Xu <i>et al.</i> , 1983
			not specified	Lu <i>et al.</i> , 1983
			stem bark	Lu <i>et al.</i> , 1985
			stem	Wu <i>et al.</i> , 1993
	Fissistigine A (30)	aporphine	not specified	Xu <i>et al.</i> , 1982
	Fissistigine B (31)	aporphine	not specified	Xu <i>et al.</i> , 1982
	Fissistigine C (32)	aporphine	not specified	Xu <i>et al.</i> , 1982
	Fissohamione (33)	furanone	seed	Chia <i>et al.</i> , 1999
	<i>N</i> -methyl-2,3,6-tri- methoxymorphinan- dien-7-one (34)	morphinandie- none	stem	Wu <i>et al.</i> , 1993
	<i>N</i> -norxylopinine (35)	aporphine	not specified	Lu <i>et al.</i> , 1983
	(-)-Norannura- dhapurine (19)	aporphine	stem wood	Lu <i>et al.</i> , 1985

Table 1 Distribution of chemical constituents in the genus *Fissistigma* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	(+)- <i>O</i> -methyl-flavinantine (36)	morphinandienone	stem bark	Lu <i>et al.</i> , 1985
	<i>O</i> -methylmoschatoline (37)	oxoaporphine	stem	Wu <i>et al.</i> , 1993
	Syringic acid (38)	carboxylic acid	not specified	Xu <i>et al.</i> , 1982
			not specified	Xu <i>et al.</i> , 1983
	<i>trans</i> -cinnamic acid (39)	carboxylic acid	not specified	Xu <i>et al.</i> , 1982
			not specified	Xu <i>et al.</i> , 1983
	2,3,6-Trimethoxymorphinandien-7-one (40)	morphinandienone	stem	Wu <i>et al.</i> , 1993
	Xylopine (41)	aporphine	not specified	Lu <i>et al.</i> , 1983
			stem bark	Lu <i>et al.</i> , 1985
			stem wood	Lu <i>et al.</i> , 1985
			stem	Wu <i>et al.</i> , 1993
				Xu <i>et al.</i> , 1985

Table 1 Distribution of chemical constituents in the genus *Fissistigma* (continued)

Plant species	Chemical constituent	Category	Part	Reference
<i>F. polyanthoides</i>	Capaurimine (42)* (ALK1)	tetrahydro protoberberine	stem bark	Theraratthailert, 1996
	2',5'-Dihydroxy-3',4',6'- trimethoxy-dihydro- chalcone (43)	dihydro- chalcone	stem bark	Theraratthailert, 1996
	Isopedicin (44)	flavanone	stem bark	Theraratthailert, 1996

*The structure of this compound has been revised in this study.

2. Chemical Constituents of the Genus *Ochna*

The majority of the chemical constituents of plants in the genus *Ochna* are flavonoids (Table 2). Derivatives of lipids, benzenoids, steroids, quinoids are also found.

Table 2 Distribution of chemical constituents in the genus *Ochna*

Plant species	Chemical constituent	Category	Part	Reference
<i>Ochna</i>	Ochnaflavone (45)	biflavone	leaf	Kamil <i>et al.</i> , 1983
<i>atropurpurea</i>			leaf	Khan <i>et al.</i> , 1984

Table 2 Distribution of chemical constituents in the genus *Ochna* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	Palmitoleic acid (46)	fatty acid	seed	Ahmad <i>et al.</i> , 1982
<i>O. calodendron</i>	Calodenin A (47)	biflavonoid	stem bark	Messanga <i>et al.</i> , 1994
	Calodenin B (48)	biflavonoid	stem bark	Messanga <i>et al.</i> , 1994
	Calodenin C (49) [guibourtinidol- (4 α →8)-afzelechin]	dimeric proan- thocyanidin	stem bark	Messanga, Ghogomu <i>et al.</i> , 1998
	Calodenone (50)	isobiflavonoid	stem bark	Messanga <i>et al.</i> , 1992
	5,4'-Dihydroxy-3'- methoxy-6,7- methylenedioxy- isoflavone (51)	isoflavone	stem heartwood	Messanga <i>et al.</i> , 1998
	5-Hydroxy-4'- methoxy-6,7- methylenedioxy- isoflavone (52)	isoflavone	stem heartwood	Messanga <i>et al.</i> , 1998

Table 2 Distribution of chemical constituents in the genus *Ochna* (continued)

Plant species	Chemical Constituent	Category	Part	Reference
	Lophirone A (53)	biflavonoid	stem bark	Messanga <i>et al.</i> , 1992
	Lophirone C (54)	biflavonoid	stem bark	Messanga <i>et al.</i> , 1994
	Lophirone K (55)	biflavonoid	stem bark	Messanga <i>et al.</i> , 1994
	β -sitosterol- β -D-glucosid	glycoside	stem bark	Messanga <i>et al.</i> , 1992
<i>O. jabotapita</i>	Isoorientin (56)	C-glycosyl-flavone	leaf	Nair <i>et al.</i> , 1975
	Orientin (57)	C-glycosyl-flavone	leaf	Nair <i>et al.</i> , 1975
	Vitexin (58)	C-glycosyl-flavone	leaf	Nair <i>et al.</i> , 1975
<i>O. obtusata</i>	2,3-Dihydro ochnaflavone (59)	biflavonoid	leaf	Rao <i>et al.</i> , 1997
	2,3-Dihydro ochnaflavone 7-O-methyl ether (60)	biflavonoid	leaf	Rao <i>et al.</i> , 1997

Table 2 Distribution of chemical constituents in the genus *Ochna* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	Kaempferol 3- <i>O</i> -glucoside (61)	glycosyl-flavone	leaf	Rao <i>et al.</i> , 1997
	Ochnaflavone (45)	biflavone	leaf	Rao <i>et al.</i> , 1997
	Przewalskinone B (62)	anthraquinone	stem bark	Sivaprakasam <i>et al.</i> , 1997
	Quercetin 3- <i>O</i> -glucoside (Isoquercitrin) (63)	glycosyl-flavone	leaf	Rao <i>et al.</i> , 1997
<i>O. pulchra</i>	Acetylvismione D (64)	anthranoid	root bark	Sibanda <i>et al.</i> , 1993
	3- <i>O</i> -geranylemodin anthrone (65)	anthranoid	root bark	Sibanda <i>et al.</i> , 1993
	(-)-Ochnabianthrone(66)	anthranoid	root bark	Sibanda <i>et al.</i> , 1990
	Vismione D (67)	anthranoid	root bark	Sibanda <i>et al.</i> , 1993
	Vismione L (68)	anthranoid	root bark	Sibanda <i>et al.</i> , 1993

Table 2 Distribution of chemical constituents in the genus *Ochna* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	Vismione M (69)	anthranoid	root bark	Sibanda <i>et al.</i> , 1993
<i>O. pumila</i>	Ochnaflavone (45)	biflavone	leaf	Kamil <i>et al.</i> , 1983
			leaf	Kamil <i>et al.</i> , 1987
	7''-O-methyl ochnaflavone (70)	biflavone	leaf	Kamil <i>et al.</i> , 1983
			leaf	Kamil <i>et al.</i> , 1987
	7''-O-methyl tetrahydro amentoflavone (71)	biflavone	leaf	Kamil <i>et al.</i> , 1987
	Tetrahydro- amentoflavone (72)	biflavone	leaf	Kamil <i>et al.</i> , 1987
<i>O. squarrosa</i>	Campesterol (73)	steroid	not specified	Purushothaman <i>et al.</i> , 1980
	4', 7-Di-O-methyl ochnaflavone (74)	diflavonyl- ether	leaf	Okigawa <i>et al.</i> , 1976
	Isovitexin (75)	C-glycosyl- flavone	leaf	Mohammad <i>et al.</i> , 1982

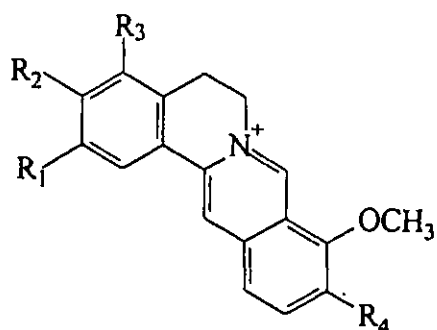
Table 2 Distribution of chemical constituents in the genus *Ochna* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	5-Methoxyfurano- (2'',3'':7,8)- flavone (76)	flavone	stem	Reddy <i>et al.</i> , 1983
	n-octacosanol (77)	long-chained alcohol	not specified	Purushothaman <i>et al.</i> , 1980
	Ochnaflavone (45)	biflavone	leaf	Okigawa <i>et al.</i> , 1976
	4'-O-methyl ochnaflavone (78)	diflavonyl- ether	leaf	Okigawa <i>et al.</i> , 1976
	Orientin (57)	C-glycosyl- flavone	leaf	Mohammad <i>et al.</i> , 1982
	β -sitosterol (79)	steroid	heartwood	Rao <i>et al.</i> , 1989
	β -sitosterol glucoside	glycoside	not specified	Purushothaman <i>et al.</i> , 1980
	Squarrosin (80)	isoflavone	heartwood	Rao <i>et al.</i> , 1989

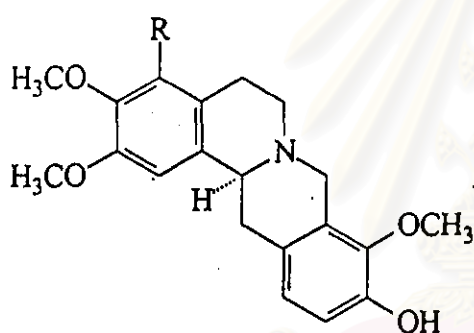
Table 2 Distribution of chemical constituents in the genus *Ochna* (continued)

Plant species	Chemical constituent	Category	Part	Reference
	5,7,8-Trimethoxy-3',4'-methylene-dioxyisoflavone (81)	isoflavone	root bark	Nia <i>et al.</i> , 1992
	5,3',4'-Trimethoxy-6,7-methylenedioxy-isoflavone (82) [Methyliriskumaonin]	isoflavone	heartwood	Rao <i>et al.</i> , 1989
	Vitexin (58)	C-glycosyl-flavone	leaf	Mohammad <i>et al.</i> , 1982

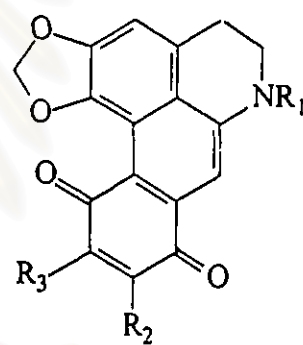
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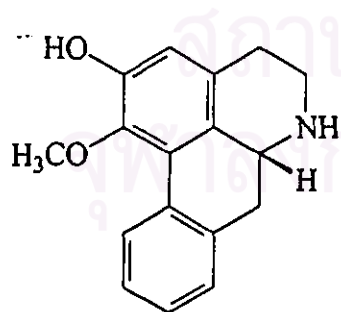
	R ₁	R ₂	R ₃	R ₄
(1) Columbamine	OH	OCH ₃	H	OCH ₃
(2) Dehydrodiscretamine	OCH ₃	OH	H	OH
(4) Fissisaine	OCH ₃	OCH ₃	OH	OH



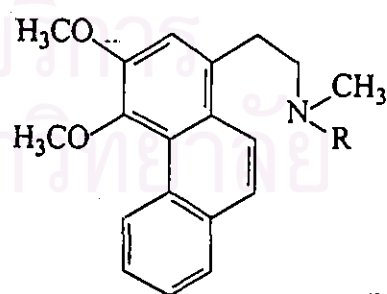
	R
(5) Kikemanine	H
(7) Thaipetaline	OH



	R ₁	R ₂	R ₃
(3) Fissilandione	CH ₃	OCH ₃	H
(6) Norfissilandione	H	OCH ₃	H



(8) (-)-Asimilobine



(9) Atherosperminine

(18) N-noratherosperminine

Figure 1 Structures of chemical constituents of *Fissistigma*.

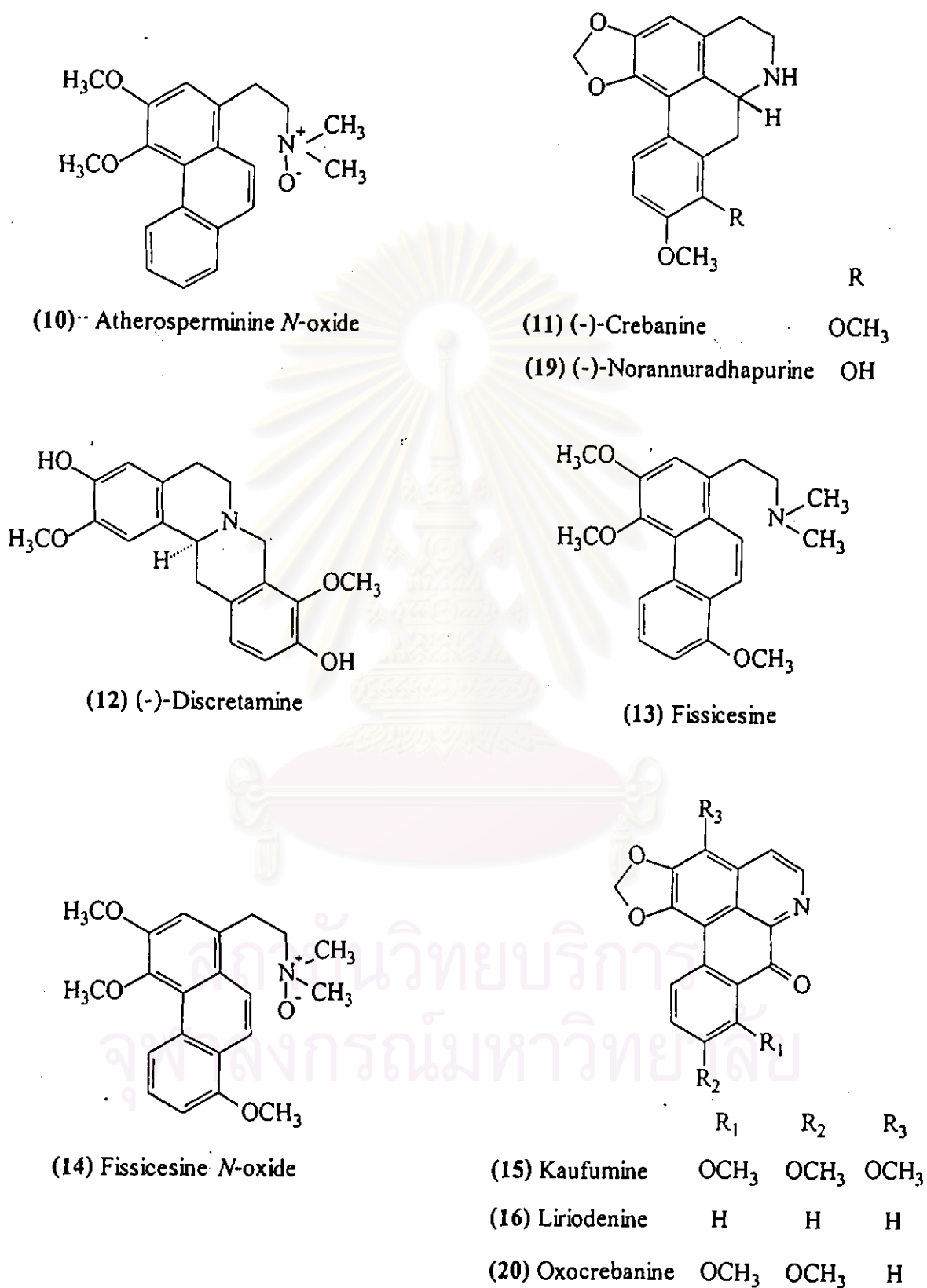
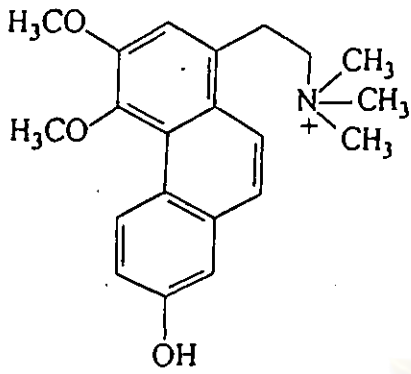
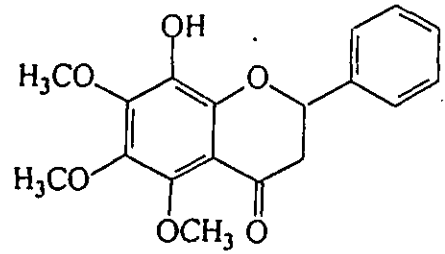
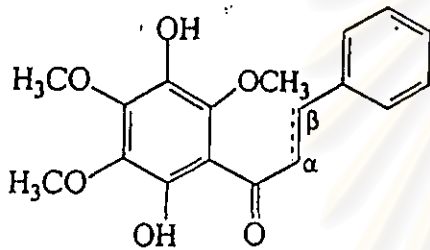


Figure 1 Structures of chemical constituents of *Fissistigma* (continued).

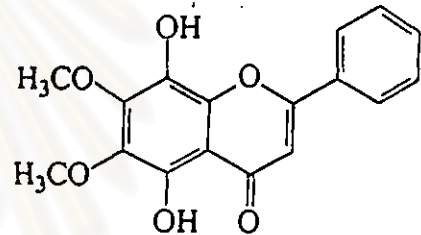
(17) *N*-methylatherosperminium

(21) 8-Hydroxy-5,6,7-trimethoxyflavanone

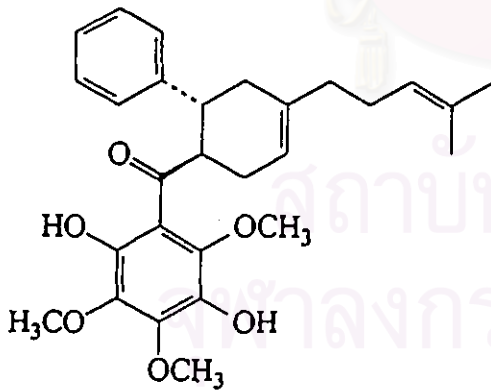
(Kwangsienin A)



(22) Dihydropedicin



(23) 6,7-Dimethoxy-5,8-hydroxyflavone

(26) Pedicin $\Delta^{\alpha,\beta}$ 

(24) Fissistin



(25) Isofissistin

Figure 1 Structures of chemical constituents of *Fissistigma* (continued).

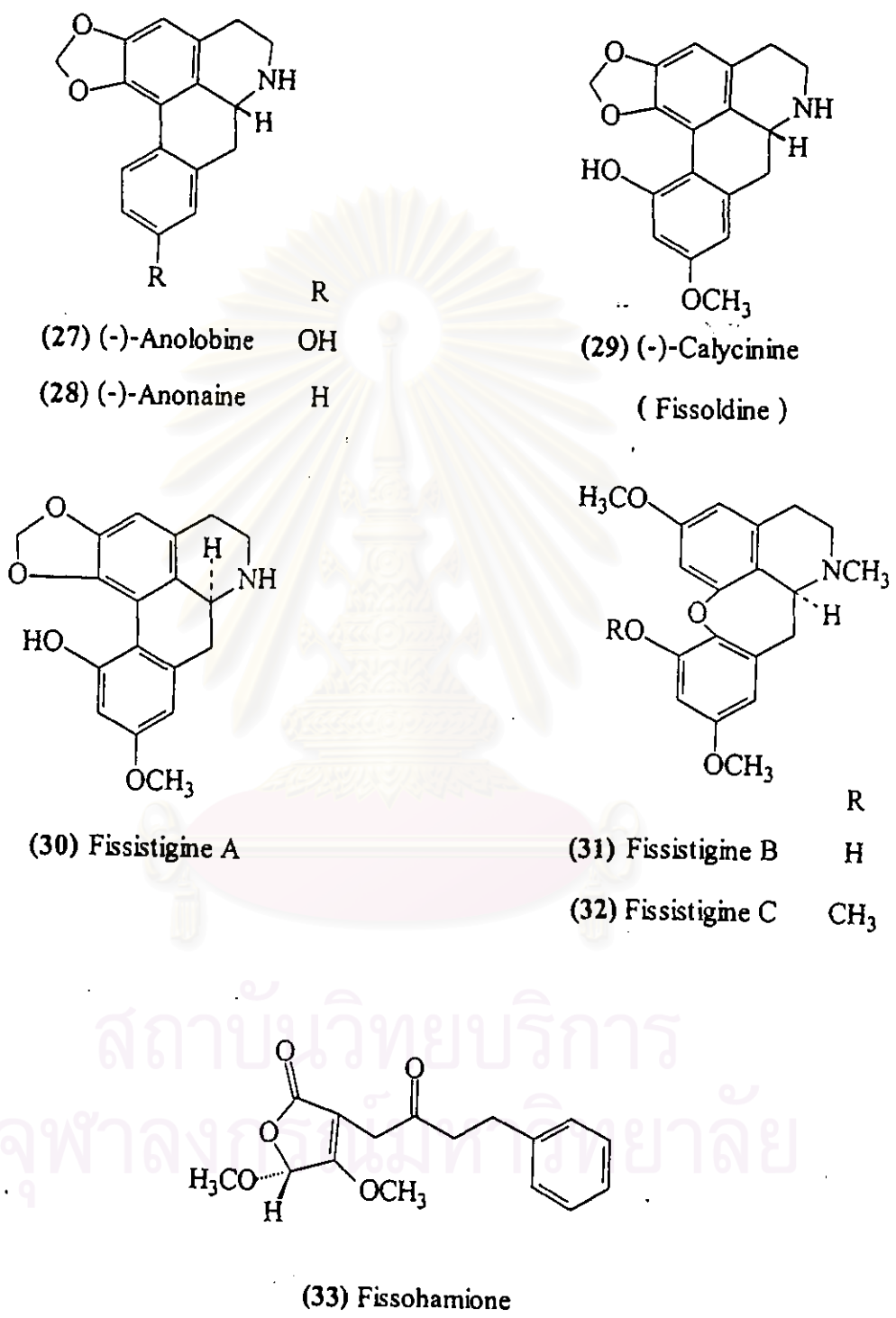
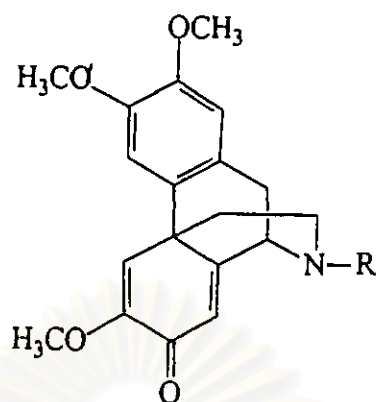


Figure 1 Structures of chemical constituents of *Fissistigma* (continued).



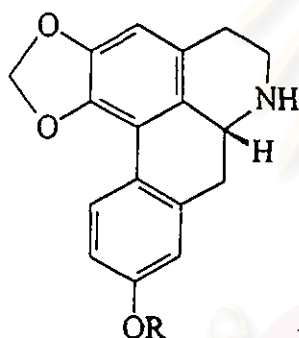
(34) *N*-methyl-2,3,6-trimethoxymorphinandien-7-one

(40) 2,3,6-trimethoxymorphinandien-7-one

R

CH₃

H

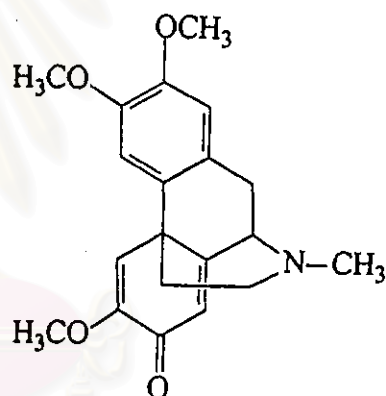


(35) *N*-norxylopine

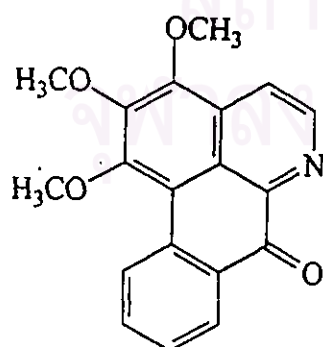
(41) (-)-Xylopine

R

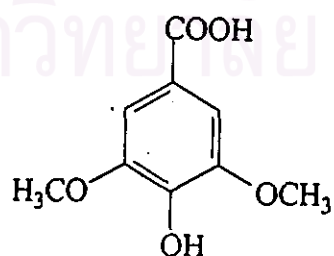
H

CH₃

(36) (+)-*O*-methylflavinantine



(37) *O*-methhlymoschatoline



(38) Syringic acid

Figure 1 Structures of chemical constituents of *Fissistigma* (continued).

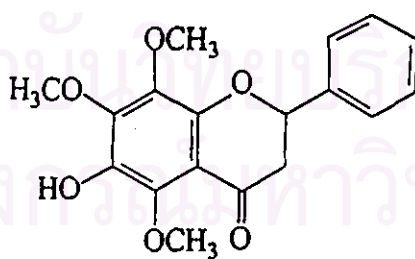
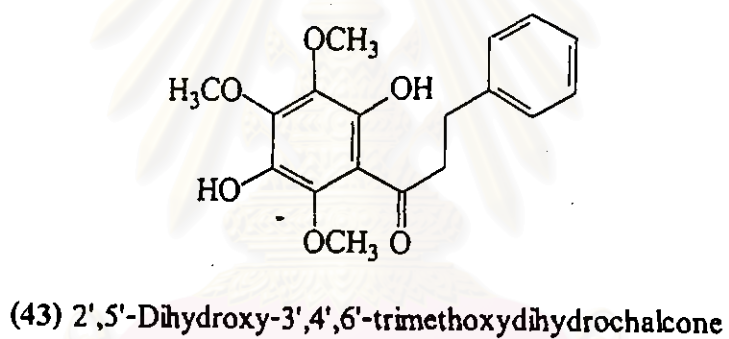
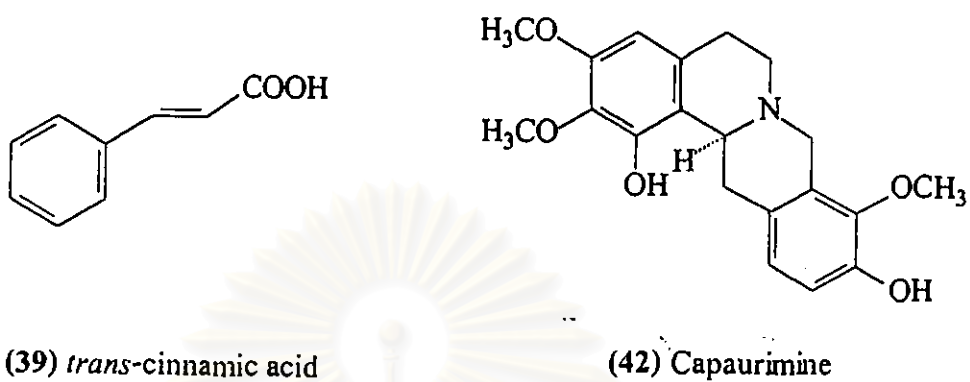
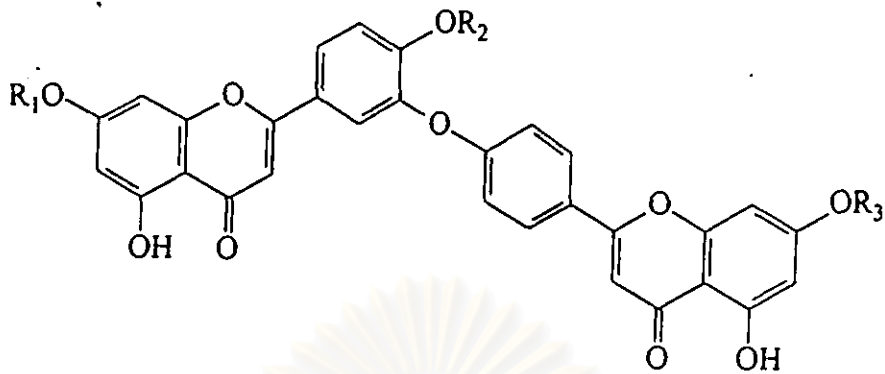
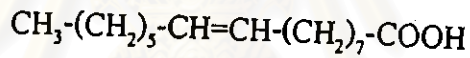


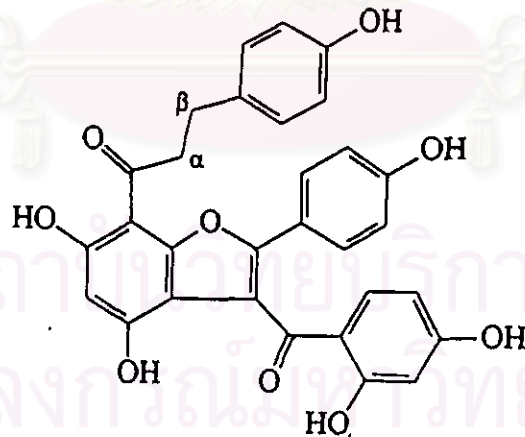
Figure 1 Structures of chemical constituents of *Fissistigma* (continued).



	R ₁	R ₂	R ₃
(45) Ochnaflavone	H	H	H
(70) 7''-O-methyl ochnaflavone	H	H	CH ₃
(74) 4', 7-di-O-methyl ochnaflavone	CH ₃	CH ₃	H
(78) 4'-O-methyl ochnaflavone	H	CH ₃	H

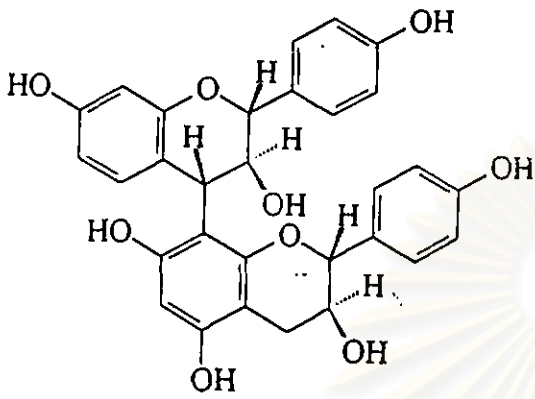


(46) Palmitoleic acid

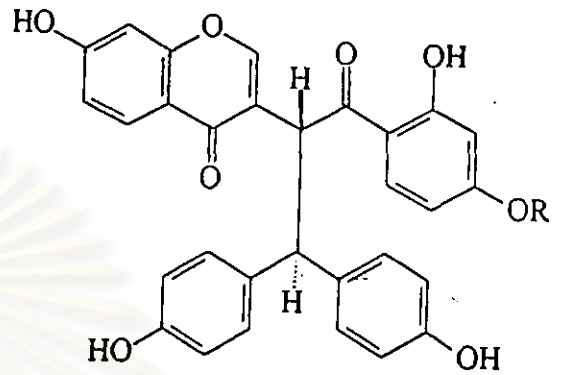


(47) Calodenin A

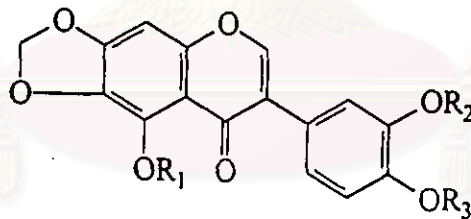
(48) Calodenin B [E- α,β -dehydro derivative of (47)]Figure 2 Structures of chemical constituents of *Ochna*.



(49) Calodenin C

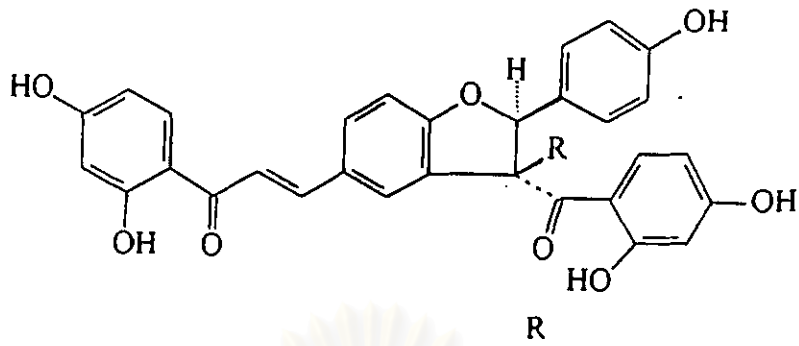


	R
(50) Calodenone	CH ₃
(53) Lophirone A	H



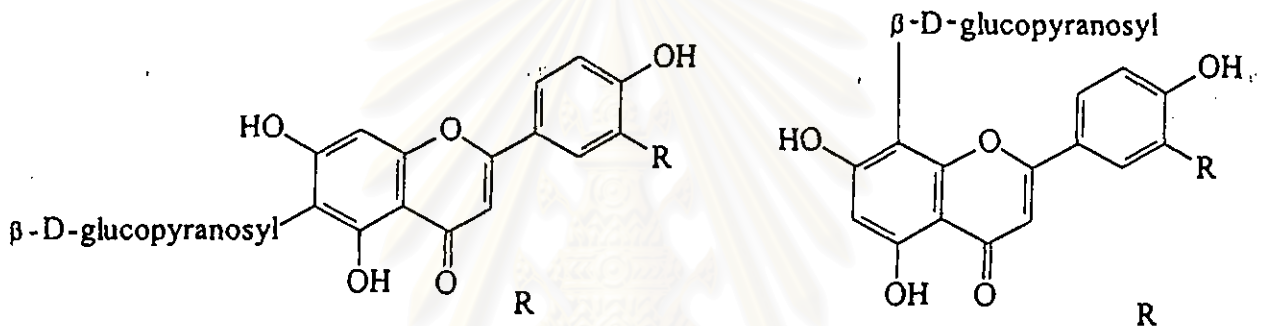
	R ₁	R ₂	R ₃
(51) 5,4'-Dihydroxy-3'-methoxy-6,7-methylenedioxyisoflavone	H	CH ₃	H
(52) 5-Hydroxy-4'-methoxy-6,7-methylenedioxyisoflavone	H	H	CH ₃
(80) Squarrosin	H	CH ₃	CH ₃
(82) 5,3',4'-Trimethoxy-6,7-methylenedioxyisoflavone (Methyliriskumaonin)	CH ₃	CH ₃	CH ₃

Figure 2 Structures of chemical constituents of *Ochna* (continued).



(54) Lophirone C H

(55) Lophirone K OH

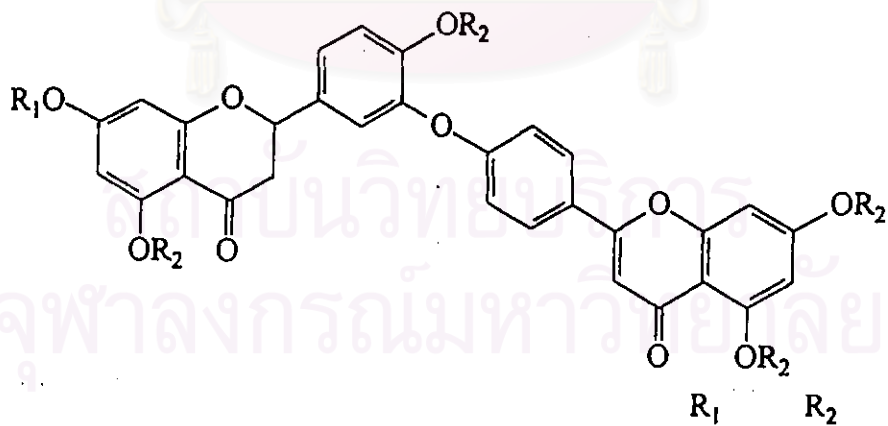


(56) Isoorientin OH

(57) Orientin OH

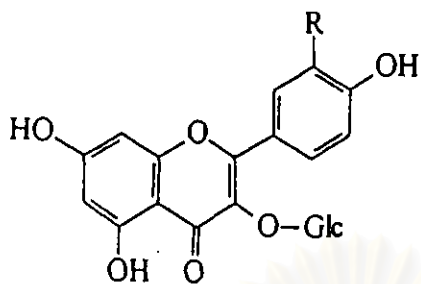
(75) Isovitexin H

(58) Vitexin H



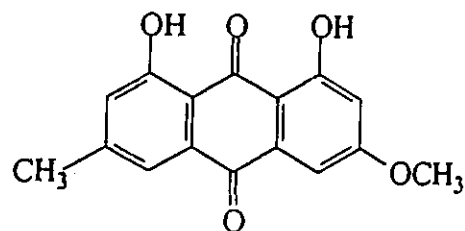
(59) 2,3-dihydrochonaflavone H H

(60) 2,3-dihydrochonaflavone 7-O-methyl ether CH₃ HFigure 2 Structures of chemical constituents of *Ochna* (continued).

(61) Kaempferol 3-*O*-glucoside

R

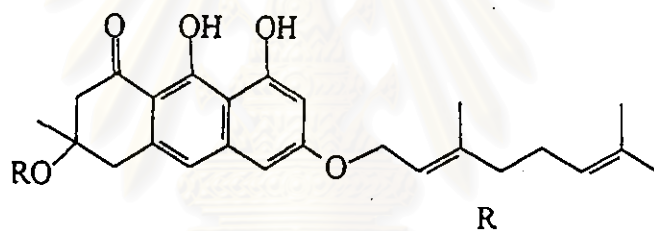
H



(62) Przewalskinone B

(63) Quercetin 3-*O*-glucoside (Isoquercitrin)

OH



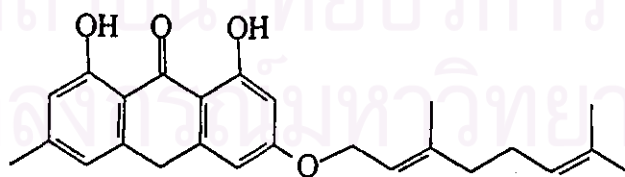
(64) Acetylvismione D

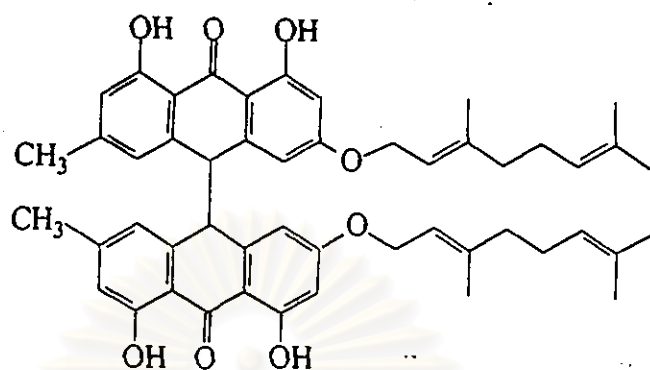
R

Ac

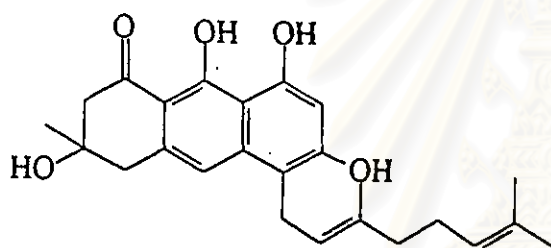
(67) Vismione D

H

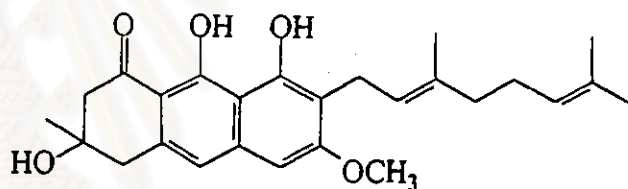
(65) 3-*O*-geranylemodin anthroneFigure 2 Structures of chemical constituents of *Ochna* (continued).



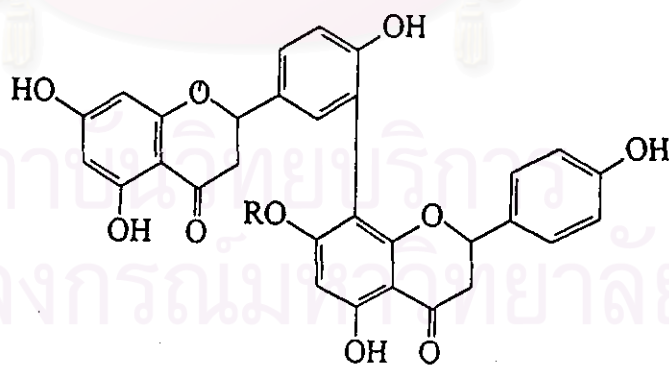
(66) (-)-Ochnabianthrone



(68) Vismione L

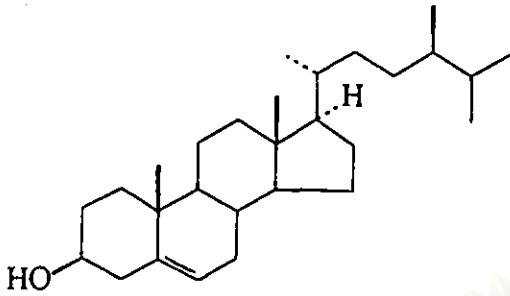


(69) Vismione M

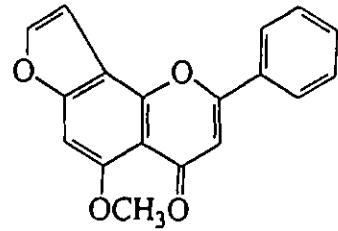
(71) 7''-O-methyl tetrahydroamentoflavone CH₃

(72) Tetrahydroamentoflavone H

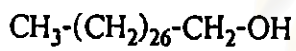
Figure 2 Structures of chemical constituents of *Ochna* (continued).



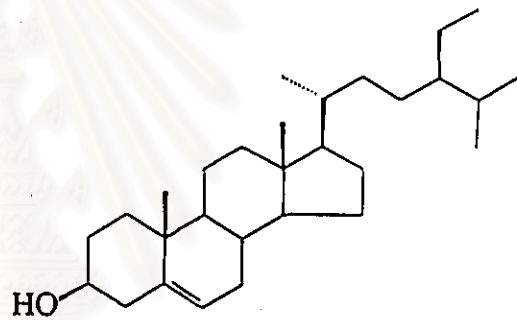
(73) Campesterol



(76) 5-Methoxyfurano (2',3':7,8) flavone



(77) n-octacosanol

(79) β -sitosterol

(81) 5,7,8-trimethoxy-3',4'-methylenedioxyisoflavone

Figure 2 Structures of chemical constituents of *Ochna* (continued).