CHAPTER I

INTRODUCTION

Medicinal plants are plants containing biological active. 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 used in industry e. g. perfume. Medicinal plants have little side effect incontrast to synthetic drugs, as shown by literature surveys.Besides, they are cheap and easily available.

Taa Suea Bai Lek (*Amoora gigantea* Pierre) is an interesting medicinal plants because of its known uses in therapeutic drugs, for example, the woods are bitter bark which can be used as an astringent, the fruits as a treatment for rheumatic pain, the leaves as a treatment for inflammation and the bark as lull sputum. The above-mentioned properties of Taa Suea Bai Lek is the important motivation to search for chemical substance that can be used to treat inflammation. As far as literature surveys no report on Taa Suea Bai Lek are seen at all. Therefore, it is the main objective of this research to investigate the chemical constituents of the leaf of *Amoora gigantea* Pierre. ex. Laness. Moreover, the author wishes to find the chemical substances that can be used to treat inflammation.

Amoora gigantea Pierre.(1,2) (or *Aglaia gigantea* Pelligrin.(3,4)) is the plant in the family and subfamily of "Meliaceae" and "Meliodeae", respectively(5). It is a large perennial tree found in Thailand, Laos, Cambodia and Cochinchina. In Thailand, it is commonly known as Taa Suea Bai Lek which is used as herbal medicine. There are three kinds of this plants(6,7); Taa Suea or Ton klo or Mai pi-pi (*Amoora cucullata* Roxb.), Taa Suea or Taa puu or Ma aa or Ma hang kaan (*Amoora rohituka* or *Aphanamixis polystacha*) and

Taa Suea Bai Lek. (*Amoora gigantea* Pierre. or *Aglaia gigantea* Pelligrin.) In the genus of Amoora, there are twenty-five species(8) for example, *A.rohituka, A. cucullata, A. ridleyi, A. rubescens*, etc.

General Characterization of the Plants in the Family of Meliaceae (9-11)

This family, which consists mostly of large tree plays an important part in the composition of tropical rain forest. There are 1400 species in over 50 genera. Tree or shrubs or at least somewhat ligneous the wood often hard and colored, sometimes fragrant and, exceptionally, with a bitter bark. Leaves mostly alternate, usually pinnate, sometimes pellucid-punctate or-lined; stipules lacking. Flowers usually hermaphrodite, the 4-5 calyx segments commonly imbricate, the 4-5, rarely 3-7, petals free, contoted or imbricate, sometimes connate or adnate with the stamen tube and valvate. Stamens typically 8-10, rarely 5, exceptionally 16-20, the filaments usually connate into a tube that is entire, dentate or variously lacerate, the anthers sessile or stiped, included or exserted, erect, 2-celled, the connective sometimes produced. Disk varying from annulate to vaginate or pulvinate but the ovary free, often 3-5-celled, obtuse or shortly attenuate into the simple elongate style, the stigmas disciform or pyramidal. Ovules usually 2 in each cell, collateral or superposed, rarely solitary. Fruit baccate, capsular or drupaceous, often dehiscing; seeds with or without endosperm, sometimes winged.

Research in the Biological and Pharmacological Activity Screening of Some Meliaceous Plants (12)

During 1968-1972, Dhar., et al. performed the experiments on the biological activity screening of Indian plants including plants in family Meliaceae. The results were summarized in Table 1.

Table 1. The Biological Activity Screening of Some Meliaceous Plants.

Scientific Names	Plant Parts	Observed Activites	Ref.
Aglaia odoratissima Bl.	Plant excluding	Anticancer	13
Cedrela microcarpa C.DC.	Plant excluding	CNS effect	13
Dysoxylum binectariferum Hook.f	Plant excluding	CNS effect	13
Amoora wallachi King.	Stem	Anthelmintic	14
		Antiviral	
		Anticancer	
Amoora rohituka W&A.	Stem	Anticancer	14
(*Aphanamixis polystacha* Parker.)		Blood pressure	
Cedrela toona Roxb.	Stem barks	Spasmogenic	14
		Anticancer	
	Leaves	Antiprotozoa	
		Hypoglycaemic	
		Spasmogenic	
		CNS effect	
Cipadessa fruticosa Bl.	Plant excluding	Spasmogenic	15
Melia azedarach L.	Stem barks	Antiviral	15
		Spasmogenic	
		Anticancer	

The Pharmacological activies of the Meliaceous plant were listed in the following table according to the literature survey.

Table 2. Pharmacological Activities of the Meliaceous Plants.

Scientific Names	Isolated Compounds	Pharmocological Activity	Ref.
Aglaia elliptifolia Merrill.	Rocoglamide	Anti-leukemic	16
Aglaia roxburghiana	Ethanolic extract	Antivirus	17
Amoora grandiofolia	Aphanamol I	Toxic principle	18
	Aphanamol II	Toxic principle	
Azadirachta indica	Meliantriol	Antifeedant	19
	Azadirachtin	Antifeedent	
	Nimbionone	Antibacterial	20
	Nimbionol	Antibacterial	
	Nimbidin	Anti-ulcer	21
		Anti-arthritic	
		Anti-inflammatory	
		Antipyretic	
Dysoxylum alliaceum	(+)-8-hydroxycala-menene	Antibacterial	22
Dysoxylum binectariferum	Dysobinin	CNS-depressant	23
Hook.f.	Rohitukine	Analgesic	24
		Immunodulatory activity	
		Anti-inflammatory	25

Table 2. (continued)

Scientific Names	Isolated Compounds	Pharmacological Activity	Ref.
Dysoxylum lenticellarare Gillespie.	Dysoxyline	Cardiac effect	26
	Homolaudanosine-3-epi-12-hydroxy-schelhammericine	Cardiac effect	
		Cardiac effect	
	Lenticelllarine	Molluscidal activity	27
	Methanoic extract	Cardio depressant	
Dysoxylum richii	Dysoxysulfone	Antibacterial	28
Dysoxylumroseum C.DC.	Dysorone E	Exhibits moderate Cytotoxic activity	29
Melia azedarach Linn.	N9GI	Antitumor	30
	Limonoid glycoside	Antibacterial	31
	Sendanin	Antimurine P388 Lymphocytic leukemia	32
	Meliatoxin	Acute nervous symthom	33
Melia volkeinsii Gurke.	Volkensin	Antifeedant	34
Swierenia mahogani	Swietemahonin A	Inhibition against	35
	Swietemahonin D	PAF-induced aggregation	
	Swietemahonin E		
	Swietemahonin G	(PAF antagonists)	
Turraea nilotica	Lericiresinol 4 monomethyl ether	Anticancer	36

General Characterization of the Plants in "Amoora"Genus (37, 38)

A genus of trees of about twenty-five species, of the family Meliaceae. Some are considerable trees; but the timber is not much used. It is characteristic of trees of this genus to have reddish wood. Infloresences supra-axillary, paniculiform, racemiform, or spiciform; flowers hermaphrodite, male and female; calyx 5-merous or 3-lobed, thick-fleshy, finely cilicate; petals 3, free, imbricate, connivent, concave, suborbicular-oblong, fleshy; stamens 6; filaments connate into an almost entire, irregularly incised or more or less distinctly 3 lobed, subglobose-obovate, fleshy tube; anthers medifixed, oblong; disk obscure; ovary-cells 3, 1-2 ovuled; stigma sessile, entire or 3-lobed; capsule globose-pyriform-ellipsoid, loculicidally 3-valved or indehiscent, coriaceous; pericarp laticiferous; cells 1-0 seeded. Leaves spirally arranged, imparipinnate or partly paripinnate; leaflets entire, thinly to thicky coriaceous. Trees, hairy or with stellate scales.

Research Studies in Chemical Constituents on the Plants in "Amoora" Genus

From literature surveys, there are twenty-five species that belong to Amoora genus, however, only three species in this genus have been studied. The chemical constituent of some Amoora species have been studied since 1976. Many new compounds are isolated from crude extracts of these plants.

In 1976, Sengupta, A. and Mazumder, U.K. (39) investigated on the fatty acid composition of *Amoora rohituka* W&A. seed oil by gas chromatography and found five fatty acids. The mole percentages of individual acids were; palmitic 24.8, stearic 12.4, oleic 20.9, linoleic 28.5, and linolenic 13.4. Triglyceride composition was calculated from the fatty acid composition of the native oil and of the monoglyceride produced from it by pancreatic lipase hydrolysis. This calculation give 2.2, 28.6, 48.1 and 21.1% trisaturated, disaturated., monosaturated. and triunsaturated. glycerides, respectively.

In the same year, Subrahmanyam, K.M., et al. (60) isolated β-sitosterol from the heartwoods of *Amoora wallachi* which was extracted by C_6H_{14}.

In 1977, Conolly, J.D., et al. (40) studied on the structure of rohitukin, limonoid from the subfamily Meliodeae of the family Meliaceae which unusually found high absorption frequency for a six-membered lactone ring. Rohitukin was isolated from the seeds of *Aphanamixis polystacha* Parker. (syn. *Amoora rohituka* W&A.). Its structure was determined by spectroscopic methods.

In 1979, Harmon, A.D., et al. (41) studied on the structure of rohitukine, the main alkaloids from the seeds of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.) which was detected from spectral data and by x-ray crystallographic analysis.

In the same year, Brown, D.A. and Taylor, D.A.H. (42) isolated four limonoids from the seeds of *Aphanamixis polystacha* Parker. (syn. *Amoora*

rohituka W&A.). The structures of limonoids were determined from spectroscopic data (esp. NMR)

In the same year, Polonsky, J., et al. (57) studied on and isolated amoorastatin (Antineoplastic agent) from the seeds of *Aphanamixis grandifolia* (syn. *Amoora grandifolia*). The structure of antineoplastic agent amoorastatin was determined by mass spectroscopy ,^{1}H NMR comparison with aphanastatin and x-ray crystal structure determination of the (28)R-epimer of amoorastatin.

In the same year, Polonsky, J., et al. (58) isolated two new limonoid terpenes from aq. exts. of seeds from *Aphanamixis gradifolia* (syn. *Amoora grandifolia*) and were identified as 12-hydroxyamoorastatin and amoorastatone by mass spectra and NMR data.

In 1980, Mulholland, D.A. and Taylor, D.A.H. (44) isolated a new limonoid from the seeds of *Aphanamixis polystacha* Parker.(syn. *Amoora rohituka* W&A.). The structure was identified as polystachin by ^{1}H and ^{13}C NMR data.

In 1982, Bhatt, S.K., et al. (45) isolated a new saponin from seeds of *Amoora rohituka* W&A.(syn. *Aphanamixis polystacha* Parker.) and its structure was determined by chemical methods to be stigmasta-5,24(28)-dien-3β-O-β-D-glucopyranosyl-O-α-L-rhamnopyranoside.

In the same year, Bhatt, S.K., et al. (56) isolated a new glycoside dihydrorobinetin 7-O-β-D-glucopyranosyl-O-α-L-rhamnopyranoside, m.p.97-99° which was extracted with AcOEt from H_2O-solution portion of the EtOH extraction of *Amoora rohituka* Roxb. seeds and was purified on silica gel.

In 1983, McLachalan, L.K. and Taylor, D.A.H. (43) revised the structures of two limonoids from the seeds of *Amoora rohituka* Parker. (syn. *Aphanamixis polystacha* Parker.) and were reassigned from their carbon-13 and IR spectra.

In 1984, Nishizawa, M., et al. (59) isolated and identified a unique sesquiterpenoids, names, Aphanamol I and II from fruits of *Aphanamixis*

grandifolia (syn. *Amoora grandifolia*), as minor toxic principles and their structures established on the basis of their IR and NMR spectra, esp. 2 dimensional NMR pulse sequence COSY/COSY-45.

In 1985, Srivastava, S.K.and Agnihotri, V.K. (48) studied on chemical investigation of the stem bark of *Aphanamixis polystacha* Parker. (syn. *Amoora rohituka* W&A.) which contained β-sitosterol, stigmasterol and a saponin composed of the genin aglaiol having side chain composed of rhamnose and xylose.

In the same year, Srivastava, S.K. and Agnihotri, V.K. (49) isolated two new glycoside from the stem bark of *Aphanamixis polystacha* Parker. (syn. *Amoora rohituka* W&A.) and identified as 1,5-dihydroxy-6,7,8-trimethoxy-2-methylanthraquinone-3-O-β-D-xylopyranoside and naringenin 7,4′-dimethyl-ether 5-O-α-L-rhamnopyranoside on the basis of physicochemical data.

In the same year, Srivastava, S.K. and Agnihotri, V.K. (47) studied on chemical investigation of the stem bark of *Aphanamixis polystacha* Parker.(syn. *Amoora rohituka* W&A.) and isolated three compounds which were identified as β-sitosterol, stigamasterol and a new tetracyclic triterpenoid glycoside, dammer-(20:21)-ene-(24:25)-epoxy-3β-O-α-L-rhamnopyranosyl-(1→4)-β-D-xylopyranoside on the basis of spectral and chemical evidences.

In the same year, Jain, S.A. and Srivastava, S.K. (52) isolated a new flavone glycoside from the roots of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.). The air-dried, powder root was extracted with EtOH to yield 8-C-methylquercetin-3-O-β-D-xylopyranoside. Methylation of its followed by acid hydrolysis, afforded 8-C-methylquercetin-5,7,3′,4′-tetramethyl ether.

In the same year, Kundu, A.B., et al. (54) isolated a new triterpene, aphananin from the petroleum extract of the fruits of *Aphanamixis polystacha* Parker.(syn. *Amoora rohituka* W&A.) and its structure was established as

21,23S-epoxytirucall-7-ene-3β,21β,24,25-tetrol-3β-monoacetate from spectral analyses and chemical transformations.

In 1986, Jain, S.A. and Srivastava, S.K. (53) isolated a new terpenoid glycoside from the roots of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.) and identified as betulin-3β-O-β-D-xylopyranoside which was characterized on the basis of chemical and spectral evidences.

In the same years, Majumder, S.M., et al. (46) studied on the physico-chemical properties of *Amoora rohituka* W&A.(Pitraj) seed oil and analysis of it cake. The component of the fatty acid of the oil were identified by TLC and estimated by liquid chromatography.

In 1987, Agnihotri, V.K., et al. (50) isolated a new limonoid, amoorinin from the stem bark of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.) on the basis of chemical and spectral evidences and structurally characterized as 3-dihydroandirobin.

In 1988, Agnihotri, V.K., et al. (55) isolated a new limonoid, amoorinin from the stem bark of *Amoora rohituka* Wall. and identified by chemical and spectral methods.

In the same year, Agnihotri, V.K. (51) isolated a new saponin, poriferasterol-3-0-α-L-rhamnopyranoside from the stem bark of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.).

List of compounds found in various plants of some *Amoora* species have been summaried in Table 3.

Table 3. Summary of Research in Chemical Constituents of Some *Amoora* Species.

Scientific Name	Plant Part	Isolated Compounds	Ref.
Amoora rohituka W&A. (syn. *Aphanamixis olystacha* Parker.)	Seeds	Palmitic acid (I)	39
		Stearic acid (II)	
		Oleic acid (III)	
		Linoleic acid (IV)	
		Linolenic acid (V)	
		Rohitukin (VI)	40
		Rohitukine (VII)	41
		Limonoids (VIII, IX, X, XI, XII, XIII, XIV, XV, XVI)	42
		Limonoids (XVII, XVIII)	43
		Polystachin (XIX)	44
		Stigmasta-5,24(28)-dien-3β-O-β-D-glucopyranosyl-O-α-L-rhamnopyranoside	45
		Ash	46
		Protein	
		Crude fiber	
		Crude starch	
		Reducing sugar	
	Stem barks	Dammer-(20:21)-ene-(24:25)-epoxy-3β-O-α-L-rhamnopyranosyl-(1$\rightarrow$4)-β-D-xylopyranoside	47
		β-sitosterol (XX)	47,48
		Stigmasterol (XXI)	
		Saponin (XXII)	48

Table 3. (continued)

Scientific Name	Plant Part	Isolated Compounds	Ref.
Amoora rohituka W&A. (syn. *Aphanamixis polystacha* Parker.)	Stem barks	1,5-dihydroxy-6,7,8-trimethoxy-2-methylanthraquione-3-O-β-D-xylopyranoside (XXIII)	49
		Naringenin 7,4′-dimethylether-5-O-α-L-rhamnopyranoside (XXIV)	
	Roots	Amoorinin (XXV)	50
		Poriferasterol-3-O-α-L-rhamnopyranoside (XVI)	51
		8-C-Methylquercetin-3-O-β-D-xylopyranoside (XXVII)	52
		Betulin-3β-O-β-D-xylopyranoside (XXVIII)	53
Amoora rohituka Wall. *Amoora rohituka* Roxb.	Fruits	Aphananin (21,23s-epoxytirucall-7-ene-3β,21β,24,25-tetrol-3β-monoacetate) (XXIX)	54
	Stem barks	Amoorinin (XXV)	55
Amoora grandiofolia (syn. *Aphanamixis grandiofolia*)	Seeds	Dihydrorobinetin-7-β-D-glucopyranosyl-α-L-rhamnopyranoside	56
		Amoorastatin (XXX)	57
		Amoorastatone (XXXI)	58
Amoora wallachi		12-hydroxyamoorastatin (XXXII)	
	Fruits	Aphanamols I and II (XXXIII, XXXIV)	59
	Heartwood	β-sitosterol (XX)	60

Characterization and Utilization for Medicine of "*Amoora gigantea* Pierre." (61)

Taa Suea Bai Lek is a kind of a large perennial tree in evergreen forest or along the verge of river, 15-25 m. high. It is a big shrub, flat and fragrant yellow flowers like Prayong (*Aglaia odorata* Lour.) but it is bigger than Prayong. Fruits are rounded or nearly so, hanging in cluster on long stem. Mature fruits are reddish which seem tiger's eyes. It occures in September-December. Fruits are poisonous bitter substance and may cause death(62). The oil pressed out of the seeds is employed in both medicine and industry.The woods are used for good furniture and decorative work because of its stickness and excellent hardness for example; floor, lid, ceiling, Sampan, fishing boat, box, propeller of the plane, etc.

For medical uses of Taa Suea Bai Lek (63), it is believed that the woods of Taa Suea Bai Lek which is bitter bark can be used as an astringent, the fruits as a treatment for rheumatic pain, the leaves as a treatment for inflammation and the barks as lull sputum.

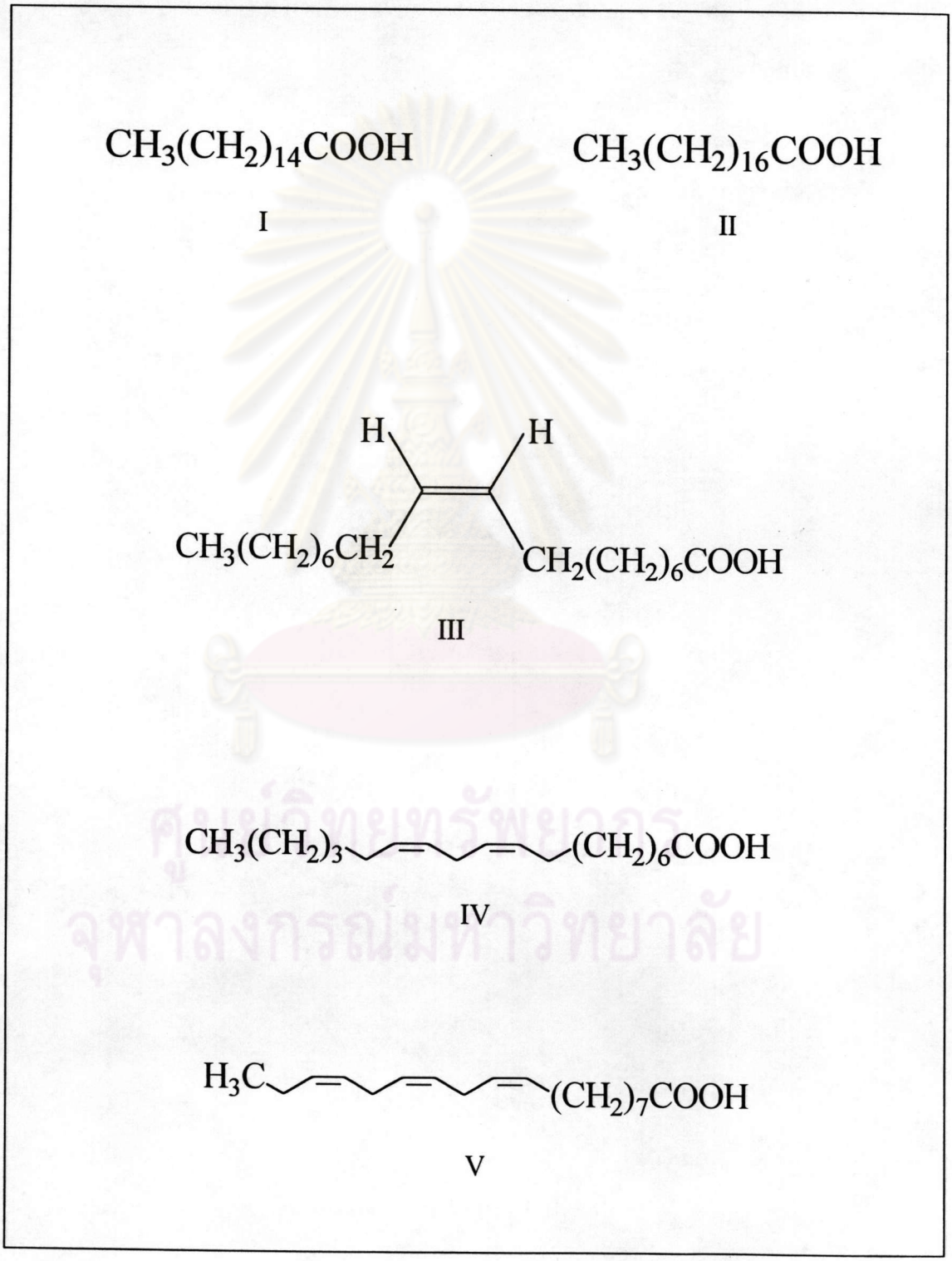
To our knowledge, there is no report on the chemical constituents of *Amoora gigantea* Pierre. Therefore, the objective of this research will be summaried as follow:

1. To extract and isolate the chemical constituents from the leaf of *Amoora gigantea* Pierre.

2. To identify the structural formula of the isolated substances.

Figure 1 The Leaf of *Amoora gigantea* Pierre ex. Laness.

Figure 2 Organic Compounds Found in the Seeds of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.) (7)



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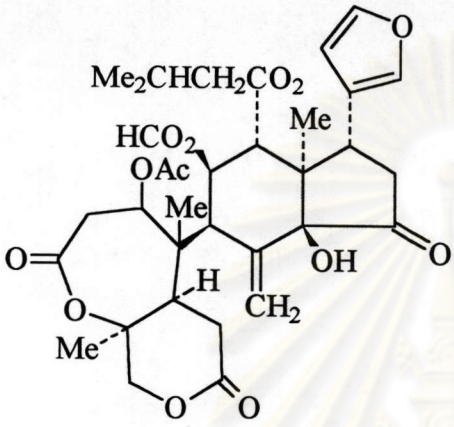

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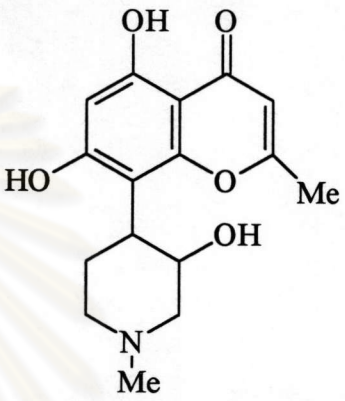
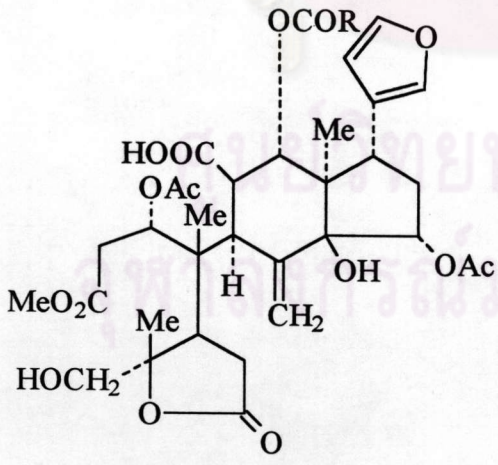
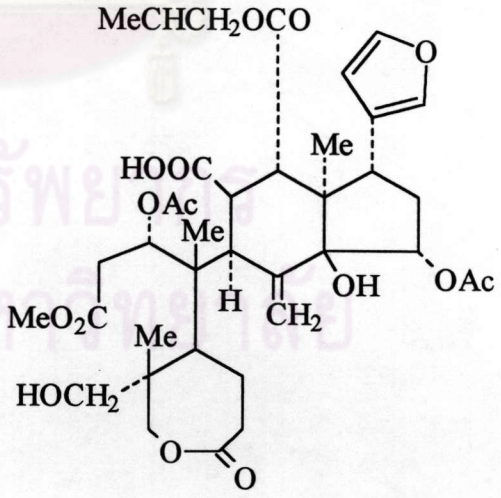


VII



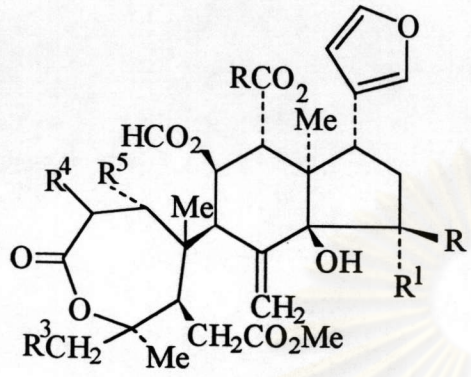
XVII; R = Me_2CHCH_2

XVIII; R = EtMeCHCH(OH)



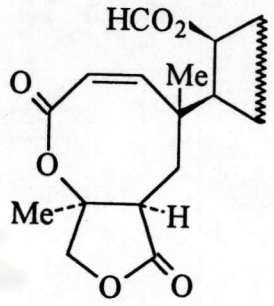
XIX

Figure 2 (continued)



VIII; R =Me_2CHCH, $R^1 = R^5 = OAc$,
R^2-$R^4 = H$

IX; R = EtCHMeCHCH(OH)
$R^1 = R^5 = OAc$, $R^2 = R^4 = H$

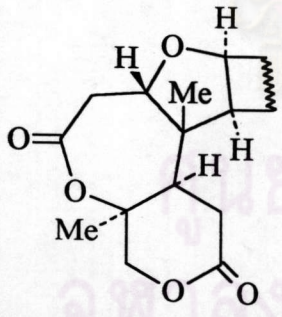


XII; R = EtCHMeCH(OH),
$R^1 = OAc$, $R^2 = H$

XIII; R = Me_2CHCH_2,
$R^1 = OAc$, $R^2 = H$

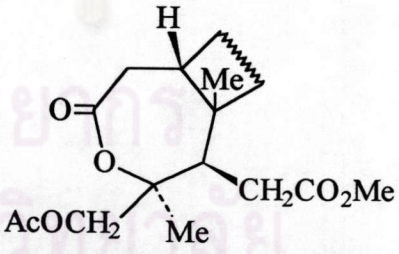
X; R = Me_2CHCH_2, $R^1R^2 = O$, $R^3 = Ac$, $R^4 = H$, $R^5 = OAc$

XI; R = Me_2CHCH_2, $R^1 = OAc$, $R^2 = H$, $R^3 = Ac$, $R^4R^5 = bond$



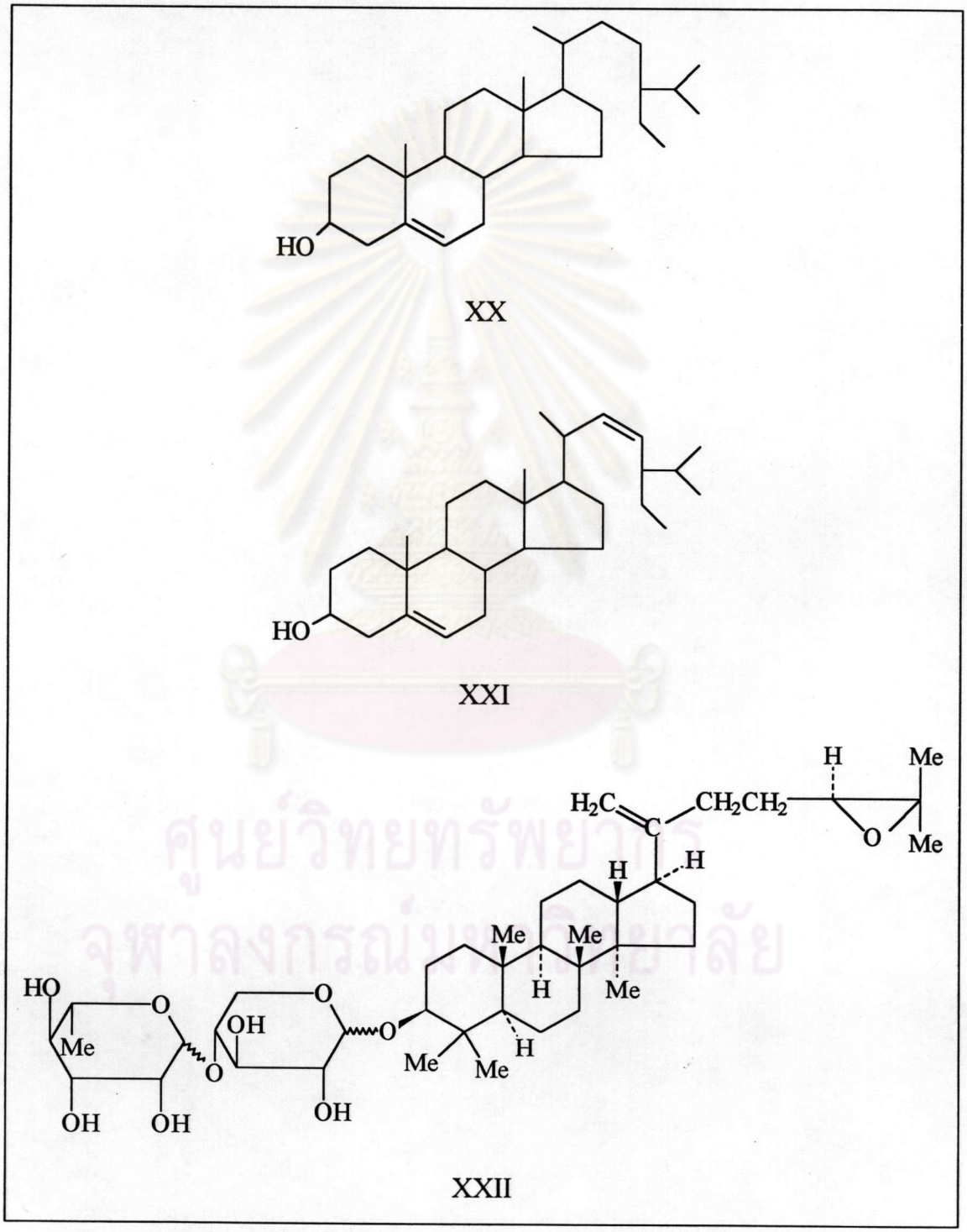
XIV; R = EtCHMeCH(OH),
$R^1R^2 = O$

XV; R = EtCHMeCH(OH),
$R^1 = OAc$, $R^2 = H$



XVI; R = Me_2CHCH_2, $R^1 = OAc$,
$R^2 = H$

Figure 3 Organic Compounds Found in the Stem barks of *Amoora rohituka* W&A.(syn. *Aphanamixis polystacha* Parker.)



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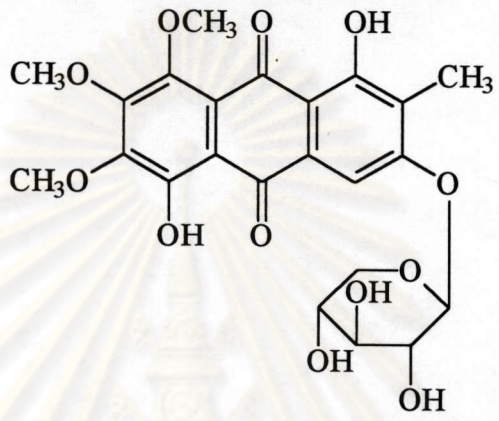
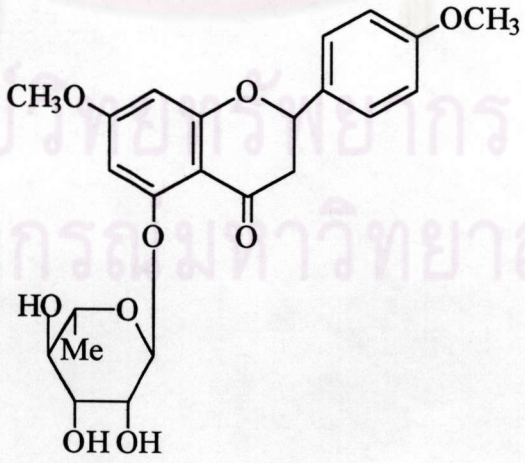
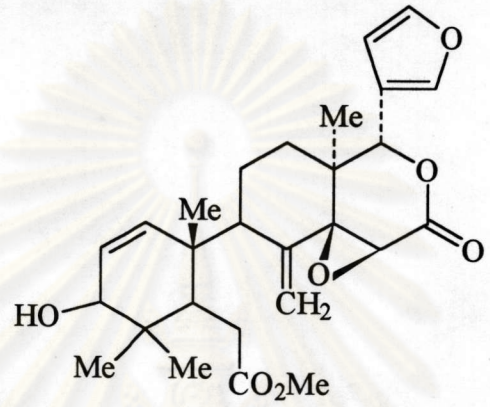


XXIII

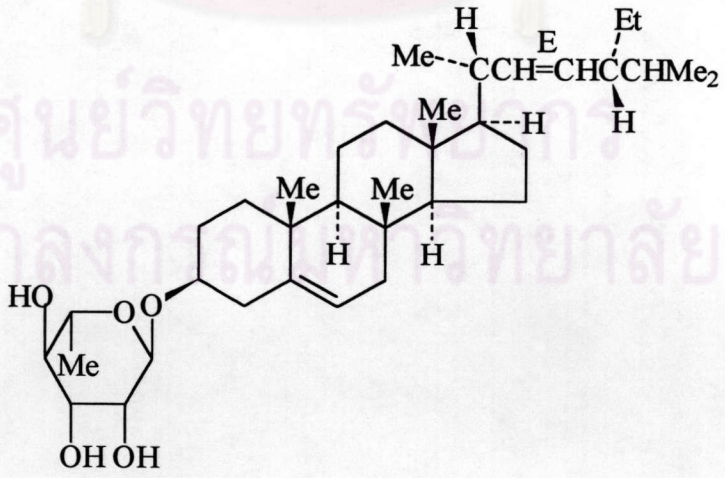


XXIV

Figure 3 (continued)

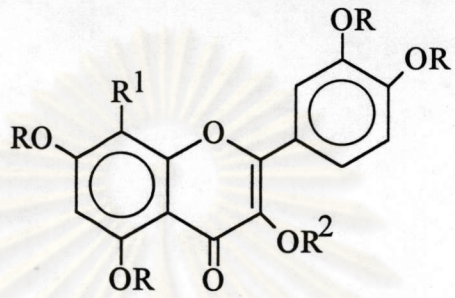


XXV

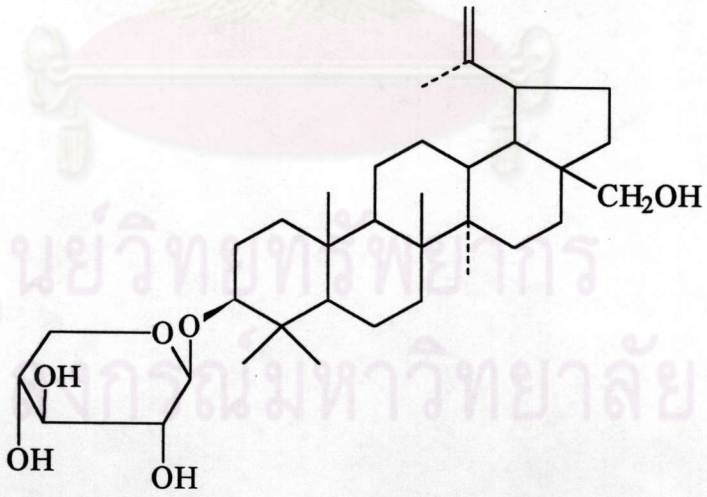


XXVI

Figure 4 Organic Compounds Found in the Roots of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.)

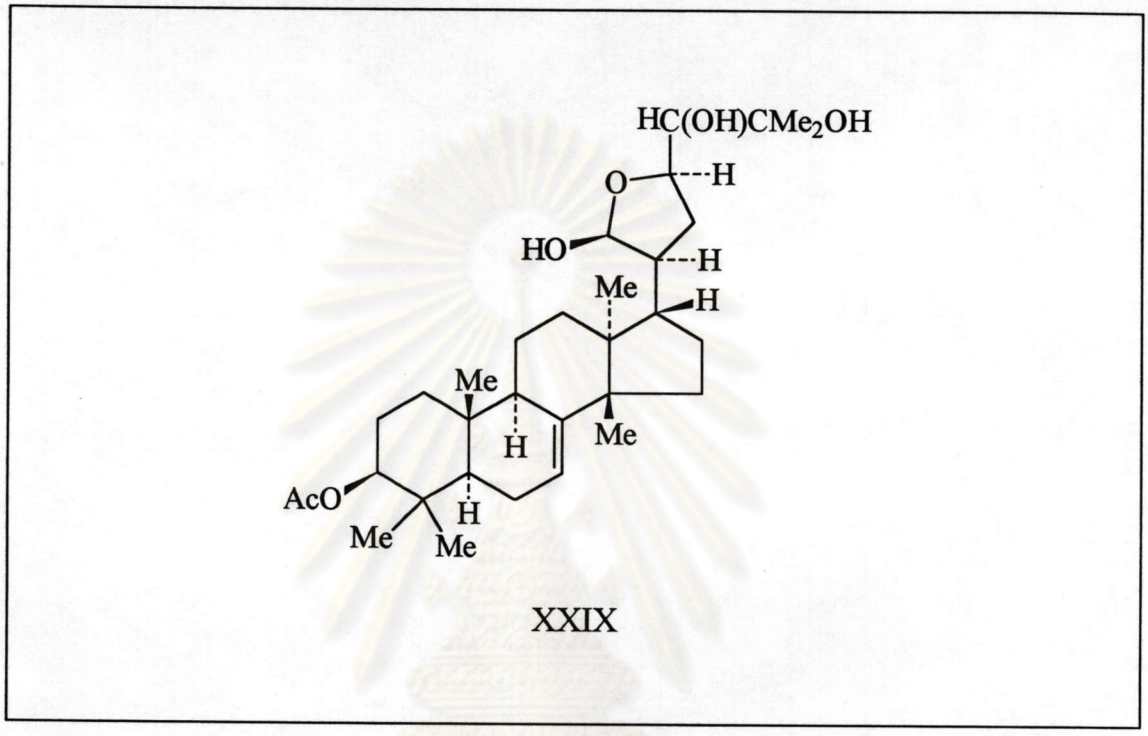


XXVII; R = H, R^1 = Me, R^2 = xylose



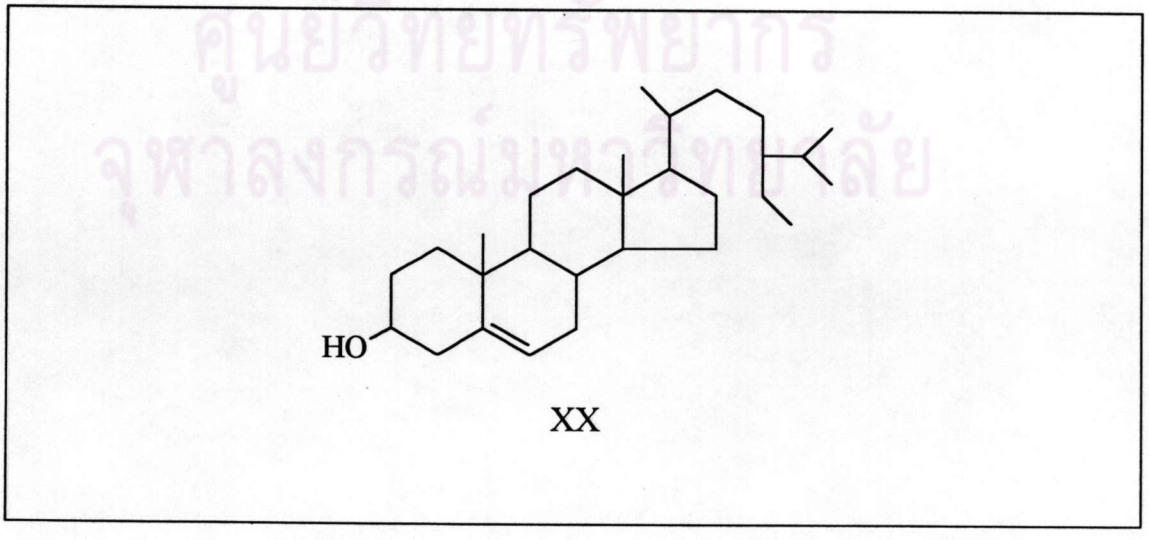
XXVIII

Figure 5 Organic Compounds Found in the Fruits of *Amoora rohituka* W&A. (syn. *Aphanamixis polystacha* Parker.)



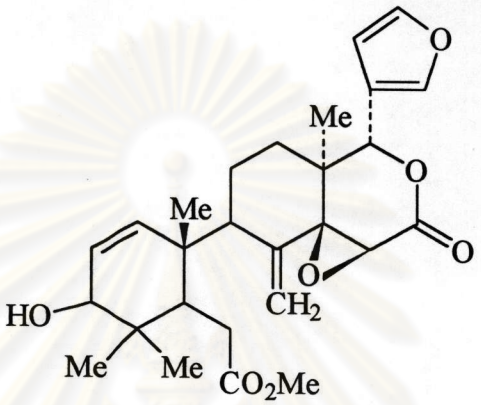
XXIX

Figure 6 Organic Compounds Found in the Heartwoods of *Amoora wallachi*



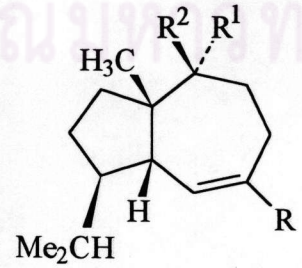
XX

Figure 7 Organic Compounds Found in the Stem barks of *Amoora rohituka* Wall.



XXV

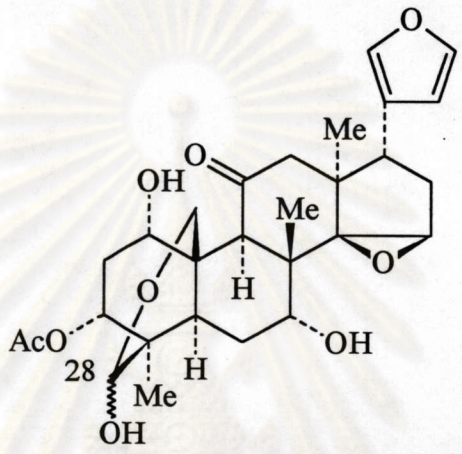
Figure 8 Organic Compound Found in the Fruits of *Amoora grandiofolia* (syn. *Aphanamixis grandiofolia*) (62)



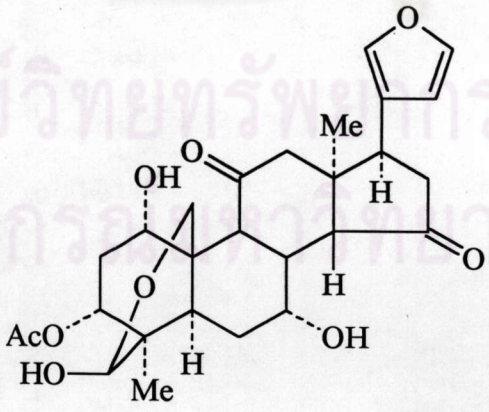
XXXIII; R = CH_2OH, R^1R^2 = O

XXXIV; R = CHO, R^1 = H, R^2 =OH

Figure 9 Organic Compounds Found in the Seeds of *Amoora grandiofolia* (syn. *Aphanamixis grandiofolia*)

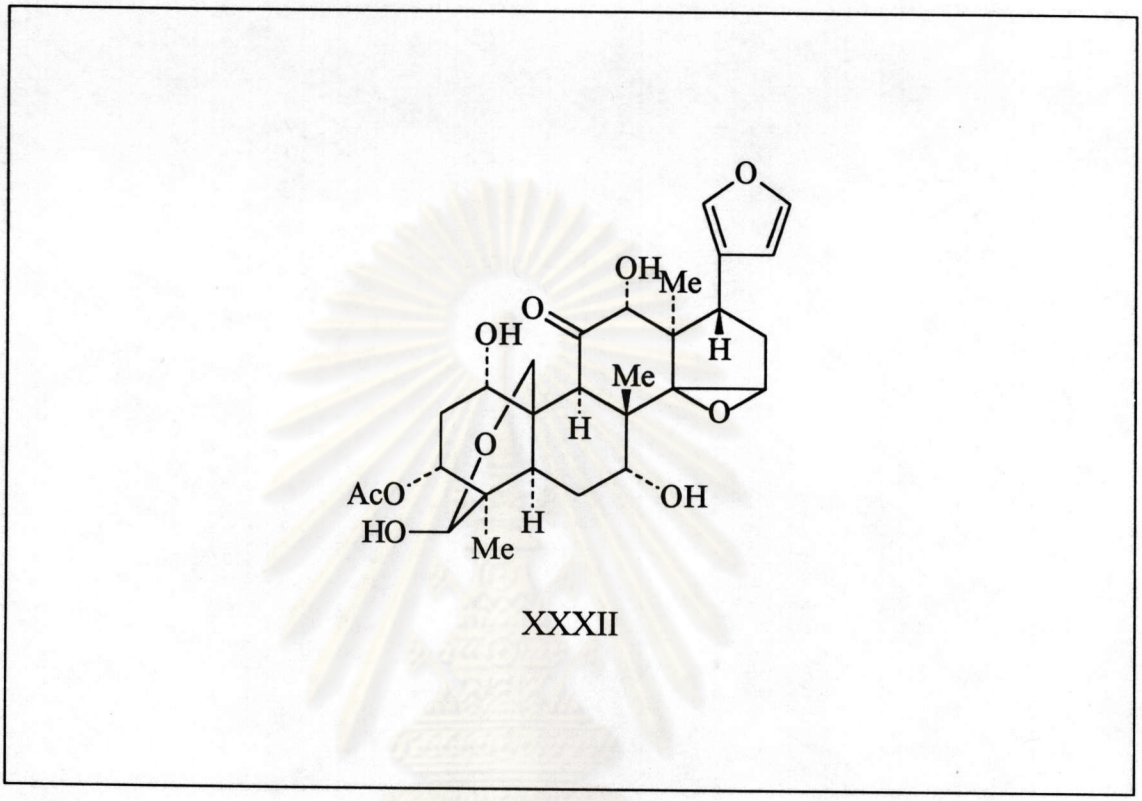


XXX



XXXI

Figure 9 (continued)



XXXII