CHAPTER I

INTRODUCTION

Bridelia ovata Decne. (or Bridelia siamensis Craib.) is the plant in Euphorbiaceae family. In Thailand it has been known as Makaa, Matkaa, Maatkaa (Nongkay), Saalao, Si-waa-laa(Maehongsorn), Kong(The North), Kong kaeb (Chiangmai), Kheelao maatkaa (Khonkan) and etc(1).

THE PLANTS IN EUPHORBIACEAE FAMILY

There are 300 genera and 5,000 species in Euphorbiaceae family. The plants in this family have be identified into 4 types as the fellowing(2).

1. The soft wood such as Acalypha indica L., Euphorbia hirta L., Hyllanthus niruri. L., and etc.

2. The shrub such as Excoecaria bicolor Hassk., Croton cumingii Muell. Arg., and etc .

3. The perennial plant such as Aleurites moluccana Willd., Bridelia siamensis Craib.,and etc.

4. The climbing plant such as Mallotus repandus Muell. Arg., Cnesmone javanica Bl., and etc.

CHARACTERISTIC OF THE PLANTS IN EUPHORBIACEAE FAMILY

Like cactus, the stem of the plants in this family is fleshy. Leaves are single-leaf. The edges of leaves are smooth or lobular. Flowers have male and female in

the same trees(monoecious) or in the different trees(diocious). Petals which are under the hypogynous have rather regular size, single level, five units or five merous. In the male flowers, the number of pollens are twice of the outer petals. In the female flowers, the ovaries have three lobes and three cells. There are three stigmas. The fruit of this plant is dry, breakable and sometimes fleshy. In the seeds, endosperm resembles albumin while cotyledons are broad and narrow and hard.

CHARACTERISTIC AND GENERAL UTILIZATION OF THE PLANTS IN BRIDELIA GENUS(3,4)

The plants in bridelia genus such as B. retusa Spreng., B. penangiana, B. monoica Merr. or B. tomentosa Blume., B. stipularis and B. pustulate have different characteristic and utility.

B. retusa Spreng ;

Characteristic - The tree can grow up to 60 feet. They have been found in torrid zone in India, the south of Thailand and Sri lanka. In India, woods have good quality, beautiful decorative design and endurance.

Utility - Woods have been used as carts, agricultural, posts and accessories.

- Barks which contain about 16- 40 % of tannin have been used as dye and astringent.
- Leaves have been used as feedstuff for horses and cows)
- Fruits which can be eatable with sweet taste.

B. penangiana ;

Characteristic - Stems have small size. They have been found from

Tanuaosri moutain to Newkeni island and the north of Malay peninsula.

Utility - Leaves have been used as lotion which prevents painfulness.

B. monoica Merr. or B. tomentosa Blume ;

Characteristic - The tree can grow up to 60 feet . They have been found from Himalaya moutain to the north of Australia and in Malay Peninsula.

Utility - Leaves have been used as medicine for curing fever and stomachache.

- Roots have been used as medicine for newly born baby.
- Barks have been used as dye.
- Fruits can be eatable.

B. stipularis ;

Characteristic - Stems have many branches. They have been found in torrid zone in Africa, the south of Asia to Philippines and Timor island and the south of Malay Peninsula.

Utility - Barks have been used as dye.

- Leaves have been used with Nigella sativa for curing other aches.

B. pustulata ;

Characteristic - The tree can grow up to 60 feet. They have been found in the south-west south of Malay Peninsula from Penang to Singapore.

- Woods are brown and durable.

RESEARCH IN PHARMACOLOGY STUDY ON THE PLANTS IN BRIDELIA GENUS

In 1963, S.Sengupta and B.N.Ghosh(5) studied on the barks of Bridelia stipularis Blume. Barks which were extracted with by benzene were separated and found "friedelin and β-sitosterol".

In 1965, K.Nakanishi, et al.(6) did preliminary pharmacological test on chemistry and biology of crude extracts of the stems, leaves and flowers of Makaa (Bridelia ovata Decne.) in 50% MeOH/H_2O(by volume). The results are shown in **Table 1.**

Table 1 The results of preliminary pharmacological test on the crude extracts of Bridelia ovata Decne.

Plant parts	Yields of extract from powder (%)	Chemical Test		
		D	LB	$FeCl_3$
Stems	1.3	±	+	−
Leaves	9.1	±	±	−
Flowers	9.6	+	+	+

Plant parts	Yields(%)	Biological Test					
		Anti-microbial				Estimated LD_{50} mg/kg	Antitumor
		B. subtilis	S. aureus	E. coli	P. vulgaris		
Stems	1.3	-	-	-	-	> 1000	-
Leaves	9.1	+	-	-	+	> 800	-
Flowers	9.6	+	+	-	+	500-1000	-

Note: + ; positive test D ; Dragendorff's reagent

- ; negative test LB ; Liebermann-Burchard reaction

± ; weak activity

In 1968, K.H. Pegal and C.B.Rogers(7) studied on the constituents of Bridelia micrantha Bail. Barks which were extracted with hexane and were separated and found "taraxerone, friedelin, taraxerol and epifriedelinol"; crude ether extract was found "gallic acid"; crude acetone extract was found "ellagic acid" and crude extract of hot HCl solution was found "anthocyanidin and delphinidine". Woods which were extracted by hexane were separated and found "taraxerol, friedelin"; crude extract of ether and acetone was found "gallic acid and ellagic acid" and crude extract of hot HCl solution was found "anthocyanidin, delphinidine and caffeic acid".

In the same year, W.H.Hui and M.L.Fung(8) studied on the leaves and stems of Bridelia monoica Merr. Crude petroleum ether extract was found "friedelin, friedelan-3β-ol, glutin-3-en-3β-ol, stigmasterol,β-sitosterol and long aliphatic chain ($C_{20}H_{38}O_2$)".

In 1975, N.Yadavand, S.K.Nigam(9) studied on the leaves of Bridelia montana. Crude alcohol extract was found "β-D-glucoside of β-sitosterol, hexacosanol, triterpenoid m.p. 273-276 ^{0}C and sugars such as fructose, glucose and sucrose".

In 1980, R.C.Carpenter , et al.(10) studied on the constituents of five species of the plants in Euphorbiaceae family:- Podadenia thwaitesii (Baill) Muel Arq., Apurosa cardiosperma. Merr., Glochidion moonii Thw., Bridelia moonii Thw. and New Glochidon as shown in **Table 2.**

Table 2 Constituents of five species of the plants in Euphorbiaceae family

Scientific names	Plant parts	Solvent extract	substances
Podadenia thwaitesii	barks and woods	Petroleum ether, benzene and methanol	- aleuritolic acid - aleuritolic acid acetate - aleuritonic acid - sitosterol
	Woods	Petroleum ether	- 19 hydrocarbons (C_{13} up)
Apurosa cardiosperma	Barks	Petroleum ether	- friedelin - friedelan-3β-ol
	Woods	Petroleum ether	- 20 hydrocarbons (C_{11}-C_{14})
New Glochidion	Barks	Petroleum ether	- glochidonol - lup-20(29)-ene-30,25-diol - lup-20(29)-ene-1,3,23-triol - glochidiol
Glochidion moonii	Stems	Petroleum ether	- sitosterol - glochidonol - lup-20(29)-ene-3.23-diol - glochidiol

Table 2 (continue)

Scientific names	Plant parts	Solvent extract	substances
	Barks	Petroleum ether	- glochidone - friedelin - friedelan-3β-ol - sitosterol
	Woods	Petroleum ether	- hydrocarbon m.p. 80-81 °C

In 1985, I. Addae-Menash and H. Achenbach(11) studied on the leaves of Bridelia ferruginea. Crude extracts of methanol, ether, ethylacetate and butanol were found "rutin, quercetin-3-O-β-D-glucoside and myricetin-3'-O-rhamnoside". Study on the petroleum ether extract of the roots was found "phytosterol ester, the mixture of hydrocarbons, D:A-friedo-oleanan-3-one, D:-friedo-oleanan-3β-ol, sitosterol and the mixture of β-sitosterol and stigmasterol".

In 1991, Boonyaratavej, S. and Petsom, A.(12) studied on the crude chloroform extract of the roots of Bridelia tomentosa Bl. and found the new substances "24-methyllanosta-9(11), 25-diene-3-one ($C_{31}H_{50}O$), together with 24,24-dimethyllanosta-9(11),25-diene-3-one ($C_{32}H_{52}O$), friedelin, friedelan-3β-ol and triacanthine". This is the first report of triacanthine alkaloid found in Euphorbiaceae family.

In 1992, Boonyaratavej, S., et al.(13) studied on the crude chloroform extract of the branches of Bridelia ovata Decne. and found the new ester *trans*-triacontyl-4-hydroxy-3-methoxy cinnamate together with "24-methyllanosta-9(11),25-diene-3-one

($C_{31}H_{50}O$), 24,24-dimethyllanosta-9(11),25-diene-3-one ($C_{32}H_{52}O$), friedelin, and friedelin-3β-ol".

The studies on Bridelia were summarized in **Table 3**.

Table 3 Summary of research in Pharmacology and Chemistry of Bridelia genus

Year	Plants	Plant parts	Solvent extraction	Substances
1963	Bridelia stipularis Blume.	Bark	Benzene	friedelin, β-sitosterol
1965	Bridelia ovata Decne.	Stem, leave and flower	50% MeOH/H_2O	test biological activities in pharmacology and chemistry
1968	Bridelia micrantha Baill.	Bark	Hexane	taraxerone, friedelin taraxerol, epifriedelinol
			Ether	gallic acid
			Acetone	ellagic acid
			Hot HCl	anthocyanidin, delphinidine
1968	Bridelia micrantha Bail.	Wood	Hexane	taraxerol, friedelin
			Ether	gallic acid
			Acetone	ellagic acid
		Fresh-leave	Hot HCl	anthocyanidin, delphinidine, caffeic acid

Table 3 (continue)

Year	Plants	Plant parts	Solvent extraction	Substances
	Bridelia monoica Merr.	Leave and stem	Petroleum ether	friedelin, friedelan-3β-ol, glutin-3-en-3β-ol, stigmasterol, β-sitosterol
1975	Bridelia montana	Leave	Alcohol	β-D-glucoside of β-sitosterol, hexacosanol, triterpenoid
1980	Bridelia moonii	Bark	Petroleum ether	glochidone, friedelin friedelan-3β-ol
1985	Bridelia ferruginea	Leave	Methanol, Ether, Chloroform, Butanol	rutin, quercetin-3-O-β-D-glucoside, myricetin-3'-O-rhamnoside
		Root	Petroleum ether	phytosterol ester
1991	Bridelia tomentosa Bl.	Root	Methanol, Chloroform	$C_{31}H_{50}O$, $C_{32}H_{52}O$, friedelin, friedelan-3β-ol, triacanthine

Table 3 (continue)

Year	Plants	Plant parts	Solvent extraction	Substances
1992	Bridelia ovata Decne.	Branch	Methanol, Chloroform	$C_{31}H_{50}O$, $C_{32}H_{52}O$, friedelin, friedelan-3β-ol, *trans*-triacontyl-4-hydroxy-3-methoxy cinnamate

As far as investigation of preliminary test in pharmacology and chemistry are concerned, there has not yet been an investigation on the chemical constituents of the leaves of B. ovata. However, the chemical constituents of the branches of B. ovata" were studied and found the unknown ester: *trans*-triacontyl-4-hydroxy-3-methoxy cinnamate. In this research the chemical constituents of the leaves of B. ovata" will be studied in comparison with substances found in the branches of B. ovata". Furthermore, the result obtained from this work will give the additional data for those who are interested in investigating the plants in "Euphorbiaceae" family especially the Bridelia genus.

CHARACTERISTIC AND ULTILIZATION OF "B. ovata" FOR MEDICINE

Characteristic of "B. ovata"(14):

B. ovata is a large shrub or a small perennial plant. Tree can grow up to 2 - 4 metres. Many shapes of the leaves are oval, ellipse and parallel. The base of leaves is sharp and the edge is wavy. The width of leaves is 3-8 cm. and the length is 6-20 cm. Flowers, both male and female, which are yellow have small size. Male

flowers have the flower-stalk which length of 2-3 cm. Many ovaries in male flowers are withering. Unlike male flowers, female flowers have no flower-stalk. Fruits which are black have diameter about 5 mm. Season for plant is winter. Because of easy growth, there is no need for maintenance. Sometimes "B. ovata" is planted in home and garden because they have utilization for medicine.

Utilization for medicine(15-18):

- The leaves are used as purgative and febrifuge.
- The boiled young-leaves are used as the medicine for removing sputum.
- The roots are used for curing fever.
- The seeds are used for tight teeth.

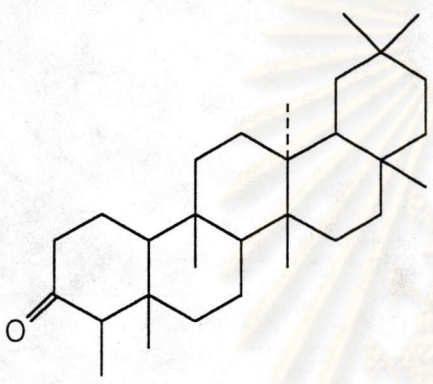
The method for "purgative" use of the leaves of "B. ovata":

- About 15 g of old-leaves were toasted or dried in the sun. These dried-leaves then were boiled with water and salts for drink.
- About 1.5-2 g of fresh-leaves were toasted. These dried leaves were soaked in boiled water about 10-20 minutes for drink.

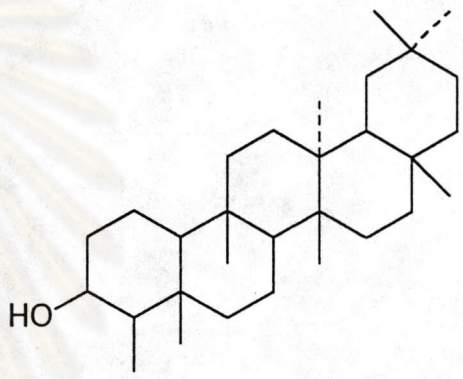
It has been found that crude ethanol extract of the leaves has activities as purgative by using 2 g. of crude extract per 1 kg of the weight of rat(19). When the activity of crude extract has been compared with that of standard medicine "Senokot" in rat(19) , they have found that the activities are similar. The crude 95%ethanol extract of 6 g./kg was similar to standard medicine "Senokot" 1.04 g/kg but duration of activities of crude 95% ethanol extraction (3-5 hours was faster than Senokot (6-7 hours).

However, information of toxicity of crude extract of the leaves of "B. ovata" has not been investigated . If the crude extract is not poisonous, the leaves of "B. ovata" should be brought to use as purgative.

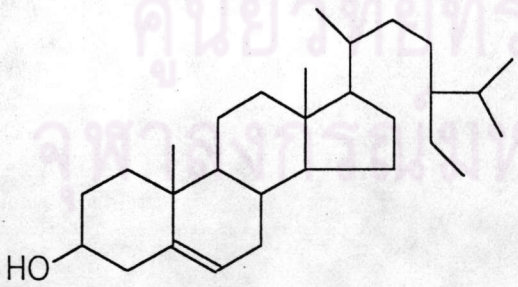
Substances obtained from the plants in Bridelia genus are shown below.



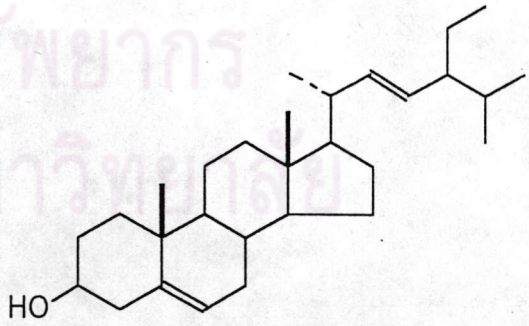
Friedelin (Friedelan-3-one)



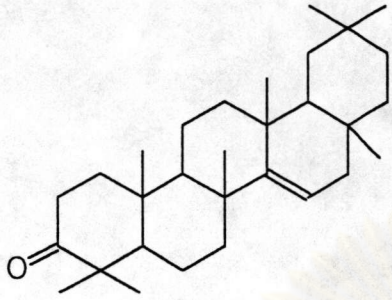
Friedelan-3β-ol



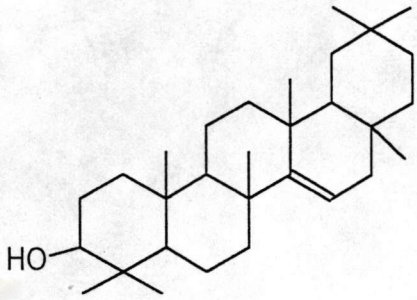
β-sitosterol



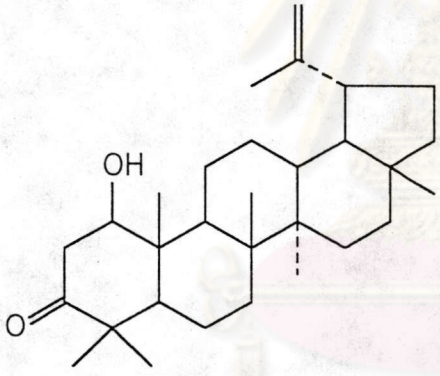
Stigmasterol



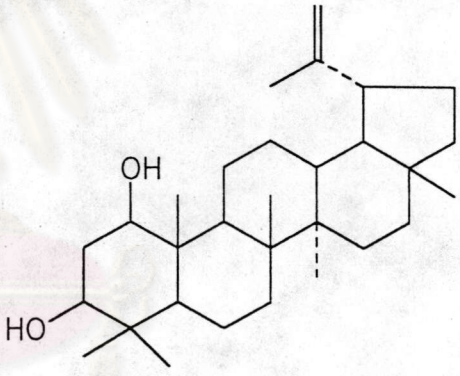
Taraxerone ($C_{30}H_{48}O$)



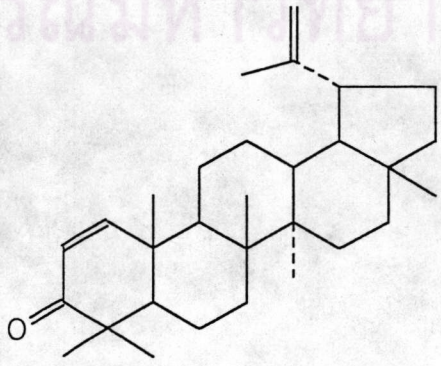
Taraxerol ($C_{30}H_{50}O$)



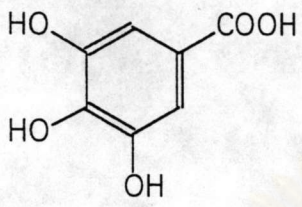
Glochidonol ($C_{30}H_{48}O_2$)



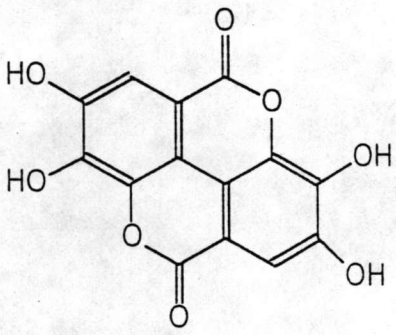
Glochidiol ($C_{30}H_{50}O_2$)



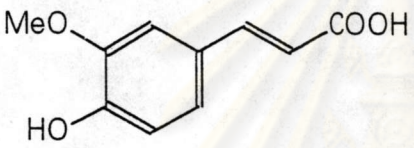
Glochidone ($C_{30}H_{46}O$)



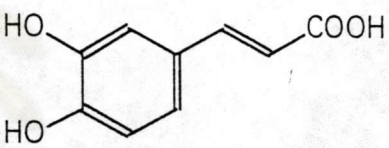
Gallic acid ($C_7H_6O_5$)



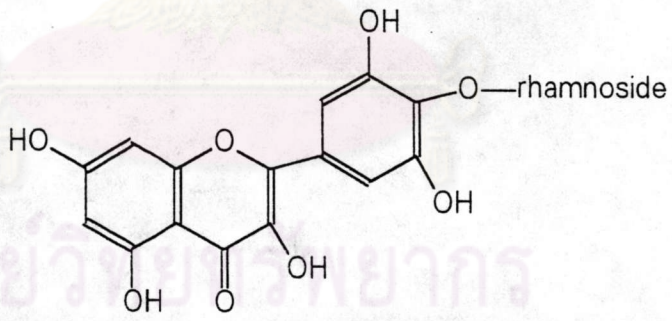
Ellagic acid ($C_{14}H_6O_8$)



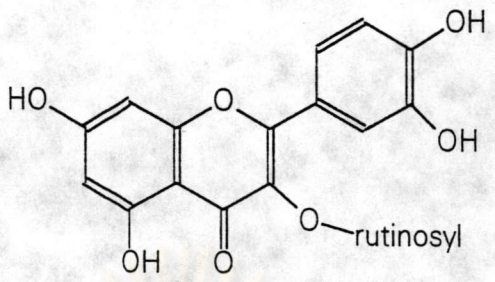
Ferulic acid ($C_{10}H_{10}O_4$)



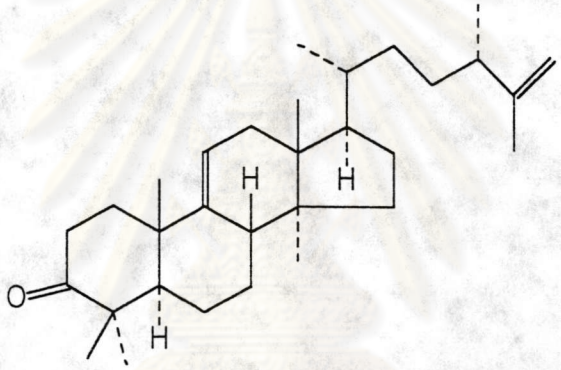
Caffeic acid ($C_9H_8O_4$)



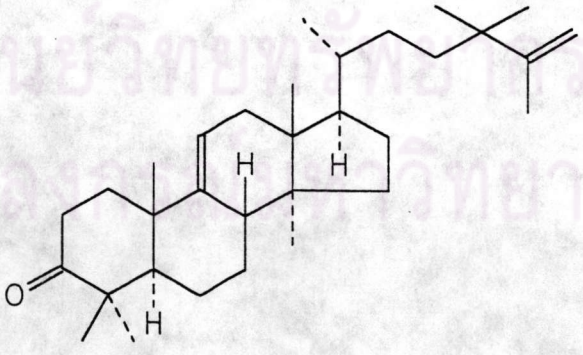
myricetin-3'-O-rhamnoside



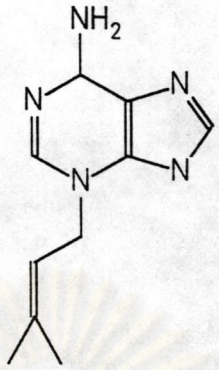
Rutin ($C_{27}H_{30}O_{16}$)



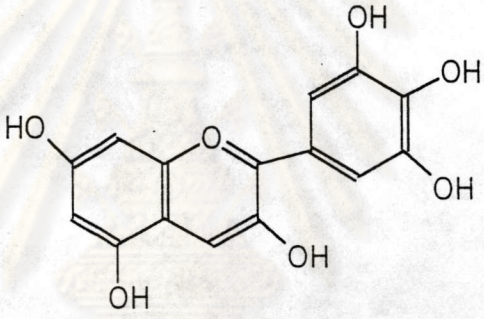
24-methyllanosta-9(11),25-diene-3-one ($C_{31}H_{50}O$)



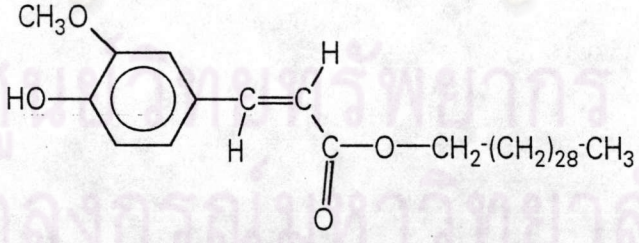
24,24-dimethyllanosta-9(11),25-diene-3-one ($C_{32}H_{52}O$)



Triacanthine ($C_{10}H_{14}N_5$)



Delphinidin ($C_{15}H_{11}O_7$)



trans-triacontyl-4-hydroxy-3-methoxy-cinnamate