CHAPTER I

INTRODUCTION

In mankind's effort to overcome physical suffering and distress, following a seemingly endless path of searching, the use of medicinal plants has revealed. Almost all medicinal plants or herbal medicines, originated from natural products, have been accepted as healing drugs that have less potential to result in side effects than synthetic drugs. Therefore these plants bring about injury and damage less than synthetic drugs. Furthermore, these plants are always cheap and easily available. Consequently, there has been a global line of thought in furtherance of evolvement for more complete using of medicinal drugs. Moreover, there have been incessant attempts to do research and to develop for accomplishments that are not apt to cause or incur danger or harm, dependable, and have an intended effect and act as effectively. For example, Plao noi (*Croton sublyratus* Kurz.), a Thai medicinal plant, has been developed to be an anti-peptic ulcer drug. [1]

Plao Yai is considered by its scientific name as *Croton oblongifolius* Roxb. It is arranged in the Euphorbiaceae family [2], which consists of 800 genera and 5000 species. Plao Yai is scattered around all parts of evergreen forests, deciduous forests and the groves or brushwood. The medicinal plants are most widely known in Thailand as Plao Yai (in Northern Thailand), Poh (in Kamphaeng Phet Province), Khwa-wuu (in Karen, Kanchanaburi Province), Saa-kuu-wa (in Karen, Mae Hong Son Province) and as Haa-yoeng (in Shan, Mae Hong Son Province).

In referring to Thai pharmacopoeia [3, 4], Plao Yai has been realized for the importance of its usefulness, which its every part is capable of being used for remedying in aspect of herbal medicines. For example, the bark is able to restrain chronic enlargements of the liver, the leaves are capable of restoration or curing scabies, chloasma and leprosy, the fruit and seeds can be used for stimulating bowel movements loosen up more or as laxatives and the flowers can destroy parasites. In additional, the heartwood can be used to relieve feebleness and unconsciousness,

and the roots can also treat diarrhea, dysentery, rheumatism and chronic inflammation of the joints.

1.1 General characteristics of the plants in the Genus *Croton* [3]

The genus *Croton* comprises of 700 species of trees and shrubs. The leaves of these plants are usually alternate and have 2-glandular stipules at the base. The flowers are all over single and gathered in the rachis of the final raceme and the bracts are little in size. The male flowers are enclosed by 5-petals and 5-calyxes. Each male flower contains many stamens, which are interpolated on a hairy receptacle. Furthermore, the female flowers are usually more ovate than the male flower. Its petals are either smaller than the sepals and are lacking. The flat annular comprises 4-6 glands that are opposite the sepals. Each female flower includes three ovaries and a singular ovule in each cell. The seeds of these plants are free from irregularities or have a fine texture, have ample albumen, and spacious cotyledons.

1.2 Botanical characteristics of *Croton oblongifolius* Roxb. [4]

Croton oblongifolius Roxb. is a middle sized medicinal plant. The magnitudes of leaves are between 5.6-12.0 cm to 13.0-24.0 cm. The flat-edged leaf is oblong-lanceolate shaped. The flowers are solitary or existing alone and pale yellowish-green. The female flowers are situated in the depth less than the part of the raceme, while the male flowers are located in the higher part of the raceme. The male calyx are more than 6.0 mm and have segments that are ovate, obtuse, blunt and more than 2.5 mm long. The six male petals are covered with a wooly texture, and 3.0 mm long and elliptic-lance late shaped. The twelve stamens are alterable in the bud and have filaments 3.0 mm long. The female flowers have the short pedicels, physically strong and are vigorous. Its sepals are more acute or shrewd than the sepals in the male flower and have relatively high density ciliated margins. The fruits have a diameter less than 1.3 cm, are frailly 3-lobed which are small orbicular scales. In addition, inside each fruit there are eight seeds, each seed approximately 6.0 mm long, spherical or circular in shape and smooth to get to the back completely.

The picture of the stem bark, leaves, flowers and fruits of *Croton oblongifolius* Roxb. are shown in Figure 1 [5].

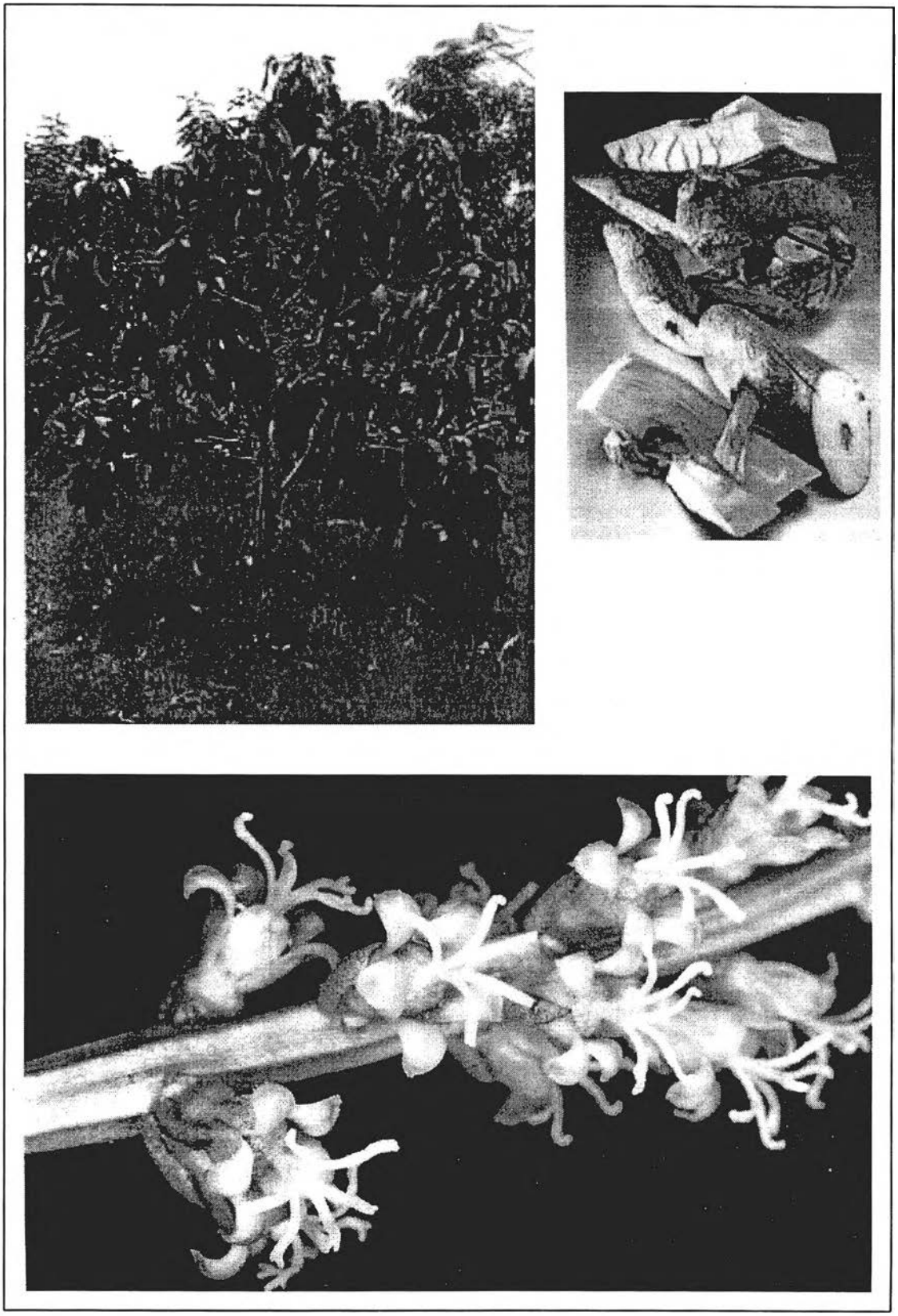
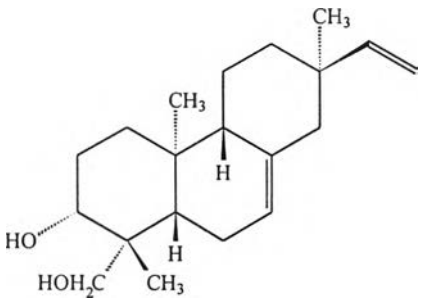


Figure 1. *Croton oblongifolius* Roxb.

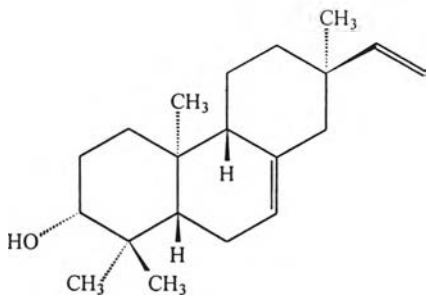
1.3 Previous research studies on diterpenoid compounds of *Croton oblongifolius* Roxb.

From numerous literature reviews, it is obvious that *Croton oblongifolius* Roxb. has been widely studied. As a result, many different organic compounds, mainly diterpenoid compounds, have been discovered and are characterized in the following table.

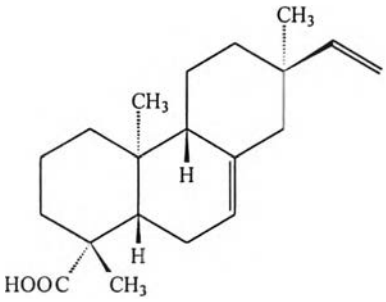
Plant Parts	Crude Extract	Organic Compounds	References
Stem barks	Hexane	Oblongifoliol	[6]
		19-Deoxyoblongifoliol	[7]
		Oblongifolic acid	[8]
		ent-Isopimara-7,15-diene	[9]
		ent-Isopimara-7,15-diene-19-aldehyde	[9]
		11-Dehydro(-)-hardwickiic acid	[10]
		(-)-Hardwickiic acid	[10]
		Crotocembraneic acid	[11]
		Neocrotocembraneic acid	[12]
		Neocrotocembranal	[13]
		Poilaneic acid	[13]
		Crovatin	[13]
		Isokolavenol	[13]
		Crotohalimaniec acid	[13]
		Benzoyl crotohalimanolic acid	[13]
		Nidorellol	[13]
		Crotohalimoneic acid	[13]



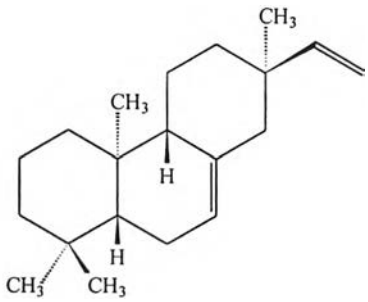
Oblongifoliol



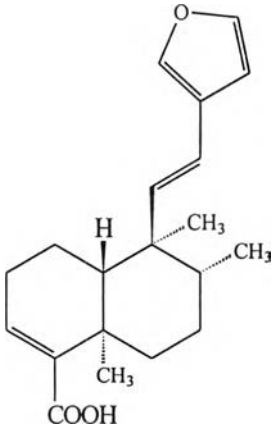
19-Deoxyoblongifoliol



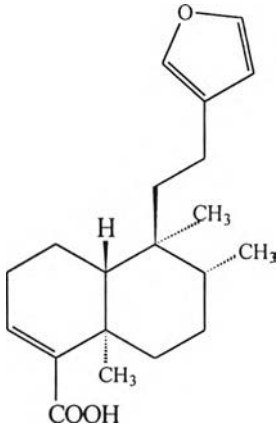
Oblongifolic acid



ent-Isopimara-7,15-diene

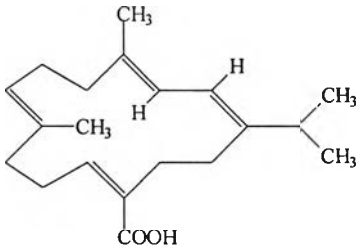


11-Dehydro-(-)-hardwickiic acid

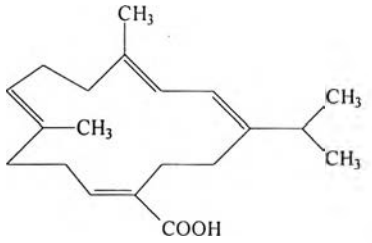


(-)-Hardwickiic acid

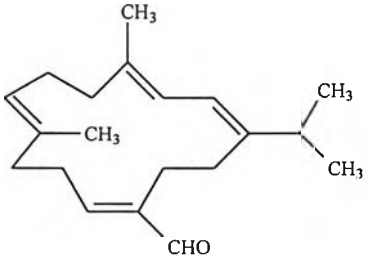
Fig. 2 The structures of diterpenoid compounds from *Croton oblongifolius* Roxb.



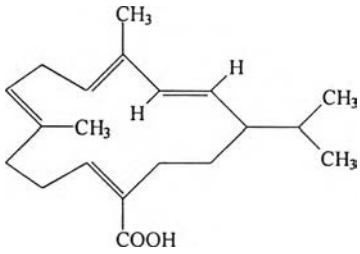
Crotocembraneic acid



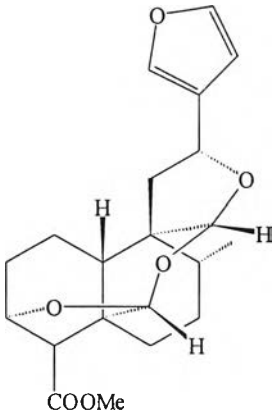
Neocrotocembraneic acid



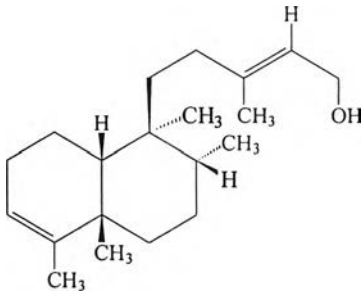
Neocrotocembranal



Poilaneic Acid



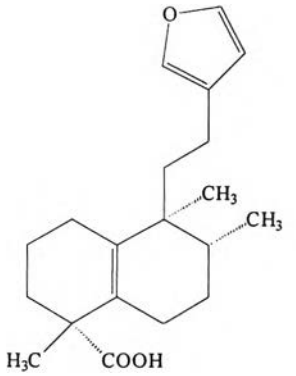
Crovatin



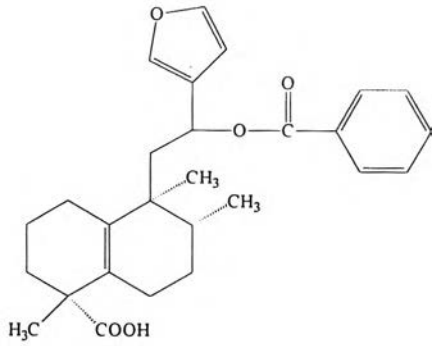
Isokolavenol

Fig. 2 The structures of diterpenoid compounds from

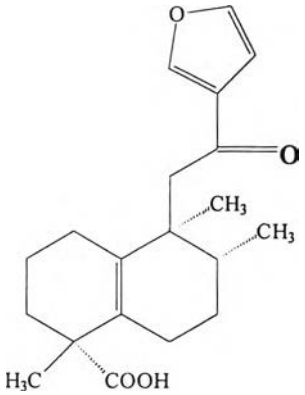
Croton oblongifolius Roxb. (continued)



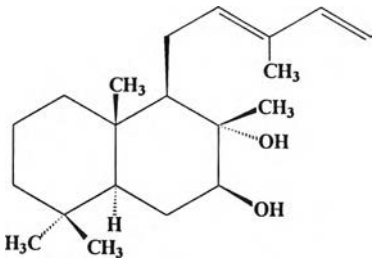
Crotohalimaneic acid



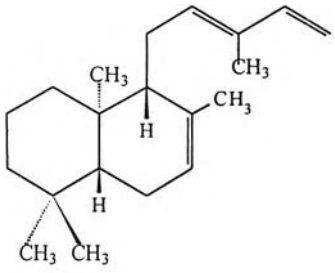
benzoyl crotohalimanolic acid



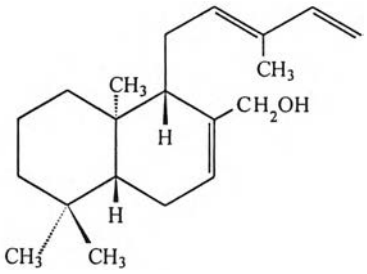
Crotohalimoneic acid



Nidorellol

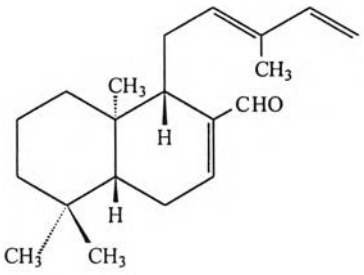


Labda-7,12(*E*),14-triene [14]

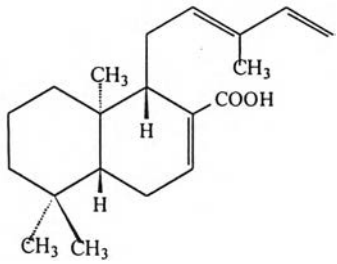


Labda-7,12(*E*),14-triene-17-ol [14]

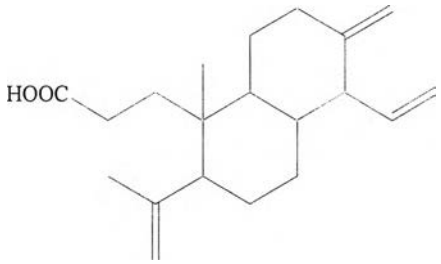
Fig. 2 The structures of diterpenoid compounds from *Croton oblongifolius* Roxb. (continued)



Labda-7,12(*E*),14-triene-17-al [14]



Labda-7,12(*E*),14-triene-17-oic acid [14]



Cleistantha-4, 13(17), 15-triene-3-oic acid [15]

Fig. 2 The structures of diterpenoid compounds from *Croton oblongifolius* Roxb. (continued)

From the literature review, the stem barks of *Croton oblongifolius* Roxb. can be used as therapeutic drugs [5]. Numerous compounds have been isolated from the stem barks of *Croton oblongifolius* Roxb. Some of these compounds have interesting biological activity. The diversity of chemical constituents found in the stem barks of *Croton oblongifolius* Roxb. from different places have led to continuous studying. Also, from primary ^{1}H-NMR screening, it was found that the crude hexane spectrum of the stem barks of *Croton oblongifolius* Roxb., from Amphoe Pranburi, Prachuabkhirikhan Province, was different from the spectrum of *Croton oblongifolius* Roxb. that were collected from other provinces. Therefore, it was intended to re-

investigate the diterpenoid compounds of the stem barks of *Croton oblongifolius* Roxb.

Thus, the objectives of this research were as follows:

1. To extract and isolate the diterpenoid compounds from the stem barks of *Croton oblongifolius* Roxb., from Amphoe Pranburi, Prachuabkhirikhan Province
2. To identify the structural formula of the isolated substances.
3. To investigate the biological activity of the obtained compounds.