

## CHAPTER 1

### INTRODUCTION

Zingiberaceae, a Ginger family is the largest family of plant kingdom. It comprises about 1300 species occur in tropical Asia. The greatest concentration of genera and species is in the Malesian region that includes Indonesia, Malaysia, Singapore, Brunei, the Philippines and Papua New Guinea.<sup>(1)</sup> The Zingiberaceae are perennial herbs and useful products for food widely cultivated in Thailand and tropical regions of Asia. They are used for the many reasons such as in the cosmetic industry, in pharmacy, as decorative plants and also for the culinary needs. For example, *Ginger* (*Zingiber officinalis*, Khing) is used against a large variety of illnesses including travel sickness. *Elaiti* (*Elettaria cardamomum*, Krawan) is used as spice and also as a medicine. *Turmeric* (*Curcuma longa*, Khamin-chun) is used as spice and is useful against inflammatory and liver diseases in most Asian medical systems for a large variety of illnesses.<sup>(2)</sup> *Kaempferia* (*Kaempferia galangal*, Proh) is used as detoxicant for poisonous plants<sup>(3)</sup> and useful antibacterial and antitumor.<sup>(4)</sup> *Alpinia* (*Alpinia galangal*, Kha) is used as flatulence, laxative<sup>(3)</sup> and useful antimicrobial and antitumor.<sup>(4)</sup>

The genus *Globba* is the third largest genus of the Zingiberaceae. *Globba* species are distributed throughout tropical (and parts of subtropical) Asia, ranging from India to southern China, south and east to the Philippines and New Guinea<sup>(5)</sup>, the *Shorea robusta* Gaertn.f. forests of Nepal<sup>(6)</sup>, with the center of distribution in monsoonal Southeast Asia, especially Thailand<sup>(7)</sup> and Myanmar.<sup>(8)</sup>

They comprise about 70 species growing in tropical areas<sup>(1)</sup> and 41 species have been found in Thailand.<sup>(9)</sup> *Globba* species<sup>(9)</sup> are very common components of many plant communities throughout Thailand and neighbouring countries from the deep shade of the evergreen forests of the Malay Peninsula to the dry, deciduous dipterocarp forests in the North and to the pine forests on the ridges of the northern mountains where they are found up to over 2000 m. Some are found in open grassland and along waysides. Morphological of *Globba* genus are:

1. The rhizomes is short; at least one species develops runners.
2. The inflorescence is terminal on the leafy shoot, varying from a dense spike with overlapping bracts to a lax, spread thyrse composed of cincinnae.
3. The bracts are green, white or purplish.
4. The flowers vary in colour from white and violet to yellow, orange and red.
5. The calyx is tubular or campanulate; corolla tube is long with usually cucullate lobes; the lateral staminodes are conspicuous; labellum is bilobed or entire, adnate to the filament above the staminodes.
6. The filament and style are long exerted and arched like a bow.
7. The fruit is a fleshy capsule with several arillate seeds.

*Globba reflexa*, commonly known as Kaopansa is one of the 41 species of *Globba* found in Thailand, ranging from northern to midland such as Chiang Mai, Lampang and Saraburi. Morphological of rhizomes is light tan outside, whitish and slightly aromatic inside, corolla is orange, inflorescence is nodding and leaves are blades dull dark green above, pale light green below.<sup>(10)</sup>

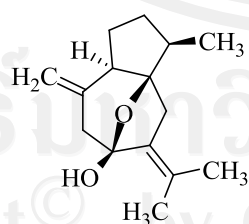


**Figure 1** Morphological illustration of *Globba reflexa*

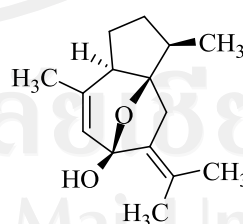
Phytochemical and biological activity of *Globba reflexa* has not been previously reported, investigation of this plant was under taken in this study. However, a previous study of the genus *Globba* described the isolation and biological activities as follows.

*Globba laeta* and *Globba wintii* have been used as decorative plants and useful muscle pain relief.<sup>(11)</sup> The crude extract of *Globba sp.* showed biological activities such as antimicrobial activity for *Globba marantina*<sup>(12)</sup> and inhibitory effect on 2,2'-azobis (2-amidinopropane) dihydrochloride (AAPH)-induced protein oxidation and protein glycation for *Globba wintii*.<sup>(13)</sup>

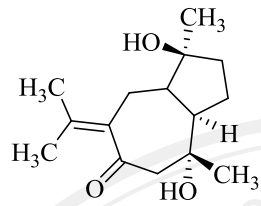
The isolation of chloroform extract of ground-dried rhizomes of *Globba malaccensis* Ridl. gave three sesquiterpenoids; isocurcumenol (**1**), curcumenol (**2**), zedoarondiol (**3**), and one curcumenoid; curcumin (**4**). These four compounds showed moderate to high inhibitory effect against cAMP phosphodiesterase.<sup>(14)</sup> Curcumenol (**2**) was also recrystallized from ethyl acetate in hexane. The structure was established based on X-ray diffraction.<sup>(15)</sup>



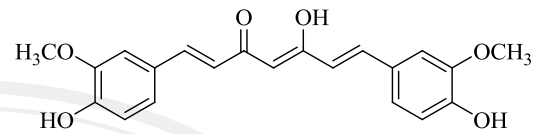
Isocurcumenol (**1**)



Curcumenol (**2**)

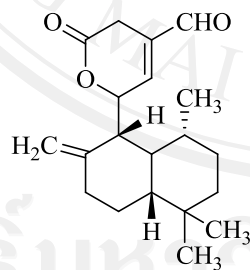


Zedoarondiol (3)

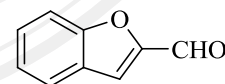


Curcumin (4)

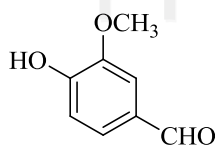
Phytochemical investigation on *Globba pendula* resulted in the isolation of two new compounds; 16-oxo-(8)17-12-labdadien-15,11-olide (5) and benzofuran-2-carboxaldehyde (6). Eight known compounds including vanillin (7), indirubin (8), isoandrographolide (9), vanillic acid (10), 2(3*H*)-benzoxazolone (11),  $\beta$ -sitosterol- $\beta$ -D-glucopyranoside (12),  $\beta$ -sitosterol (13), and 7 $\alpha$ -hydroxysitosterol (14) were also isolated. Furthermore, compound 9 has demonstrated strong cytotoxic properties towards MCF-7, PC-3 and H-460 cancer cell lines with IC<sub>50</sub> values of 7.9, 8.7 and 9.0  $\mu$ M, respectively.<sup>(16)</sup>



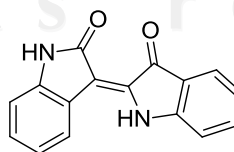
16-oxo-(8)17-12-labdadien-15,11-olide (5)



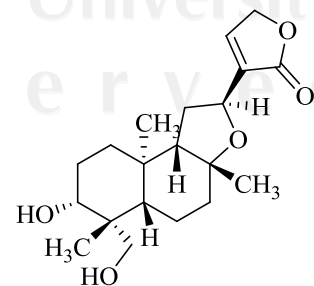
benzofuran-2-carboxaldehyde (6)



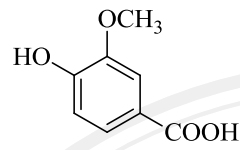
vanillin (7)



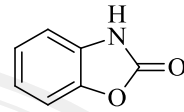
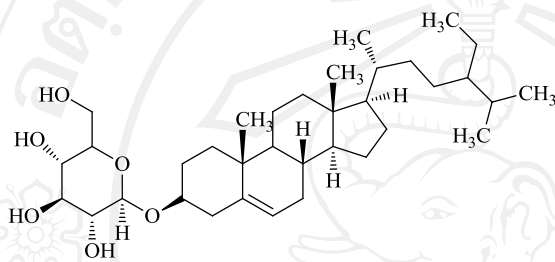
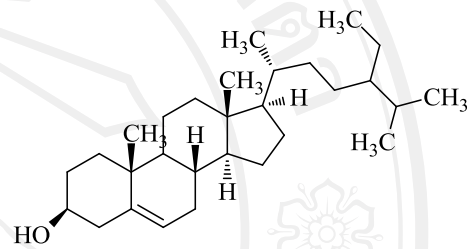
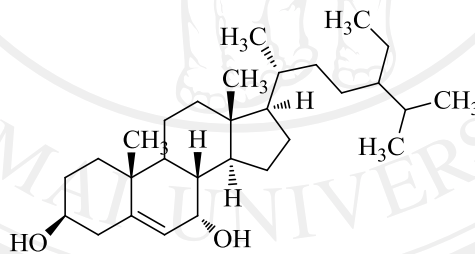
indirubin (8)



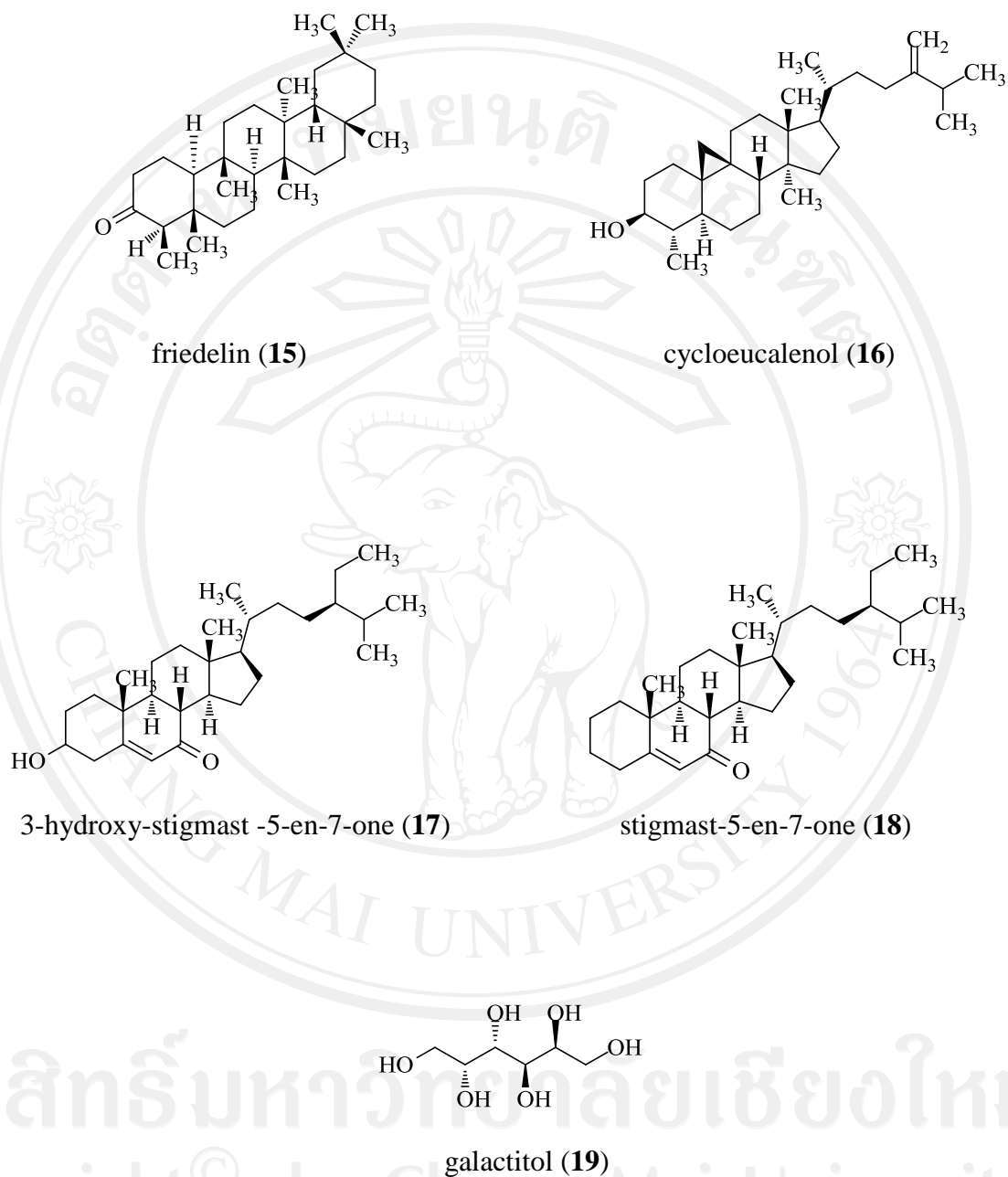
isoandrographolide (9)



vanillic acid (10)

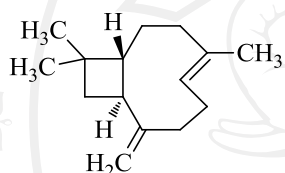
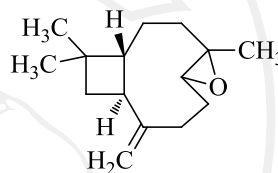
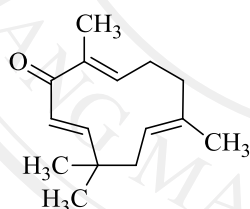
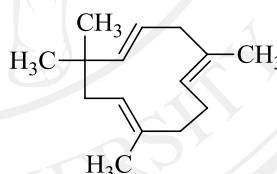
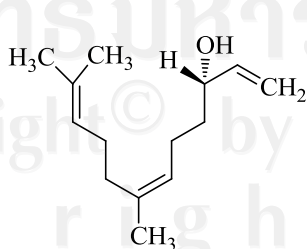
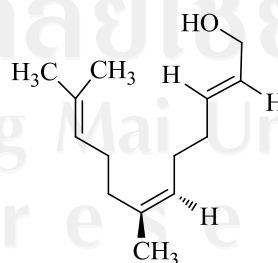
2(3*H*)-benzoxazolone (11) $\beta$ -sitosterol- $\beta$ -D-glucopyranoside (12) $\beta$ -sitosterol (13)7 $\alpha$ -hydroxysitosterol (14)

Six constituents were isolated from the underground parts of *Globba racemosa* Smith and identified as friedelin (15), cycloeucalenol (16), 3-hydroxy-stigmast-5-en-7-one (17), stigmast-5-en-7-one (18), galactitol (19) and  $\beta$ -sitosterol (13) based on spectral data.<sup>(17)</sup>



The essential oils from several *Globba* species were reported to contain sesquiterpenoids and oxygenated sesquiterpenoids as major components.  $\beta$ -caryophyllene (20) (31.7 %) and caryophyllene oxide (21) (10.31%) were found in fresh whole plants oil of *Globba schomburgkii* Hook.f. The essential oils of *Globba*

*ophioglossa* was dominated by oxygenated sesquiterpenoids; zerubone (**22**) (22.0%) and caryophyllene oxide (**21**) (21.8%).<sup>(18)</sup> Moreover *Globba cernua* Baker, *Globba marantina* L. and *Globba ophioglossa* Wight were analyzed by GC-FID and GC/MS and  $\beta$ -Caryophyllene (**20**) (19.3-24.2%) was found to be the major component of the oils. Other significant compounds included  $\alpha$ -humulene (**23**), (*Z*)-nerolidol (**24**) and (*Z,Z*)-farnesol (**25**).<sup>(19)</sup>

 $\beta$ -caryophyllene (**20**)caryophyllene oxide (**21**)zerubone (**22**) $\alpha$ -humulene (**23**)(*Z*)-nerolidol (**24**)(*Z,Z*)-farnesol (**25**)