

## CONTENTS

	<b>Page</b>
บทคัดย่อ	(3)
ABSTRACT	(5)
ACKNOWLEDGEMENT	(7)
THE RELEVANCE OF THE RESEARCH WORK TO THAILAND	(9)
CONTENTS	(10)
LIST OF TABLES	(12)
LIST OF ILLUSTRATIONS	(16)
ABBREVIATIONS AND SYMBOLS	(20)
CHAPTER	
1 INTRODUCTION	1
1.1 Introduction	1
1.2 Review of Literatures	3
1.3 Biosynthesis of Limonoid	13
1.4 Biological Activity of <i>Xylocarpus</i> Species	19
2 EXPERIMENTAL	23
2.1 Instruments and chemicals	23
2.2 Plant material	24
2.3 Extraction	24
2.4 Isolation and chemical investigation	24
2.4.1 Investigation of the crude hexane extract from the seeds of <i>X. granatum</i>	24
	(10)

## CONTENTS (Continued)

	<b>Page</b>
2.4.2 Investigation of the crude dichloromethane extract from the seeds of <i>X.granatum</i>	28
<b>3 RESULTS AND DISCUSSION</b>	<b>31</b>
3.1 Structural elucidation of compounds from the seeds of <i>X.granatum</i>	31
3.1.1 Compound XC1	32
3.1.2 Compound XC2	42
3.1.3 Compound XC3	53
3.1.4 Compound XC4	63
3.1.5 Compound XC5	72
3.1.6 Compound XC6	82
3.1.7 Compound XH1	83
3.1.8 Compound XH2	93
3.1.9 Compound XH3	105
3.2 Biological activities of the crude extract and the pure compounds from <i>X. granatum</i>	117
REFERENCE	122
APPENDIX	127
VITAE	227

## LIST OF TABLES

Table	Page
1 Compounds isolated from <i>Xylocarpus</i> genus	4
2 Ethnomedical information on <i>Xylocarpus</i>	19
3 Biological activities for extracts of <i>Xylocarpus granatum</i>	20
4 $^{13}\text{C}$ and DEPT spectral data of compound XC1	34
5 300 MHz COSY correlation of some protons of compound XC1	35
6 Major HMBC correlation of compound XC1	36
7 $^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XC1	37
8 Comparison of $^1\text{H}$ NMR spectral data between compound XC1 and 7-oxogedunin	40
9 Comparison of $^{13}\text{C}$ NMR spectral data between compound XC1 and 7-oxogedunin	40
10 $^{13}\text{C}$ and DEPT spectral data of compound XC2	44
11 300 MHz COSY correlation of some protons of compound XC2	45
12 Major HMBC correlation of compound XC2	46
13 $^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XC2	48
14 Comparison of $^1\text{H}$ NMR spectral data between compound XC2 and xyloccensin K	50
15 Comparison of $^{13}\text{C}$ NMR spectral data between compound XC2 and xyloccensin K	51
16 $^{13}\text{C}$ and DEPT spectral data of compound XC3	54
17 300 MHz COSY correlation of some protons of compound XC3	56
18 Major HMBC correlation of compound XC3	56

## LIST OF TABLES (Continued)

Table	Page
19 $^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XC3	58
20 Comparison of $^1\text{H}$ NMR spectral data between compound XC3 and 6-acetoxycedrodorin	60
21 Comparison of $^{13}\text{C}$ NMR spectral data between compound XC3 and 6-acetoxycedrodorin	61
22 $^{13}\text{C}$ and DEPT spectral data of compound XC4	64
23 300 MHz COSY correlation of some protons of compound XC4	66
24 Major HMBC correlation of compound XC4	66
25 $^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XC4	67
26 Comparison of $^1\text{H}$ NMR spectral data between compound XC4 and hispidol B	69
27 Comparison of $^{13}\text{C}$ NMR spectral data between compound XC4 and hispidol B	70
28 $^{13}\text{C}$ and DEPT spectral data of compound XC5	74
29 300 MHz COSY correlation of some protons of compound XC5	75
30 Major HMBC correlation of compound XC5	76
31 $^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XC5	78
32 Comparison of $^1\text{H}$ NMR spectral data between compound XC5 and odoratone	79
33 Comparison of $^{13}\text{C}$ NMR spectral data between compound XC5 and odoratone	80
34 $^{13}\text{C}$ and DEPT spectral data of compound XH1	85

## LIST OF TABLES (Continued)

Table		Page
35	300 MHz COSY correlation of some protons of compound XH1	86
36	Major HMBC correlation of compound XH1	86
37	$^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XH1	88
38	Comparison of $^1\text{H}$ NMR spectral data between compound XH1 and methyl angolensate	90
39	Comparison of $^{13}\text{C}$ NMR spectral data between compound XH1 and methyl angolensate	91
40	$^{13}\text{C}$ and DEPT spectral data of compound XH2	95
41	300 MHz COSY correlation of some protons of compound XH2	97
42	Major HMBC correlation of compound XH2	97
43	$^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XH2	99
44	Comparison of $^1\text{H}$ NMR spectral data between compound XH2 and xylocensin P	102
45	Comparison of $^{13}\text{C}$ NMR spectral data between compound XH2 and xylocensin P	103
46	$^{13}\text{C}$ and DEPT spectral data of compound XH3	107
47	300 MHz COSY correlation of some protons of compound XH3	108
48	Major HMBC correlation of compound XH3	109
49	$^1\text{H}$ and $^{13}\text{C}$ spectral data of compound XH3	111
50	Comparison of $^1\text{H}$ NMR spectral data between compound XH3 and xylocensin O	113

## LIST OF TABLES (Continued)

Table		Page
51	Comparison of $^{13}\text{C}$ NMR spectral data between compound XH3 and xylocensin O	114
52	Biological activity of antibacterial of the crude extract and the pure compounds from the seeds of <i>X. granatum</i>	118
53	Biological activity of antiyeasts of the crude extract and the pure compounds from the seeds of <i>X. granatum</i>	119
54	Biological activity of antimicrobial of the reference for test the sample	120
55	Biological activity of antiyeasts of the crude extract and the pure compounds from the seeds of <i>X. granatum</i>	121
56	Crystal data and structure refinement for compound XC1	128
57	Bond lengths [ $\text{\AA}$ ] and angles [ $^\circ$ ] for compound XC1	129
58	Torsion angles [ $^\circ$ ] for compound XC1	133
59	Crystal data and structure refinement for compound XC2	136
60	Bond lengths [ $\text{\AA}$ ] and angles [ $^\circ$ ] for compound XC2	137
61	Torsion angles [ $^\circ$ ] for compound XC2	142
62	Crystal data and structure refinement for compound XC4	145
63	Bond lengths [ $\text{\AA}$ ] and angles [ $^\circ$ ] for compound XC4	146
64	Torsion angles [ $^\circ$ ] for compound XC4	151

## LIST OF ILLUSTRATIONS

Figure		Page
1	<i>Xylocarpus granatum</i> (Meliaceae)	2
2	X-ray ORTEP diagram of compound XC1	39
3	X-ray ORTEP diagram of compound XC2	50
4	X-ray ORTEP diagram of compound XC4	69
5	UV (MeOH) spectrum of compound XC1	153
6	IR (Neat) spectrum of compound XC1	154
7	<sup>1</sup> H NMR (300 MHz, CDCl <sub>3</sub> ) spectrum of compound XC1	155
8	<sup>13</sup> C NMR (75 MHz, CDCl <sub>3</sub> ) spectrum of compound XC1	156
9	DEPT (CDCl <sub>3</sub> ) spectrum of compound XC1	157
10	2D COSY spectrum of compound XC1	158
11	2D HMQC spectrum of compound XC1	159
12	2D HMBC spectrum of compound XC1	160
13	NOESY spectrum of compound XC1	161
14	Mass spectrum of compound XC1	162
15	UV (MeOH) spectrum of compound XC2	163
16	IR (Neat) spectrum of compound XC2	164
17	<sup>1</sup> H NMR (300 MHz, CDCl <sub>3</sub> ) spectrum of compound XC2	165
18	<sup>13</sup> C NMR (75 MHz, CDCl <sub>3</sub> ) spectrum of compound XC2	166
19	DEPT (CDCl <sub>3</sub> ) spectrum of compound XC2	167
20	2D COSY spectrum of compound XC2	168
21	2D HMQC spectrum of compound XC2	169
22	2D HMBC spectrum of compound XC2	170

## LIST OF ILLUSTRATIONS (Continued)

Figure		Page
23	Mass spectrum of compound XC2	171
24	UV (MeOH) spectrum of compound XC3	172
25	IR (Neat) spectrum of compound XC3	173
26	$^1\text{H}$ NMR (300 MHz, $\text{CDCl}_3$ ) spectrum of compound XC3	174
27	$^{13}\text{C}$ NMR (75 MHz, $\text{CDCl}_3$ ) spectrum of compound XC3	175
28	DEPT ( $\text{CDCl}_3$ ) spectrum of compound XC3	176
29	2D COSY spectrum of compound XC3	177
30	2D HMQC spectrum of compound XC3	178
31	2D HMBC spectrum of compound XC3	179
32	IR (KBr) spectrum of compound XC4	180
33	$^1\text{H}$ NMR (300 MHz, $\text{DMSO}-d_6$ and $\text{CDCl}_3$ ) spectrum of compound XC4	181
34	$^{13}\text{C}$ NMR (75 MHz, $\text{DMSO}-d_6$ and $\text{CDCl}_3$ ) spectrum of compound XC4	182
35	DEPT ( $\text{DMSO}-d_6$ and $\text{CDCl}_3$ ) spectrum of compound XC4	183
36	2D COSY spectrum of compound XC4	184
37	2D HMQC spectrum of compound XC4	185
38	2D HMBC spectrum of compound XC4	186
39	IR (Neat) spectrum of compound XC5	187
40	$^1\text{H}$ NMR (300 MHz, $\text{CDCl}_3$ ) spectrum of compound XC5	188
41	$^{13}\text{C}$ NMR (75 MHz, $\text{CDCl}_3$ ) spectrum of compound XC5	189
42	DEPT ( $\text{CDCl}_3$ ) spectrum of compound XC5	190
43	2D COSY spectrum of compound XC5	191
44	2D HMQC spectrum of compound XC5	192



## LIST OF ILLUSTRATIONS (Continued)

Figure		Page
45	2D HMBC spectrum of compound XC5	193
46	Mass spectrum of compound XC5	194
47	IR (Neat) spectrum of compound XC6	195
48	$^1\text{H}$ NMR (300 MHz, $\text{CDCl}_3$ ) spectrum of compound XC6	196
49	UV (MeOH) spectrum of compound XH1	197
50	IR (Neat) spectrum of compound XH1	198
51	$^1\text{H}$ NMR (300 MHz, $\text{CDCl}_3$ ) spectrum of compound XH1	199
52	$^{13}\text{C}$ NMR (75 MHz, $\text{CDCl}_3$ ) spectrum of compound XH1	200
53	DEPT ( $\text{CDCl}_3$ ) spectrum of compound XH1	201
54	2D COSY spectrum of compound XH1	202
55	2D HMQC spectrum of compound XH1	203
56	2D HMBC spectrum of compound XH1	204
57	NOESY spectrum of compound XH1	205
58	Mass spectrum of compound XH1	206
59	UV (MeOH) spectrum of compound XH2	207
60	IR (Neat) spectrum of compound XH2	208
61	$^1\text{H}$ NMR (300 MHz, $\text{CDCl}_3$ ) spectrum of compound XH2	209
62	$^{13}\text{C}$ NMR (75 MHz, $\text{CDCl}_3$ ) spectrum of compound XH2	210
63	DEPT ( $\text{CDCl}_3$ ) spectrum of compound XH2	211
64	2D COSY spectrum of compound XH2	212
65	2D HMQC spectrum of compound XH2	213
66	2D HMBC spectrum of compound XH2	214

## LIST OF ILLUSTRATIONS (Continued)

<b>Figure</b>		<b>Page</b>
67	NOESY spectrum of compound XH2	215
68	Mass spectrum of compound XH2	216
69	UV (MeOH) spectrum of compound XH3	217
70	IR (Neat) spectrum of compound XH3	218
71	<sup>1</sup> H NMR (300 MHz, CDCl <sub>3</sub> ) spectrum of compound XH3	219
72	<sup>13</sup> C NMR (75 MHz, CDCl <sub>3</sub> ) spectrum of compound XH3	220
73	DEPT (CDCl <sub>3</sub> ) spectrum of compound XH3	221
74	2D COSY spectrum of compound XH3	222
75	2D HMQC spectrum of compound XH3	223
76	2D HMBC spectrum of compound XH3	224
77	NOESY spectrum of compound XH3	225
78	Mass spectrum of compound XH3	226

## ABBREVIATIONS AND SYMBOLS

<i>s</i>	=	singlet
<i>d</i>	=	doublet
<i>t</i>	=	triplet
<i>m</i>	=	multiplet
<i>dd</i>	=	doublet of doublet
<i>dt</i>	=	doublet of triplet
<i>br s</i>	=	broad singlet
<i>g</i>	=	gram
nm	=	nanometer
mp.	=	melting point
cm <sup>-1</sup>	=	reciprocal centimeter (wave number)
$\delta$	=	chemical shift relative to TMS
<i>J</i>	=	coupling constant
$\lambda_{\text{max}}$	=	maximum wavelength
$\nu$	=	absorption frequencies
$\epsilon$	=	molar extinction coefficient
°C	=	degree celcius
MHz	=	Megahertz
ppm	=	part per million
c	=	concentration
IR	=	Infrared
UV	=	Ultraviolet-Visible
MS	=	Mass Spectroscopy
NMR	=	Nuclear Magnetic Resonance

## ABBREVIATIONS AND SYMBOLS (Continued)

2D NMR	=	Two Dimensional Nuclear Magnetic Resonance
COSY	=	Correlation Spectroscopy
DEPT	=	Distortionless Enhancement by Polarization Transfer
HMBC	=	Heteronuclear Multiple Bond Correlation
HMQC	=	Heteronuclear Multiple Quantum Coherence
NOESY	=	Nuclear Overhauser Effect Spectroscopy
CC	=	Column Chromatography
QCC	=	Quick Column Chromatography
TMS	=	tetramethylsilane
CDCl <sub>3</sub>	=	deuteriochloroform
DMSO <i>d</i> <sub>6</sub>	=	hexadeutero-dimethyl sulphoxide