

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
ABSTRACT (in English)	iv
ABSTRACT (in Thai)	v
TABLE OF CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
ABBREVIATIONS AND SYMBOLS	xiv
 CHAPTER 1 INTRODUCTION	
1.1 Information regarding <i>Vernonia</i> genus	1
1.2 Information of <i>Vernonia parishii</i> Hook f.	2
1.3 Objectives of the research	2
 CHAPTER 2 LITERATURE REVIEWS	
2.1 Previous Reports of <i>Vernonia</i> plants	4
 CHAPTER 3 EXPERIMENTAL	
3.1 General Methods	20
3.2 Plant Material	20
3.3 Extraction and Isolation	20
3.4 Separation of the dichloromethane extract	21
3.5 Biological assay	25
 CHAPTER 4 RESULTS AND DISCUSSION	
4.1 Biological activities screening of dichloromethane extract of <i>V. parishii</i> leaves	26
4.2 Structure elucidation of isolated compounds	26

4.3	Biological activities of isolated compounds from previous literatures	79
4.4	Biosynthesis of isolated triterpenes from <i>V. parishii</i>	81
CHAPTER 5 CONCLUSIONS		84
REFERENCES		85
APPENDIX		90
CURRICULUM VITAE		156

LIST OF TABLES

Table		Page
1	Bioactivities screening of dichloromethane extract of <i>V. parishii</i>	26
2	¹ H NMR and ¹³ C NMR spectrum of stigmasterol (58)	29
3	¹ H NMR spectrum of α -amyrin acetate (9)	33
4	¹³ C NMR spectrum of α -amyrin acetate (9)	34
5	¹ H NMR spectrum of lupeol acetate (59)	40
6	¹³ C NMR spectrum of lupeol acetate (59)	41
7	¹ H NMR spectrum of lupeol palmitate (60)	48
8	¹³ C NMR spectrum of lupeol palmitate (60)	49
9	¹ H NMR spectrum of lupenone (61)	55
10	¹³ C NMR spectrum of lupenone (61)	55
11	¹ H NMR spectrum of lupeol (41)	62
12	¹³ C NMR spectrum of lupeol (41)	62
13	¹ H NMR spectrum of α -amyrin (13)	69
14	¹³ C NMR spectrum of α -amyrin (13)	69
15	Bioassay of five triterpenes from previous literatures	79

LIST OF FIGURES

Figure	Page
1 Morphological illustration of <i>Vernonia parishii</i> Hook f.	3
2 Structures of compounds 1 and 2	4
3 Structure of compound 3	5
4 Structures of compounds 4 and 5	5
5 Structure of compound 6	6
6 Structure of compound 7	6
7 Structures of compounds 8-14	7
8 Structures of compounds 15 and 16	8
9 Structures of compounds 17 and 18	8
10 Structures of compounds 19-21	9
11 Structures of compounds 22-24	10
12 Structures of compounds 25 and 26	11
13 Structure of compound 27	12
14 Structure of compound 28	12
15 Structures of compounds 29-35	13
16 Structures of compounds 36-38	14
17 Structures of compounds 39 and 40	15
18 Structures of compounds 41-44	15
19 Structures of compounds 45-48	16
20 Structures of compounds 49 and 50	16
21 Structure of compound 51	17
22 Structures of compounds 52-53	17
23 Structure of compound 54	18
24 Structures of compounds 55-57	18
25 The extraction flowchart of <i>V. parishii</i> leaves	21
26 The isolating flowchart of dichloromethane extract of <i>V. parishii</i> leaves of compounds 58 , 60 , 9 , and 59	22

27	The isolating flowchart of dichloromethane extract of <i>V. parishii</i> leaves of compounds 61 , 13 , and 41	23
28	The isolating flowchart of dichloromethane extract of <i>V. parishii</i> leaves of compounds 62 , and 63	24
29	Labeling number of each carbon in structure of stigmasterol (58)	27
30	¹ H NMR spectrum of stigmasterol (58)	28
31	¹³ C NMR spectrum of stigmasterol (58)	28
32	Mechanism of key fragment ions of stigmasterol (58) from EI-MS	31
33	Labeling number of each carbon in structure of α -amyrin acetate (9)	32
34	¹ H NMR spectrum of α -amyrin acetate (9)	32
35	¹³ C NMR spectrum of α -amyrin acetate (9)	33
36	HMQC data of α -amyrin acetate (9)	35
37	HMBC data of α -amyrin acetate (9)	36
38	Mechanism of key fragment ions of α -amyrin acetate (9) from EI-MS	37
39	Labeling number of each carbon in structure of lupeol acetate (59)	38
40	¹ H NMR spectrum of lupeol acetate (59)	39
41	¹³ C NMR spectrum of lupeol acetate (59)	39
42	HMQC data of lupeol acetate (59)	43
43	HMBC data of lupeol acetate (59)	43
44	Mechanism of key fragment ions of lupeol acetate (59) from EI-MS	44
45	Labeling number of each carbon in structure of lupeol palmitate (60)	45
46	¹ H NMR spectrum of lupeol palmitate (60)	46
47	¹³ C NMR spectrum of lupeol palmitate (60)	46
48	¹ H NMR spectrum of lupeol palmitate (60) before added D ₂ O	47
49	¹ H NMR spectrum of lupeol palmitate (60) after added D ₂ O	48
50	HMQC data of lupeol palmitate (60)	51
51	HMBC data of lupeol palmitate (60)	51
52	Mechanism of key fragment ions of lupeol palmitate (60) from EI-MS	52
53	Labeling number of each carbon in structure of lupenone (61)	53
54	¹ H NMR spectrum of lupenone (61)	54
55	¹³ C NMR spectrum of lupenone (61)	54
56	HMQC data of lupenone (61)	57

57	HMBC data of lupenone (61)	58
58	Mechanism of key fragment ions of lupenone (61) from EI-MS	59
59	Labeling number of each carbon in structure of lupeol (41)	60
60	¹ H NMR spectrum of lupeol (41)	61
61	¹³ C NMR spectrum of lupeol (41)	61
62	HMQC data of lupeol (41)	64
63	HMBC data of lupeol (41)	65
64	Mechanism of key fragment ions of lupeol (41) from EI-MS	66
65	Labeling number of each carbon in structure of α -amyrin (13)	67
66	¹ H NMR spectrum of α -amyrin (13)	68
67	¹³ C NMR spectrum of α -amyrin (13)	68
68	HMQC data of α -amyrin (13)	71
69	HMBC data of α -amyrin (13)	72
70	Mechanism of key fragment ions of α -amyrin (13) from EI-MS	73
71	Labeling number of each carbon in structure of hentriacontane (62)	74
72	¹ H NMR spectrum of hentriacontane (62)	74
73	¹³ C NMR spectrum of hentriacontane (62)	75
74	Mechanism of key fragment ions of hentriacontane (62) from EI-MS	75
75	Labeling number of each carbon in structure of palmitic acid (63)	76
76	¹ H NMR spectrum of palmitic acid (63)	76
77	¹³ C NMR spectrum of palmitic acid (63)	77
78	¹ H NMR spectrum of lupeol palmitate (60) before added D ₂ O	78
79	¹ H NMR spectrum of lupeol palmitate (60) after added D ₂ O	78
80	Biosynthesis of triterpenes via Mevalonate pathway	81
81	¹ H NMR spectrum of stigmasterol (58)	91
82	¹³ C NMR spectrum of stigmasterol (58)	92
83	COSY of stigmasterol (58)	93
84	Comparison between DEPT 90, DEPT 135, and ¹³ C of stigmasterol (58)	94
85	Mass spectrum of stigmasterol (58)	95
86	IR spectrum of stigmasterol (58)	96
87	¹ H NMR spectrum of α -amyrin acetate (9)	97
88	¹³ C NMR spectrum of α -amyrin acetate (9)	98

89	COSY of α -amyrin acetate (9)	99
90	Comparison between DEPT 90, DEPT 135, and ^{13}C of α -amyrin acetate (9)	100
91	HMQC of α -amyrin acetate (9)	101
92	HMBC of α -amyrin acetate (9)	102
93	Mass spectrum of α -amyrin acetate (9)	103
94	IR spectrum of α -amyrin acetate (9)	104
95	^1H NMR spectrum of lupeol acetate (59)	105
96	^{13}C NMR spectrum of lupeol acetate (59)	106
97	COSY of lupeol acetate (59)	107
98	Comparison between DEPT 90, DEPT 135, and ^{13}C of lupeol acetate (59)	108
99	HMQC of lupeol acetate (59)	109
100	HMBC of lupeol acetate (59)	110
101	Mass spectrum of lupeol acetate (59)	111
102	IR spectrum of lupeol acetate (59)	112
103	^1H NMR spectrum of lupeol palmitate (60)	113
104	^{13}C NMR spectrum of lupeol palmitate (60)	114
105	COSY of lupeol palmitate (60)	115
106	Comparison between DEPT 90, DEPT 135, and ^{13}C of lupeol palmitate (60)	116
107	HMQC of lupeol palmitate (60)	117
108	HMBC of lupeol palmitate (60)	118
109	Mass spectrum of lupeol palmitate (60)	119
110	IR spectrum of lupeol palmitate (60)	120
111	^1H NMR spectrum of lupenone (61)	121
112	^{13}C NMR spectrum of lupenone (61)	122
113	COSY of lupenone (61)	123
114	Comparison between DEPT 90, DEPT 135, and ^{13}C of lupenone (61)	124
115	HMQC of lupenone (61)	125
116	HMBC of lupenone (61)	126
117	Mass spectrum of lupenone (61)	127
118	IR spectrum of lupenone (61)	128
119	^1H NMR spectrum of lupeol (41)	129
120	^{13}C NMR spectrum of lupeol (41)	130

121 COSY of lupeol (41)	131
122 Comparison between DEPT 90, DEPT 135, and ^{13}C of lupeol (41)	132
123 HMQC of lupeol (41)	133
124 HMBC of lupeol (41)	134
125 Mass spectrum of lupeol (41)	135
126 IR spectrum of lupeol (41)	136
127 ^1H NMR spectrum of α -amyrin (13)	137
128 ^{13}C NMR spectrum of α -amyrin (13)	138
129 COSY of α -amyrin (13)	139
130 Comparison between DEPT 90, DEPT 135, and ^{13}C of α -amyrin (13)	140
131 HMQC of α -amyrin (13)	141
132 HMBC of α -amyrin (13)	142
133 Mass spectrum of α -amyrin (13)	143
134 IR spectrum of α -amyrin (13)	144
135 ^1H NMR spectrum of hentriacontane (62)	145
136 ^{13}C NMR spectrum of hentriacontane (62)	146
137 COSY of hentriacontane (62)	147
138 Comparison between DEPT 90, DEPT 135, and ^{13}C of hentriacontane (62)	148
139 Mass spectrum of hentriacontane (62)	149
140 IR spectrum of hentriacontane (62)	150
141 ^1H NMR spectrum of palmitic acid (63)	151
142 ^{13}C NMR spectrum of palmitic acid (63)	152
143 Comparison between DEPT 135 and ^{13}C of palmitic acid (63)	153
144 Mass spectrum of palmitic acid (63)	154
145 IR spectrum of palmitic acid (63)	155

ABBREVIATIONS AND SYMBOLS

COSY	Correlation spectroscopy
δ	Chemical shift in parts per million downfield from tetramethylsilane
<i>d</i>	Doublet (spectral)
<i>dd</i>	Doublet of doublets (spectral)
<i>dt</i>	Doublet of triplets (spectral)
DEPT	Distortionless enhancement by polarization transfer
ESI-MS	Electrospray ionization mass spectrometry
FT-IR	Fourier-transform infrared
g	Gram
HMBC	Heteronuclear multiple bond correlation
HMQC	Heteronuclear multiple quantum correlation
IR	Infrared
<i>J</i>	Coupling constant
L	Litre
mL	Millilitre
m.p.	Melting point
<i>m/z</i>	Mass to charge ratio
PLC	Preparative layer chromatography
ppm	Parts per million (in NMR)
<i>s</i>	Singlet (spectral)
TMS	Tetramethylsilane
<i>t</i>	Triplet (spectral)
UV	Ultraviolet
$[\alpha]$	Specific optically rotation
ν	Wave number (cm^{-1})