

CONTNETS

Acknowledgments.....	I
List of Abbreviations.....	III
List of Tables.....	V
List of Figures.....	VIII
List of Schemes.....	X
Abstract.....	XI
Format of the thesis.....	XIV
Part A. Chapter 1. Introduction.	1
1.1 General	2
1.1.1 Alkaloids	2
1.1.2 Classification of alkaloids	3
1.2 Family Berberidaceae (Family of the current study)	7
1.3 The Genus <i>Berberis</i> (Genus of the current study)	8
1.3.1 <i>Berberis brevissima</i> Jafri (Species of the current study)	8
1.3.2 <i>Berberis parkeriana</i> Schneid (Species of the current study)	9
1.3.3 <i>Berberis royleana</i> Ahrendt (Species of the current study)	10
1.4 Literature review of the genus <i>Berberis</i>	11
1.4.1 Alkaloids	12
1.4.2 Flavonoids	17
1.4.3 Anthocyanins	17
1.4.4 Carotenoids and vitamins	19
1.4.5 Phenolic compounds	20

1.4.6	Liganins	21
1.4.7	Tripterpenoids and acids	22
1.5	Biosynthesis of isoquinoline alkaloids	23
1.5.1	Biosynthesis of tetrahydroisoquinoline alkaloids	23
1.5.2	Biosynthesis of protoberberine alkaloids	29
1.5.3	Biosynthesis of bisbenzylisoquinoline alkaloids	29
Part A.	Chapter 2. Results and Discussion	32
2.1	Phytochemicals isolated from the roots and stem of selected <i>Berberis</i> species.....	33
2.2	New alkaloids from the roots of <i>B. brevissima</i> Jafri.....	34
2.2.1	Tirahamine (65).....	34
2.2.1a	Characterization of tirahamine (65).....	34
2.2.1b	Effect of solvents and temperatures on the ¹ H NMR spectra of tirahamine (65).....	42
2.2.1c	Derivatization of tirahamine (65).....	43
2.2.2	13-Nitrotirahamine (67).....	44
2.2.2a	Characterization of 13-nitrotirahamine.....	44
2.2.2b	Effect of solvents and temperatures on the ¹ H NMR spectra of 13-nitrotirahamine.....	53
2.2.2c	Nitro compounds are rare but there	56
2.2.3	Peshawarine (68).....	56
2.2.4	New source alkaloids from the roots of <i>B. brevissima</i> Jafri.....	64

2.3	New source alkaloids from the stem of <i>B. brevissima</i> Jafri.....	65
2.4	New Source alkaloids from the roots of <i>B. parkeriana</i> Schneid.....	65
2.4.1	Berberine (69).....	65
2.4.2	Dehydrocheilanthifoline (70).....	70
2.4.3	Jatrorrhizine (71).....	75
2.4.4	Berberrubine (72).....	80
2.4.5	Other new source alkaloids from the roots of <i>B. parkeriana</i> Schneid.....	85
2.5	New source alkaloids from the stem of <i>B. parkeriana</i> Schneid.....	85
2.6	New source alkaloids from the roots of <i>B. royleana</i> Ahrendt.....	85
2.6.1	8-Oxo-berberine (73).....	85
2.6.2	Columbamine (74).....	90
2.6.3	Palmatine (75).....	96
2.6.4	Other new source alkaloids isolated from the roots of <i>B. royleana</i> Ahrendt.....	101
2.7	New source alkaloids from the stem of <i>B. royleana</i> Ahrendt.....	101
2.8	New source non-alkaloids isolated from the roots of <i>B. brevissima</i> Jafri.....	101
2.8.1	Glutamic acid (76) and its minor related constituents	101
2.8.1a	Characterization of glutamic acid (76).....	101

2.8.1b.1	Characterization of glutamic acid, methyl ester (77) from the LC-ESIMS profile of glutamic acid (76).....	104
2.8.1b.2	Characterization of di-glutamic acid (78) from the LC-ESIMS profile of glutamic acid (76)	104
2.8.1b.3	Characterization of di-glutamic acid, methyl ester (79) from the LC-ESIMS profile of glutamic acid (76)	105
2.8.1b.4	Characterization of di-glutamic acid, di-methyl ester (80) from the LC-ESIMS profile of glutamic acid (76)	105
2.8.2	Docosanoic acid (81).....	106
2.8.3	23a-Homostigmast-5-en-3 β -ol (82).....	110
2.8.4	-Sitosterol-3-O- -D-glucopyranoside (83).....	115
2.8.5	Nonacosane-10-ol (84).....	120
2.8.6	Palmitic acid (85).....	126
2.8.7	Linoleic acid (86).....	128
2.9	Fatty acid analysis of the eight oil fractions obtained from Hexane Fraction of <i>B. brevissima</i> roots.....	130
2.10	New source non-alkaloids from the stem of <i>B. brevissima</i> Jafri.....	132
2.11	New source non-alkaloids from the roots of <i>B. parkeriana</i> Schneid.....	132
2.12	New source non-alkaloids from the stem of <i>B. parkeriana</i> Schneid.....	132

2.13	New source non-alkaloids from the roots of <i>B. royleana</i> Ahrendt.....	132
2.14	New source non-alkaloids from the stem of <i>B. royleana</i> Ahrendt.....	132
Part A.	Chapter 3. Experimental	133
3.1	General experimental conditions.....	134
3.1.1	Melting points (m. p.)	134
3.1.2	Optical rotations ($^{20}[\alpha]_D$)	134
3.1.3	UV-Vis spectra (UV-Vis)	134
3.1.4	Infrared spectra (IR)	134
3.1.5	Mass spectra (MS)	134
3.1.6	Nuclear magnetic resonance spectra (NMR)	135
3.1.7	Solvents.....	135
3.1.8	GC-MS analysis of the oil fractions.....	135
3.2	Techniques used for the purification of compounds.....	137
3.2.1	Column chromatography (CC).....	137
3.2.2	Thin layer chromatography (TLC) and preparative thin layer chromatography.....	137
3.3	Locating reagents for TLC.....	137
3.3.1	Dragendorff's reagent.....	137
3.3.2	Ceric sulphate solution.....	138
3.4	Plant material.....	138

3.4.1	Extraction and fractionation of roots and stem of <i>B. brevissima</i> , <i>B. parkeriana</i> and <i>B. royleana</i>	138
3.4.2	Isolation of the constituents from the roots fractions of <i>B. brevissima</i> Jafri.....	139
3.4.3	Isolation of the constituents from the stem fractions of <i>B. brevissima</i> Jafri.....	145
3.4.4	Isolation of the constituents from the roots fractions of <i>B. parkeriana</i> Schneid.....	145
3.4.5	Isolation of the constituents from the stem fractions of <i>B. parkeriana</i> Schneid.....	148
3.4.6	Isolation of the constituents from the roots fractions of <i>B. royleana</i> Ahrendt.....	148
3.4.7	Isolation of the constituents of the stem fractions of <i>B. royleana</i> Ahrendt.....	151
3.5	Derivatization of tirahamine (65).....	151
3.6	The study of ¹ H NMR spectrum at various temperature using CDCl ₃ and DMSO-d ₆ as solvents	152
3.7	Experimental data of new alkaloids isolated from <i>B. brevissima</i> Jafri roots.....	153
3.7.1	Tirahamine (65).....	153
3.7.2	O-Acetyl-tirahamine (66).....	154
3.7.3	13-Nitrotirahamine (67).....	155
3.7.4	Peshawarine (68).....	156

3.8	Experimental data of the new source alkaloids isolated from the roots of <i>Berberis parkeriana</i> Schneid.....	157
3.8.1	Berberine (69).....	157
3.8.2	Dehydrocheilanthifoline (70).....	158
3.8.3	Jatrorrhizine (71).....	159
3.8.4	Berberrubine (72).....	160
3.9	Experimental data of the new source alkaloids isolated from the roots of <i>Berberis royleana</i> Ahrendt.....	161
3.9.1	8-Oxoberberine (73).....	161
3.9.2	Columbamine (74).....	162
3.9.3	Palmatine (75).....	163
3.10	Experimental data of new source non-alkaloids isolated from <i>B. brevissima</i> Jafri roots.....	164
3.10.1	Glutamic acid (76).....	164
3.10.1.1.	Glutamic acid, methyl ester (77)	164
3.10.1.2.	Di-glutamic acid (78)	165
3.10.1.2.	Di-glutamic acid, methyl ester (79)	165
3.10.1.2.	Di-glutamic acid, di-methyl ester (80)	166
3.10.2	Docosanoic acid (81).....	167
3.10.3	23a-Homostigmast-5-en-3 β -ol (82).....	168
3.10.4	-sitosterol-3-O- -D-glucopyranoside (83).....	169
3.10.5	Nonacosane-10-ol (84).....	170
3.10.6	Palmitic acid (85).....	171

3.10.7	Linoleic acid (86).....	171
Part B.	Chapter 4. Introduction.	172
4.1	General.....	173
4.2	Pharmacological importance of the genus <i>Berberis</i>	174
Part B.	Chapter 5. Results and Discussion.	177
5.1	Biological activities of <i>B. brevissima</i> Jafri, <i>B. parkeriana</i> Schneid and <i>B. royleana</i> Ahrendt.....	178
5.1A	Anticancer activities.....	178
5.1B	Antidiabetic activities.....	180
5.1C	Antimicrobial activities.....	181
5.1D	Antitrypanosomal activities.....	183
5.1E	Nematicidal activities.....	184
5.1Ea	<i>In vitro</i> nematicidal activity of the crude methanolic extracts and the fractions of the two <i>Berberis</i> spp. against J2s mortality of <i>M. javanica</i>	184
5.1Eb	<i>In vitro</i> nematicidal activity of the compounds isolated from the two <i>B. brevissima</i> and <i>B. parkeriana</i> against J2s mortality of <i>M. javanica</i>	186
Part B.	Chapter 6. Experimental	189
6.1	Plant material.....	190
6.2	Preparation of extracts and fractions.....	190
6.3	Anticancer assay.....	190
6.4	Antidiabetic assay.....	190

6.5	Antimicrobial and antitrypanosomal assay.....	192
6.6	Nematicidal assay.....	193
References		195
Appendices		205
Appendix A	Structures of some isolated compounds	206
Appendix B	¹ H NMR spectra of tirahamine and 13-nitro tirahamine.....	218
Appendix C	List of publications	227