

## CHAPTER II

### HISTORICAL

#### 1. Chemical Constituents of Lamiaceae

Volatile or essential oils, as their name implies, are volatile in steam. They are natural products which are commercially used in pharmaceutical products. For examples, 4-terpineol is used to as antiseptic. Citronellal and geraniol are used in combination as mosquito repellent. Most of the plants in this family secrete characteristic volatile oils from their glandular hairs. The following reviews focus only on Thai Lamiaceous plants of which the chemical compositions of essential oils have been previously worked on. List of compounds are shown below.

**Table 1** Chemical constituent of Thai Lamiaceous plants

Plant part	Chemical constituent	Reference
Leaves	<i>Coleus amboinicus</i> Lour. <b>Monoterpene</b> $\alpha$ -phellandrene $\delta$ -3-carene $\alpha$ -terpinene <i>p</i> -cymene limonene $\gamma$ -terpinene $\alpha$ -pinene sabinene myrcene $\alpha$ -thujene	Haque, 1988 ; Morton, 1992 ; Prudent <i>et al.</i> , 1995 ; Ameenah, Mala, and Fawzia, 1995 ; Pino, Garcia, and Martinez, 1996

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	camphene	
	verbenone	
	$\beta$ -pinene	
	$\beta$ -phellandrene	
	cis-sabinene hydrate	
	terpinolene	
	<b>Oxygenated monoterpene</b>	
	linalool	
	camphor	
	terpinen-4-ol	
	geraniol	
	thymol	
	carvacrol	
	$\alpha$ -terpineol	
	<b>Sesquiterpene</b>	
	$\alpha$ -copaene	
	$\beta$ -caryophyllene	
	$\alpha$ -humulene	
	$\delta$ -muurolene	
	$\beta$ -selinene	
	$\alpha$ -selinene	
	$\delta$ -cadinene	
	$\alpha$ -cis-bergamotene	
	( <i>E</i> )- $\beta$ -bergamotene	
	$\alpha$ -amorphene	
	( <i>Z</i> )- $\beta$ -farnesene	

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	<p><math>\alpha</math>-guaiene</p> <p><math>\alpha</math>-muurolene</p> <p>(<i>E</i>)-<math>\beta</math>-farnesene</p> <p><math>\beta</math>-sesquiphellandrene</p> <p><i>trans</i>-<math>\alpha</math>-bergamotene</p> <p>(<i>E,E</i>)-<math>\alpha</math>-farnesene</p> <p><math>\beta</math>-bisabolene</p> <p><b>Oxygenated sesquiterpene</b></p> <p><math>\gamma</math>-cadinol</p> <p><math>\alpha</math>-cadinol</p> <p>(<i>Z</i>) <i>E</i>-farnesol</p> <p>caryophyllene oxide</p> <p>humulene oxide II</p> <p>aromadendrene oxide</p> <p><b>Phenylpropanoid</b></p> <p>eugenol</p> <p>methyleugenol</p> <p><b>Aliphatic Alcohols</b></p> <p>1-octen-3-ol</p>	
Leaves	<p><i>Hyptis suaveolens</i> Poit.</p> <p><b>Monoterpene</b></p> <p>tricyclene</p> <p><math>\alpha</math>-pinene</p> <p>camphene</p>	<p>Iwu, Ezeugwu, and Okunji, 1990 ; Ahmed, Scora, and Ting, 1994</p>

Table 1 Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	sabinene	
	$\beta$ -pinene	
	myrcene	
	$\alpha$ -phellandrene	
	$\delta$ -3-carene	
	$\alpha$ -terpinene	
	<i>p</i> -cymene	
	limonene	
	( <i>Z</i> )- $\beta$ -ocimene	
	$\gamma$ -terpinene	
	<i>p</i> -cymemene	
	terpinolene	
	thujane	
	<b>Oxygenated monoterpene</b>	
	1, 8-cineole	
	linalool	
	camphor	
	borneol	
	terpinen-4-ol	
	$\alpha$ -terpineol	
	thymol	
	trans-pinene hydrate	
	3,7-Dimethyl-1, 6-octadien 3 ol	
	3, cyclohexen-1 -carboxaldehyde	
	<b>Sesquiterpene</b>	
	$\alpha$ -copaene	

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	$\beta$ -bourbonene $\beta$ -elemene $\beta$ -caryophyllene trans- $\alpha$ -bergamotene $\alpha$ -humulene $\gamma$ -muurolene valencene germacrene B $\alpha$ -muurolene $\alpha$ -caryophyllene <b>Oxygenated sesquiterpene</b> spathulenol globulol $\alpha$ -cadinol muurolol bergamotol $\alpha$ -caryophyllene  <b>Diterpene</b> rimuene 5- $\beta$ , 8- $\beta$ , H, 9- $\beta$ , H, 10 $\alpha$ -Labd - 14-ene	
Fresh flowering stems and leaves	<i>Mentha arvensis</i> var <i>piperascens</i> Malinvaud <b>Mono terpene</b> $\alpha$ -pinene sabinene	Retamar, and De-Riscala, 1980 ; Pino, Rosado, and Fuentes, 1995

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	<i>β</i> -pinene	
	myrcene	
	<i>p</i> -cymene	
	limonene	
	camphene	
	<b>Oxygenated monoterpene</b>	
	menthol	
	piperitone	
	pulegone	
	neomethyl acetate	
	menthyl acetate	
	isomenthyl acetate	
	menthone	
	isomenthone	
	<b>Sesquiterpene</b>	
	<i>β</i> -bourbonene	
	<i>β</i> -caryophyllene	
	<i>α</i> -humulene	
	<i>γ</i> -muurolene	
	<i>γ</i> -elemene	
	<i>δ</i> -cadinene	
	<b>Oxygenated sesquiterpene</b>	
	caryophyllene oxide	

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
Aerial part	<p data-bbox="394 362 712 395"><i>Ocimum basilicum</i> Linn.</p> <p data-bbox="394 422 580 455"><b>Monoterpene</b></p> <p data-bbox="394 482 511 515"><math>\alpha</math>-pinene</p> <p data-bbox="394 541 526 575">camphene</p> <p data-bbox="394 601 511 634"><math>\beta</math>-pinene</p> <p data-bbox="394 661 505 694">sabinene</p> <p data-bbox="394 721 505 754">myrcene</p> <p data-bbox="394 780 545 814"><math>\alpha</math>-terpinene</p> <p data-bbox="394 840 511 873">limonene</p> <p data-bbox="394 900 541 933"><math>\gamma</math>-terpinene</p> <p data-bbox="394 960 583 993"><i>(E)</i>-<math>\beta</math>-ocimene</p> <p data-bbox="394 1019 520 1052"><i>p</i>-cymene</p> <p data-bbox="394 1079 538 1112">terpinolene</p> <p data-bbox="394 1139 495 1172">carvone</p> <p data-bbox="394 1198 746 1232"><b>Oxygenated monoterpene</b></p> <p data-bbox="394 1258 538 1291">1,8-cineole</p> <p data-bbox="394 1318 505 1351">camphor</p> <p data-bbox="394 1378 489 1411">linalool</p> <p data-bbox="394 1437 541 1470"><math>\alpha</math>-terpineol</p> <p data-bbox="394 1497 500 1530">geraniol</p> <p data-bbox="394 1557 571 1590">linalyl acetate</p> <p data-bbox="394 1616 576 1650">bornyl acetate</p> <p data-bbox="394 1698 591 1731"><b>Sesquiterpene</b></p> <p data-bbox="394 1758 550 1791"><math>\alpha</math>-cubebene</p> <p data-bbox="394 1818 535 1851"><math>\alpha</math>-copaene</p> <p data-bbox="394 1877 580 1911"><math>\beta</math>-bourbonene</p>	Ozek <i>et al.</i> , 1995

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	$\beta$ -cubebene $\beta$ -elemene $\alpha$ -guaiene $\beta$ -caryophyllene $\alpha$ -humulene <i>(Z)</i> - $\beta$ -farnesene germacrene D $\gamma$ -guaiene $\gamma$ -elemene germacrene A $\delta$ -cadinene trans- $\alpha$ -bergamotene  <b>Oxygenated sesquiterpene</b> spathulenol <i>T</i> -cadinol $\beta$ -eudesmol  <b>Phenyl propanoid</b> methyl eugenol eugenol <i>(E)</i> -anethole <i>(E)</i> -methylcinnamate <i>(Z)</i> -methylcinnamate	
Fresh flowering	<b>Phenyl propanoid</b> methyl chavicol	Pino <i>et al.</i> , 1994



**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
Aerial part	<p data-bbox="397 393 681 426"><i>Ocimum canum</i> Sims.</p> <p data-bbox="397 449 586 482"><b>Monoterpene</b></p> <p data-bbox="397 504 518 537"><math>\alpha</math>-pinene</p> <p data-bbox="397 559 530 592">camphene</p> <p data-bbox="397 614 518 648"><math>\beta</math>-pinene</p> <p data-bbox="397 670 515 703">sabinene</p> <p data-bbox="397 725 595 758"><math>\alpha</math>-phellandrene</p> <p data-bbox="397 780 511 814">myrcene</p> <p data-bbox="397 836 518 869">limonene</p> <p data-bbox="397 891 548 924"><math>\beta</math>-terpinene</p> <p data-bbox="397 946 526 979"><i>p</i>-cymene</p> <p data-bbox="397 1002 545 1035"><math>\gamma</math>-terpinene</p> <p data-bbox="397 1057 545 1090">terpinolene</p> <p data-bbox="397 1201 752 1234"><b>Oxygenated monoterpene</b></p> <p data-bbox="397 1256 515 1289">camphor</p> <p data-bbox="397 1311 568 1344">terpinen-4-ol</p> <p data-bbox="397 1367 500 1400">borneol</p> <p data-bbox="397 1422 538 1455">isoborneol</p> <p data-bbox="397 1477 515 1510">myrtenol</p> <p data-bbox="397 1599 595 1632"><b>Sesquiterpene</b></p> <p data-bbox="397 1654 580 1687">caryophyllene</p> <p data-bbox="397 1709 538 1743"><math>\beta</math>-elemene</p> <p data-bbox="397 1765 526 1798">humulene</p> <p data-bbox="397 1820 535 1853"><math>\beta</math>-selinene</p> <p data-bbox="397 1875 535 1908"><math>\alpha</math>-selinene</p>	Xaasan <i>et al.</i> , 1981

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	<b>Oxygenated monoterpene</b>	
Leaves and flowers	linalool	Ntezurubanza, Scheffer, and Looman, 1985
Leaves	<i>Ocimum gratissimum</i> Linn.	Sainsbury and Sofowora, 1971 ; Zamurenko <i>et al.</i> , 1986; Ntezurubanza <i>et al.</i> , 1987;
	<b>Monoterpene</b>	Pino, Rosado, and Fuentes, 1996
	$\alpha$ -terpinene	
	$\alpha$ -thujene	
	$\alpha$ -pinene	
	camphene	
	$\beta$ -pinene	
	myrcene	
	<i>p</i> -cymene	
	( <i>Z</i> )- $\beta$ -ocimene	
	limonene	
	$\gamma$ -terpinene	
	<i>trans</i> -sabinene hydrate	
	terpinolene	
	sabinene	
	$\delta$ -3-carene	
	<i>cis</i> -sabinene hydrate	
	<b>Oxygenated monoterpene</b>	
	thymol	
	1, 8-cineole	
	camphor	
	linalool	
	$\alpha$ -terpineol	
	terpinen-4-ol	

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	carvacrol	
	borneol	
	<i>p</i> -cymen-8-ol	
	<b>Sesquiterpene</b>	
	<i>β</i> -caryophyllene	
	<i>α</i> -humulene	
	<i>β</i> -selinene	
	longifolene	
	clovene	
	<i>β</i> -bourbonene	
	<i>β</i> -elemene	
	trans- <i>β</i> -bergamotene	
	<i>γ</i> -cadinene	
	<i>α</i> -copaene	
	germacrene D	
	<i>δ</i> -cadinene	
	<b>Oxygenated sesquiterpene</b>	
	caryophyllene oxide	
	humulene oxide II	
	<i>β</i> -caryophyllene epoxide	
	<b>Phenylpropanoid</b>	
	methyl eugenol	
	eugenol	

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
Flowers	<p><b>Monoterpene</b></p> <p><math>\alpha</math>-thujene</p> <p><math>\alpha</math>-pinene</p> <p>camphene</p> <p><math>\beta</math>-pinene</p> <p>myrcene</p> <p><math>\alpha</math>-phellandrene</p> <p><i>p</i>-cymene</p> <p>limonene</p> <p><math>\gamma</math>-terpinene</p> <p>trans-sabinene hydrate</p> <p>terpinolene</p> <p><b>Oxygenated monoterpene</b></p> <p>linalool</p> <p>borneol</p> <p>terpinen-4-ol</p> <p><math>\alpha</math>-terpineol</p> <p><i>p</i>-cymen-8-ol</p> <p>thymol</p> <p>carvacrol</p> <p>Sesquiterpene</p> <p><math>\beta</math>-bourbonene</p> <p><math>\beta</math>-elemene</p> <p><math>\beta</math>-caryophyllene</p> <p><i>trans</i>-<math>\beta</math>-bergamotene</p> <p><math>\alpha</math>-humulene</p> <p><math>\beta</math>-selinene</p>	Pino <i>et al.</i> , 1996

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
seed	$\gamma$ -cadinene  <b>Oxygenated sesquiterpene</b> caryophyllene oxide humulene oxide II	Dro and Hefendehl, 1974
	<b>Phenylpropanoid</b> methyl eugenol	
Leaves	<i>Perilla frutescens</i> Britt  <b>Monoterpene</b> ocimene sabinene $\beta$ -pinene myrcene pseudolimonene limonene terpinolene perillaldehyde $\alpha$ -terpinyl acetate piperitone camphene $\alpha$ -pinene $\alpha$ -phellandrene <p>-cymene  carvone </p>	Kang <i>et al.</i> , 1992 ; Nguyen <i>et al.</i> , 1995

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	<b>Oxygenated monoterpene</b>	
	1,8-cineole	
	linalool	
	limonene oxide	
	perillyl alcohol	
	<b>Sesquiterpene</b>	
	$\beta$ -caryophyllene	
	$\alpha$ -caryophyllene	
	$\alpha$ -bergamotene	
	farnesene	
	aromadendrene	
	$\alpha$ -copaene	
	$\beta$ -bourbonene	
	$\beta$ -elemene	
	$\alpha$ -humulene	
	germacrene D	
	$\delta$ -cadinene	
	(Z)-nerolidal	
	<b>Oxygenated sesquiterpene</b>	
	caryophyllene oxide	
Leaves	<i>Pogostemon cablin</i> Benth	Nguyen, Leelereq, Tran, and La Dinh ; 1989 ; Nguyen <i>et. al</i> ; 1990
	<b>Sesquiterpene</b>	
	$\alpha$ -patchoulene	

**Table 1** Chemical constituent of Thai Lamiaceous plants (continued)

Plant part	Chemical constituent	Reference
	<i>β</i> -patchoulene <i>δ</i> -patchoulene <i>β</i> -caryophyllene <i>α</i> -quaiene <i>δ</i> -quaiene seychellene <i>α</i> -bulnesene <i>δ</i> -cadinene  <b>Oxygenated monoterpene</b> patchouli alcohol	