

## Studies on essential oils of *Alpinia conchigera* Griff. from Malaysia

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**ABSTRACT** The essential oils of the leaves and rhizomes of *Alpinia conchigera* were analyzed by GC-MS methods and more than 40 components were detected in the rhizome oil, in which bicyclo 4,11,11-trimethyl-8-methylene-undec-4-ene, is the major component. A total of 17 components were found in the leaf oil of which  $\beta$ -bisabolene is the major component.

**ABSTRAK** Minyak pati yang diperolehi daripada daun dan rizom *Alpinia conchigera* telah dianalisis dengan menggunakan kaedah GC-MS dan didapati mengandungi lebih dari-pada 40 sebatian dalam minyak rizom, dan bicyclo 4,11,11-trimethyl-8-methylene-undec-4-ene merupakan sebatian yang mempunyai kandungan yang tertinggi. Sejumlah 18 sebatian didapati dalam minyak daun dan sebatian yang tertinggi kandungannya ialah  $\beta$ -bisabolene.

(Zingiberaceae, *Alpinia conchigera*, Essential oil, GC-MS,  $\beta$ -bisabolene)

### INTRODUCTION

*Alpinia conchigera* Griff. (Zingiberaceae) is known locally as *lengkuas kecil* or *lengkuas ranting* [1] and has been used by the Malay folk as spice as well as in their traditional medicine. The rhizome is used for the treatment of rheumatism and fungal infected skin diseases [2]. The crushed rhizome of *A. conchigera* gives a similar odour to that of *Alpinia galanga* (greater galangal).

Evaluation of essential oil composition of zingiberaceous species of commercial importance have been reported [3,4,5]. The essential oils of some species of *Alpinia* were reported to contain  $\alpha$ -pinene, camphene,  $\beta$ -pinene,  $\alpha$ -phellandrene,  $\beta$ -phellandrene, myrcene,  $\alpha$ -terpene, limonene, 1,8-cineol,  $\alpha$ -terpinene, *p*-cymene, thujone, citronella, camphor,  $\beta$ -terpineol,  $\alpha$ -terpineol, terpinyl acetate, geraniol, farnesol, nerolidol, eugenol and thymol which appear to be common to the species studied [6].

### EXPERIMENTAL

Fresh plant materials of *Alpinia conchigera* were collected from Rimba Ilmu Botanical Garden,

University of Malaya, Kuala Lumpur, for analysis. A substantial amount of the rhizomes and leaves were washed and cut into small pieces. These were then separately distilled in a steam distillation apparatus for about 2-5 hours.

The distillate was separated and the oil obtained was then analyzed using GC-MS. The oil was also checked with thin layer chromatography by comparison with standards obtained from Tokyo Kasei Organic Chemicals, Japan (TCI). The GC-MS used is Shimadzu QP-5000 GC-MS (Japan). The parameters of the GC-MS for the leaves were as follows: Column: Altech Econocap (SE 30) 30m length, 0.22mm I.D. Column initial temperature was 60°C, programme rate is 5°C/min to 250°C. Carrier gas used was Helium with flow rate of 0.8ml/min. Interface temperature: 280°C, injector temperature: 220°C, split mode with split ratio of 9. The parameters of the GC-MS for the rhizomes were: Column: CBP-1 (SGE, Australia) fused silica capillary column 25m length, 0.22mm I.D. Carrier gas was helium, with flow rate of 0.7 ml/min. Interface temperature: 260°C, injector temperature: 250°C, split mode with split ratio of 12, while other parameters remain the same.

**RESULTS AND DISCUSSION**

The composition of the essential oils obtained by steam distillation on the rhizome and leaves of *A. conchigera* were studied using gas chromatography mass spectrometer (GC-MS). The volatile components of the leaves and rhizomes of *A. conchigera* were tabulated in Tables 1 and 2. Results showed that, the volatile components of the rhizome oil (Table 1) were more than that of the leaf oil (Table 2). A total of 47 and 17 compounds were identified in the rhizomes and leaves respectively. The spectrum of the analysis was as in Figures 1 and 2.

The main components in the leaf oil of *A. conchigera* include [+-]nerolidol (9.68%), isocaryophyllene (8.25%), 3,3,7,7-tetramethyl-5-[2-methyl-1-propenyl]-tricyclo heptane, (3.99%) and  $\beta$ -pinene (3.44%) with [+-]- $\beta$ -bisabolene (24.18%) as the major constituent. More components were found in the rhizome oil, of which 4,11,11-trimethyl-8-methylene-bicyclo undec 4-ene (15.65%) was the major compound. It was found that the rhizome oil also contain 12-methyl-1,5,9,11-tridecatetraene (10.97%) and caryophyllene (10.45%).

**Table 1.** Volatile components of rhizomes of *Alpinia conchigera* elucidated by Gas Chromatography-Mass Spectrometer

Pk. No.	Rt.	Base peak	Mol. Wt.	Mol. Formula	Total %	Compound Name
1.	5.23	93	136	C <sub>10</sub> H <sub>16</sub>	0.06	$\alpha$ -phellandrene
2.	5.39	93	136	C <sub>10</sub> H <sub>16</sub>	0.21	trans- $\beta$ -ocimene
3.	6.19	93	136	C <sub>10</sub> H <sub>16</sub>	0.10	$\beta$ -pinene
4.	6.30	93	196	C <sub>12</sub> H <sub>20</sub> O <sub>2</sub>	1.19	linalool acetate
5.	6.59	93	136	C <sub>10</sub> H <sub>16</sub>	0.17	$\beta$ -myrcene
6.	7.25	93	136	C <sub>10</sub> H <sub>16</sub>	0.18	2-carene
7.	7.32	93	136	C <sub>10</sub> H <sub>14</sub>	0.31	4-ethyl-1, 2-dimethyl-benzene
8.	7.56	68	136	C <sub>10</sub> H <sub>16</sub>	0.27	limonene
9.	8.31	93	136	C <sub>10</sub> H <sub>16</sub>	0.79	$\gamma$ -terpinene
10.	9.11	93	136	C <sub>10</sub> H <sub>16</sub>	0.16	terpinolene
11.	11.71	41	154	C <sub>10</sub> H <sub>34</sub> O	0.08	4-decenal
12.	12.10	43	156	C <sub>10</sub> H <sub>20</sub> O <sub>2</sub>	0.15	decenal
13.	12.38	43	172	C <sub>14</sub> H <sub>30</sub>	0.84	caprylyl acetate
14.	15.37	43	198	C <sub>11</sub> H <sub>12</sub> O <sub>2</sub>	0.09	isotetradecane
15.	15.76	134	176	C <sub>15</sub> H <sub>24</sub>	1.42	4-allylphenyl acetate
16.	16.10	135	192	C <sub>10</sub> H <sub>18</sub> O	0.07	5-methyl -2-[1-methylethyl] phenol, acetate
17.	16.30	121	204	C <sub>15</sub> H <sub>24</sub>	1.11	$\delta$ -elemene
18.	16.59	135	150	C <sub>15</sub> H <sub>24</sub>	0.09	2, 3, 4, 6-tetramethyl phenol
19.	17.05	69	224	C <sub>15</sub> H <sub>24</sub>	0.20	geranyl isobutyrate
20.	17.75	41	204	C <sub>15</sub> H <sub>24</sub>	1.61	isocaryophyllene
21.	18.57	41	204	C <sub>15</sub> H <sub>24</sub>	10.45	caryophyllene
22.	18.82	121	204	C <sub>15</sub> H <sub>24</sub>	0.44	germacrene B
23.	18.95	41	204	C <sub>15</sub> H <sub>24</sub>	0.76	[Z, E]- $\alpha$ -farnesene
24.	19.43	93	190	C <sub>14</sub> H <sub>22</sub>	10.97	12-methyl- 1, 5, 9, 11-tridecatetraene
25.	20.07	161	204	C <sub>15</sub> H <sub>24</sub>	6.49	3, 3, 7, 7-tetramethyl-5-[2-methyl-1-propenyl]-tricyclo heptane
26.	20.20	41	222	C <sub>15</sub> H <sub>26</sub> O	0.82	1ar [1ar $\alpha$ , 4 $\beta$ , 4a $\beta$ , 7 $\alpha$ , 7a $\beta$ , 7b $\alpha$ ]-, decahydro -1, 1, 4, 7-tetramethyl-1H-cyclo azulen-4-ol.

27.	20.36	93	204	C <sub>15</sub> H <sub>24</sub>	1.29	α-zingiberene
28.	20.44	81	204	C <sub>15</sub> H <sub>24</sub>	0.72	[-]-β-elemene
29.	20.55	93	204	C <sub>15</sub> H <sub>24</sub>	0.99	[-]-bisabolene
30.	20.77	41	222	C <sub>15</sub> H <sub>26</sub> O	7.72	[+]-nerolidol
31.	21.20	41	204	C <sub>15</sub> H <sub>24</sub>	15.65	4, 11, 11-trimethyl-8-methylene-bicyclo undec-4-ene
32.	21.31	-	-	-	0.75	unidentified
33.	21.93	41	204	C <sub>15</sub> H <sub>24</sub>	3.33	α-farnesene
34.	22.40	41	206	C <sub>15</sub> H <sub>26</sub>	1.12	ledane
35.	22.57	43	222	C <sub>15</sub> H <sub>26</sub> O	0.24	bisabolol
36.	22.85	59	222	C <sub>15</sub> H <sub>26</sub> O	0.44	elemol
37.	23.00	43	220	C <sub>15</sub> H <sub>24</sub> O	0.58	1, 5, 5, 8-tetramethyl-, 12-oxabicyclo 9.1.0 dodeca-3, 7-diene.
38.	23.19	41	204	C <sub>15</sub> H <sub>24</sub>	2.01	[Z]-β-farnesene
39.	23.45	43	264	C <sub>17</sub> H <sub>28</sub> O <sub>2</sub>	3.96	guaiol acetate
40.	23.55	-	-	-	2.72	unidentified
41.	23.93	161	222	C <sub>15</sub> H <sub>26</sub> O	0.47	[-]-δ-cadiol
42.	24.06	69	222	C <sub>15</sub> H <sub>26</sub> O	2.60	α-bisabolol
43.	24.46	-	-	-	1.17	unidentified
44.	24.64	41	140	C <sub>9</sub> H <sub>16</sub> O	0.66	nonadienol
45.	24.86	-	-	-	1.20	unidentified
46.	24.95	41	204	C <sub>15</sub> H <sub>24</sub>	0.89	[Z, E]-α-farnesene
47.	25.56	57	170	C <sub>12</sub> H <sub>26</sub>	0.59	dodecane

**Table 2.** Volatile components of leaves of *Alpinia conchigera* elucidated by Gas Chromatography-Mass spectrometer.

Pk. No.	Rt.	Base peak	Mol Wt.	Mol. Formula	Total %	Compound Name
1.	6.11	93	136	C <sub>10</sub> H <sub>16</sub>	1.00	α-pinene
2.	7.06	93	136	C <sub>10</sub> H <sub>16</sub>	3.44	β-pinene
3.	8.38	68	136	C <sub>10</sub> H <sub>16</sub>	0.57	limonene
4.	16.65	134	176	C <sub>11</sub> H <sub>12</sub> O <sub>2</sub>	1.87	4-allylphenyl acetate
5.	18.66	81	204	C <sub>15</sub> H <sub>24</sub>	2.28	[-]-β-elemene
6.	19.45	41	204	C <sub>15</sub> H <sub>24</sub>	8.25	isocaryophyllene
7.	19.86	41	204	C <sub>15</sub> H <sub>24</sub>	1.35	α-farnesene
8.	20.30	41	204	C <sub>15</sub> H <sub>24</sub>	3.61	[Z, E]-α-farnesene
9.	20.96	161	204	C <sub>15</sub> H <sub>24</sub>	3.99	3, 3, 7, 7-tetramethyl-5-[2-methyl-1-propenyl]-tricyclo heptane,
10.	21.11	41	204	C <sub>15</sub> H <sub>24</sub>	1.37	4, 11, 11-trimethyl-8-methylene-bicyclo undec 4-ene.
11.	21.28	119	204	C <sub>15</sub> H <sub>24</sub>	0.84	α-cadrene
12.	21.36	41	222	C <sub>15</sub> H <sub>26</sub> O	0.67	Decahydro -1, 1, 4, 7-tetramethyl-1H-cyclo azulen-4-ol,
13.	21.46	93	222	C <sub>15</sub> H <sub>26</sub> O	1.01	levomenol
14.	21.68	41	222	C <sub>15</sub> H <sub>26</sub> O	9.68	[+]-nerolidol
15.	22.05	69	204	C <sub>15</sub> H <sub>24</sub>	24.18	[+, -]-β-bisabolene
16.	22.86	41	206	C <sub>15</sub> H <sub>26</sub>	1.92	patchulane
17.	24.35	161	222	C <sub>15</sub> H <sub>26</sub> O	0.50	δ-cadinol

Figure 1 : Mass chromatogram of leaves of *A.conchigera*.

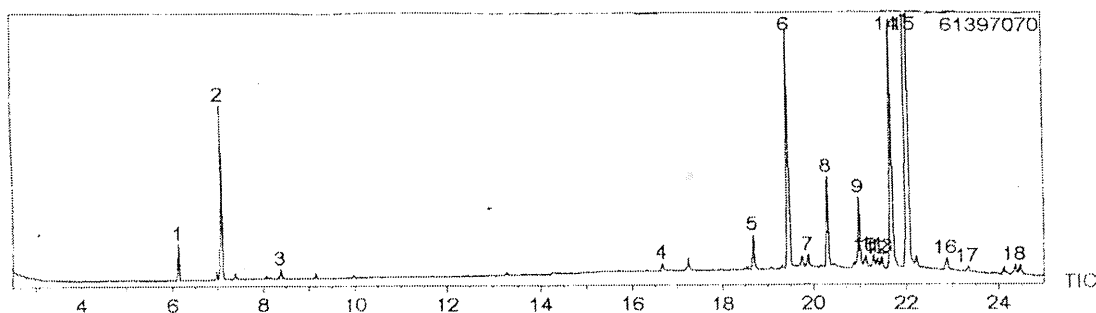
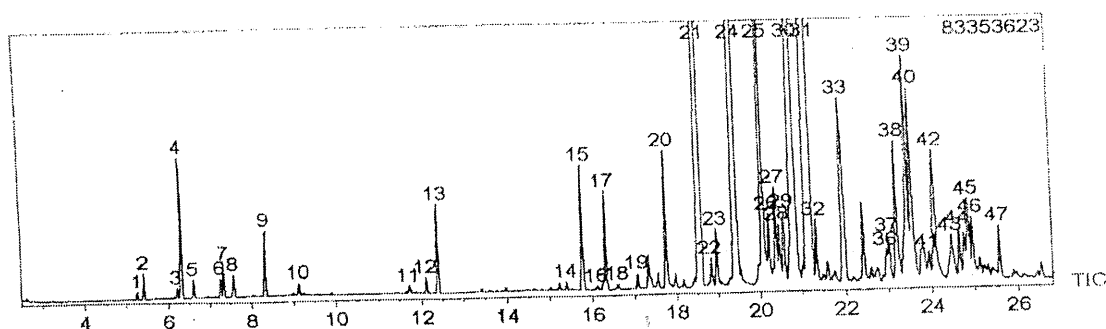


Figure 2 : Mass chromatogram of rhizomes of *A.conchigera*



There were significant differences between the distribution of the components in the leaves and rhizomes. The GC-MS analysis of the volatile components revealed the presence of high proportion of  $[+, -]\beta$ -bisabolene in the leaf oil although it was not detected in the rhizome oil. The leaf oil also contain  $\alpha$ -pinene (1.00%), levomenol (1.01%), and patchulane (1.92%) which were not found in the rhizome oil. Whereas linalool acetate (1.19%),  $\delta$ -elemene (1.11%),  $\alpha$ -zingiberene (1.29%), ledane (1.12%),  $[Z]\beta$ -farnesene (2.01%) and guaiol acetate (3.96%) were detected only in the rhizome oil.

The most common compounds present in the rhizomes and leaves were  $\beta$ -pinene, limonene, 4-allylphenyl acetate, isocaryophyllene,  $\alpha$ -farnesene,  $[Z,E]\alpha$ -farnesene, 3,3,7,7-tetramethyl-5-[2-methyl-1-propenyl]-tricyclo heptane, 4,11,11-trimethyl-8-tethylene-bicyclo undec-4-ene.,  $[+]$ -nerolidol,  $\delta$ -cadinol, and decahydro-1,1,4,7-tetra-methyl-1H-cyclop e azulen-4-ol.

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