

## 한국에서 자생하는 Saururaceae의 성분에 대한 연구(1) GC 및 GC-MS를 이용한 *Houttuynia Cordata*의 휘발성 성분

최광훈·권순자\*·정덕상\*\*·엄기동\*\*\*

영진약품 중앙연구소

\*경희대학교 문리대학 화학과

\*\*제주대학교 문리대학 화학과

\*\*\*도핑컨트롤센터

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## A Study on Chemical Composition of Saururaceae Growing in Korea (1) On Volatile Constituents of *Houttuynia Cordata* by GC and GC-MS Method

Koang-Hoon Choe, Shoon-Ja Kwon\*

Duk-Sang Jung\*\* and Khee-Dong Eum\*\*\*

Central Research Institute, Yungjin Pharmaceutical Co., Pyungtaek 451-860, Korea

\* Department of Chemistry, Kyung Hee University, Seoul 131-050, Korea

\*\* Department of Chemistry, Cheju National University, Cheju 690-120, Korea

\*\*\* Doping Control Center, Seoul 135-090, Korea

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**ABSTRACT.** The volatile constituents from the aerial parts of *Houttuynia cordata* (Yakmomil) originating in Korea (Ulleung-do) have been isolated by gas chromatography (GC) using two columns (OV-1 and PEG-20M) and identified by the comparison of their gas chromatograms or mass spectra with those of pure authentic compounds.

The analysis shows that the volatile constituents of *Houttuynia cordata* of Korea are  $\alpha$ -pinene,  $\beta$ -pinene, *p*-cymene, camphene, myrcene, limonene, linalool, geraniol, borneol, bornyl acetate,  $\beta$ -caryophyllene, humulene ( $\alpha$ -caryophyllene), thymol, octanal, decanal, dodecanal, 2-undecanone, decanoic acid, dodecanoic acid, tetradecanoic acid and hexadecanoic acid.

**Key Words:** *Houttuynia Cordata* (yakmomil)

## INTRODUCTION

*Houttuynia cordata* belonging to Saururaceae has a characteristic odor and is known as a useful medicinal plant.<sup>1,2,3,4</sup> The family Saururaceae consists of five genera (Anemopsis, Saururus, Houttuynia, Gymnotheca and Circaeocarpus) and

seven species (*A. californica*, *S. cernus*, *S. chinensis*, *H. cordata*, *G. chinensis*, *G. involocrata* and *C. saururoides*), native to North America and Asia.<sup>5</sup> Of these seven species, only two, *S. chinensis* and *H. cordata*, grow in Korea. *Houttuynia cordata* grows mainly in Ulleung-do and is called Yakmomil in Korean. *Saururus chinensis* grows mainly

in Cheju-do and is called Sambaktaso in Korean.

There are several reports on volatile constituents of *A. californica*,<sup>6,7</sup> *S. cernus*<sup>8</sup> and *H. cordata*,<sup>9,10</sup> but not one on those of Saururaceae growing in Korea. This paper deals with the results of the isolation and identification of the volatile constituents of *Houttuynia cordata* in Korea.

## EXPERIMENTAL

Plant material: *Houttuynia cordata* was collected at Kyungdong Market.

Reagents: Authentic compounds of  $\alpha$ -pinene,  $\beta$ -pinene, camphene, myrcene, *p*-cymene, limonene, linalool, thymol, geraniol and borneol were purchased from Sigma chemical Co. Ltd. (U.S.A.); octanal, decanal, dodecanal and decanoic acid were purchased from Tokyo Kasei Co. Ltd. (Japan); The other reagents used were of extra pure grade.

Apparatus: The gas chromatography (Gasukuro, Model 370) equipped with flame ionization detector was used. GC-MS measurement was performed with a HP-5890 gas chromatograph and HP-5970 mass spectrometer. The analysis conditions of GC and GC-MS are as follows. GC column 1: glass capillary column (25m  $\times$  0.25mm, PEG-20M Bonded, 55-210  $^{\circ}$ C, 4  $^{\circ}$ C/min); injection part and detector temp. 230  $^{\circ}$ C; carrier gas: H<sub>2</sub>, 0.8kg/cm<sup>2</sup>. GC column 2: glass capillary column (25m  $\times$  0.25mm, ES-Wcot OV-1 Bonded, 55-210  $^{\circ}$ C, 4  $^{\circ}$ C/min); injection part and detector temp. 230  $^{\circ}$ C; carrier gas: H<sub>2</sub>, 0.8kg/cm<sup>2</sup>. GC-MS: glass capillary column (17m  $\times$  0.25 mm, SE-54 Bonded, 55-210  $^{\circ}$ C, 4  $^{\circ}$ C/min).

Extraction of the volatile constituents: The volatile constituents were obtained from the powdered aerial parts (100g) of *Houttuynia cordata* by hydrodistillation for 6hrs., using a Dean Stark distillation tube containing ether.

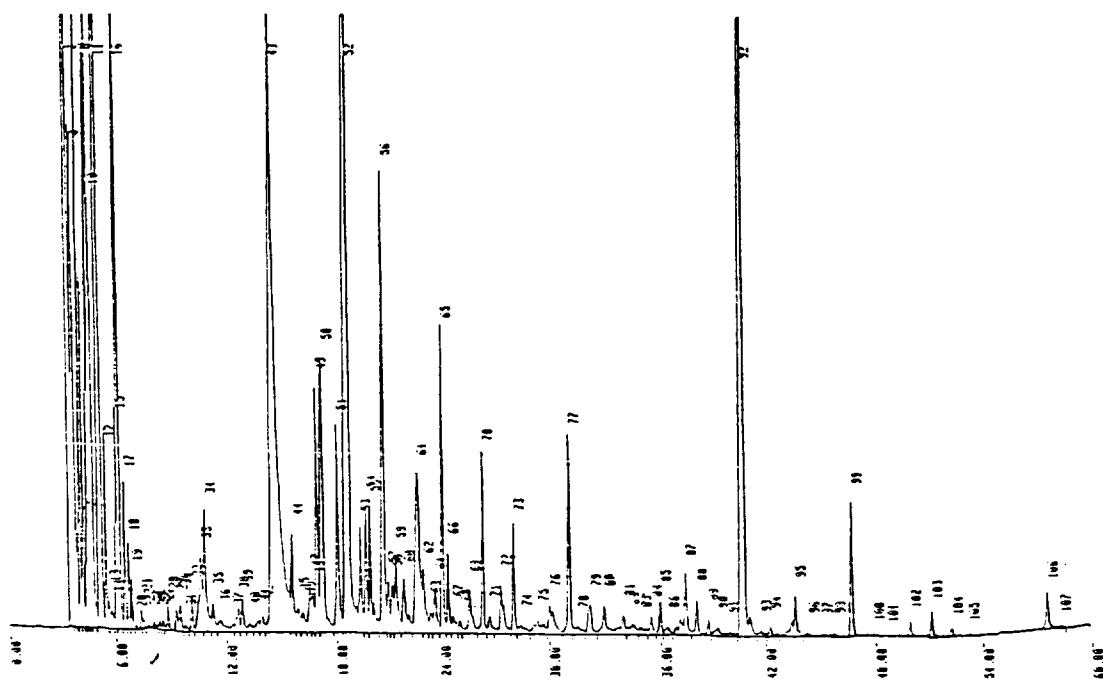


Fig. 1. Gas chromatogram of volatile constituents of *Houttuynia cordata*; column: PEG-20M (25m  $\times$  0.25mm, glass capillary column), oven temp. 55-210  $^{\circ}$ C, 4  $^{\circ}$ C/min.

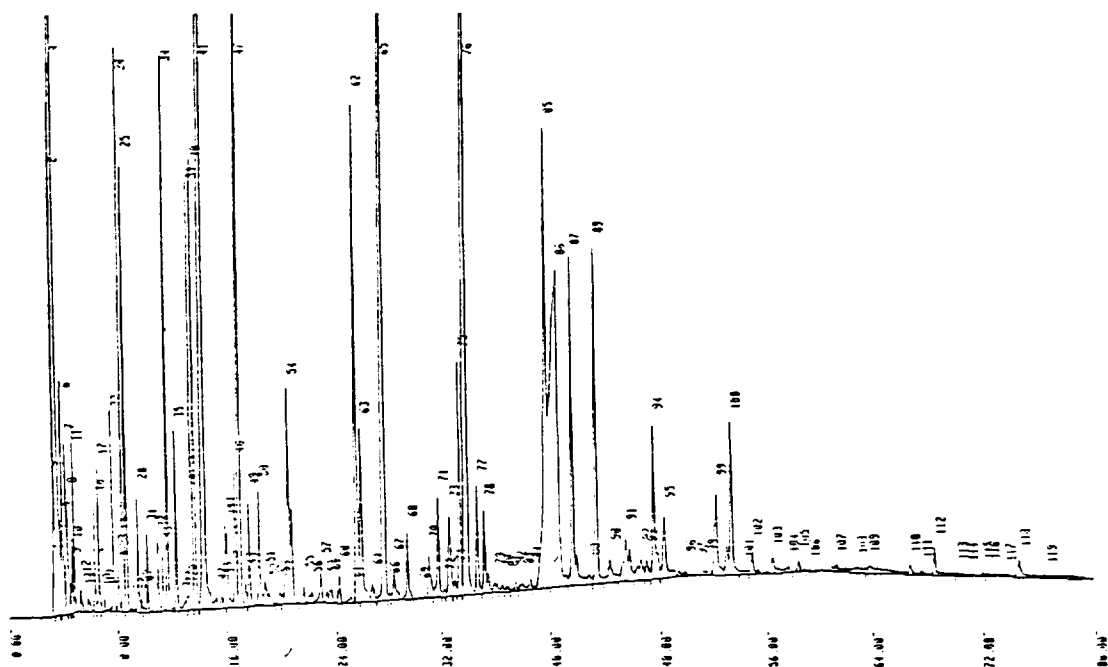


Fig. 2. Gas chromatogram of volatile constituents of *Houttuynia cordata*; column: OV-1(25m  $\times$  0.25mm, glass capillary column), oven temp. 55-210  $^{\circ}$ C, 4  $^{\circ}$ C/min.

## RESULTS AND DISCUSSION

The gas chromatogram of the volatile constituents obtained from the aerial parts of *Houttuynia cordata* by hydrodistillation are shown in Fig. 1 and Fig. 2.

We separated more volatile constituents by GC using two glass capillary column(PEG-20M and OV-1) than Lohit *et al.*<sup>9</sup> did using 3% OV-17 stainless steel column. Of the volatile constituents, two main components(2-undecanone and decanoic acid) and minor components( $\alpha$ -pinene, myrcene, *p*-cymene, limonene, linalool, thymol, geraniol, decanal, dodecanal, dodecanoic acid and hexadecanoic acid) reported by Lohit *et al.* are identified by the GC chromatogram or mass spectra and all the constituents identified are presented in Table 1. But we did not observe methyl ester of fatty acids(decanoic acid, dodecanoic acid and hexadecanoic acid) and decanoyl acetaldehyde reported by another investigator.<sup>11</sup>

As shown in Table 1, *Houttuynia cordata* of Korea has several more constituents, in addition to those of Japan cordata reported by Lohit *et al.*;  $\beta$ -pinene, camphene, borneol, bornyl acetate,  $\beta$ -caryophyllene and humulene( $\alpha$ -caryophyllene) as terpenoids. Both *Houttuynia cordata*(Korea and Japan) are composed of the similar volatile constituents, but of different contents.

Since it is difficult to carry out the quantitative analysis of all constituents identified in this medicinal plant, the contents are expressed as +, ++, +++, +++++ and trace according to peak height(or peak area) appearing in the gas chromatogram.

The mass spectra of  $\beta$ -caryophyllene and humulene( $\alpha$ -caryophyllene) isolated from *Houttuynia cordata* of Korea are shown in Fig. 3 and Fig. 4.

The results of our study are listed in Table 2, by comparing with that of other investigators. According to Table 2, generally *Houttuynia cordata* of

Table 1. Volatile constituents identified from the aerial parts of *Houttuynia cordata* of Korea

Peak no. PEG-20M OV-1	Compounds	Contents*	Methods of identification
5	34 $\alpha$ -Pinene	+++	GC,GC-MS
6	35 Camphene	++	GC,GC-MS
8	40 $\beta$ -Pinene	+++	GC,GC-MS
11	41 Myrcene	++++	GC,GC-MS
12	46 Limonene	+	GC,GC-MS
18	45 <i>p</i> -Cymene	trace	GC,GC-MS
20	Octanal	trace	GC
43	65 Decanal	++++	GC,GC-MS
47	54 Linalool	trace	GC
49	75 Bornyl acetate	++	GC,GC-MS
50	89 $\beta$ -Caryophyllene	++	GC,GC-MS
52	76 Undecanone	++++	GC,GC-MS
55	91 Humulene	+	GC,GC-MS
59	61 Borneol	trace	GC
61	Dodecanal	++	GC,GC-MS
71	70 Geraniol	trace	GC
80	Methyl eugenol	trace	GC
87	Eugenol	trace	GC
88	Thymol	trace	GC
92	86 Decanoic acid	++++	GC,GC-MS
99	99 Dodecanoic acid	+	GC,GC-MS
104	109 Tetradecanoic acid	trace	GC
106	118 Hexadecanoic acid	+	GC,GC-MS

\*Contents are classified into five degrees(+, ++, +++, ++++ and trace) according to peak or height in the gas chromatogram.

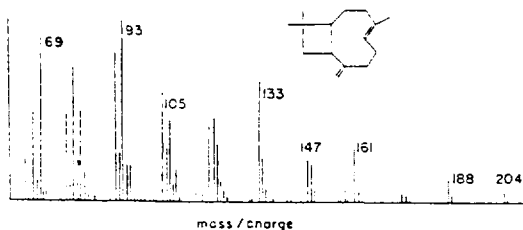
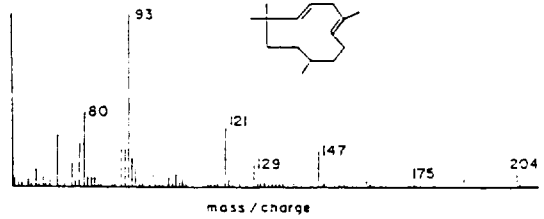
Fig. 3. Mass spectrum of  $\beta$ -caryophyllene extracted from *Houttuynia cordata*.Fig. 4. Mass spectrum of Humulene ( $\alpha$ -caryophyllene) extracted from *Houttuynia cordata*.

Table 2. Comparison of volatile constituents in Saururaceae

Compounds	<i>H. cordata</i>		<i>A. californica</i>	<i>S. cernuus</i>
	Korea	Japan		
$\alpha$ -Pinene	+	+	+	+
Camphene	+	-	+	-
$\beta$ -Pinene	+	-	+	+
Myrcene	+	+	-	-
Limonene	+	+	+	+
<i>p</i> -Cymene	+	+	+	+
Octanal	+	-	-	-
Decanal	+	+	-	-
Linalool	+	+	+	+
Bornyl ace.	+	-	-	+
$\beta$ -Caryophyllene	+	-	-	+
Undecanone	+	+	-	-
Humulene	+	-	-	+
Borneol	+	-	-	+
Dodecanal	+	+	-	-
Geraniol	+	+	-	-
Methyl-eugenol	+	-	+	+
Eugenol	+	-	+	-
Thymol	+	+	+	-
Decanoic acid	+	+	-	-
Dodecanoic acid	+	+	-	-
Tetradecanoic acid	+	-	-	-
Hexadecanoic acid	+	+	-	+

+, - means present and absent.

Korea contains more mono terpenes than that of Japan and decanal is the main component among the volatile constituents of *Houttuynia cordata* in our investigation, but it was reported as a minor

component in the volatile constituents of *Houttuynia cordata* by Lohit *et al.*

In our investigation using two columns, PEG-20M column(Fig. 1) having high polarity and OV-1 column(Fig. 2) having low polarity, for GC analysis of *Houttuynia cordata* of Korea; OV-1 column for terpenoids( $\alpha$ -pinene,  $\beta$ -pinene, camphene, limonene, linalool, myrcene etc.) and PEG-20M column for lipids(2-undecanone, decanal, dodecanal and carboxylic acids) were of high efficiency, respectively.

In conclusion, for the GC separations of complex mixture a variety of columns and various stationary liquid phases with a range of polarity and selectivity are needed. Compounds that cannot be well resolved on one phase may be separable on another phase with different polarity.

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