Chemical Composition of the Essential Oils of Two Chinese Endemic *Meconopsis* Species

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The essential oils from two Chinese endemic *Meconopsis* species, *i.e.*, *M. punicea* and *M. delavayi*, were analyzed by using GC-MS for the first time. The major constituents were hexadecanoic acid (16.8%), 1,2-dimethyl naphthalene (11.4%), 1,4-dimethyl naphthalene (6.6%), 1,3-dimethyl-5-ethyl naphthalene (5.9%), and 3-methyl biphenyl (5.6%) for *M. punicea*, and hexadecanoic acid (9.9%), 1,2-dimethyl naphthalene (7.9%), 1,3-dimethyl-5-ethyl naphthalene (6.2%), tetradecane (5.9%), and hexyl cinnamaldehyde (5.5%) for *M. delavayi.*

Key words: Meconopsis punicea, *Meconopsis delavayi*, Essential Oil

Introduction

Meconopsis, the second largest genus in the poppy family Papaveraceae, consists of about 50 species, in which one is native to west Europe and the rest species are distributed throughout the Sino-Himalayan Region of eastern Asia. In China there are 38 species including 20 endemic species such as *M. punicea* and *M. delavayi.* These endemic species, mainly distributed in southwestern China, grow in the alpine meadow with an elevation of 3000–5000 m (Taylor, 1934; Wu *et al.*, 1999). As famous horticultural plants with large and beautiful flowers, *Meconopsis* species have attracted the attention of botanists. Moreover, some Chinese species have long been used as traditional medicinal plants for anti-inflammatory and analgesic activity, especially as a traditional Tibetan medicine for more than 1000 years (Slavik and Slavikova, 1977; Xie *et al.*, 2001).

Many alkaloids have been isolated from *Meconopsis* since 1960s (Hemingway, 1975; Slavik and Slavikova, 1963, 1976, 1977, 1996; Xie *et al.*, 2001). Recently, some non-alkaloid compounds, *e.g.*, flavonols and fatty acids, have also been isolated from *Meconopsis* species (Takeda *et al.*, 1996; Tanaka *et al.*, 2001; Gao *et al.*, 1997; Pan, 1998). However, less attention has been paid to the chemical constituents of essential oils of *Meconopsis.* In the present study, the composition of essential oils from two endemic *Meconopsis* species in southwestern China were analyzed by GC-MS for the first time.

Materials and Methods

Plant materials

The whole plants of *M. punicea* and *M. delavayi* used in this study were collected in July of 2001 from Maerkang County of Sichuan Province and Lijiang District of Yunan Province, respectively. The authenticity of the materials was confirmed by the Kunming Institute of Botany, Chinese Academy of Sciences, and voucher specimens were deposited at the Zhongshan (Sun Yat-sen) University Herbarium (SYS). The samples were cleaned, dried at room temperature and stored at room temperature prior to analysis.

Extraction of essential oil

Each dried sample was ground, weighed (50 g), and steam-distilled using a Clevenger-type apparatus for 3 h. The essential oils were collected in a lighter than water system using an oil graduated trap and dried over anhydrous sodium sulfate.

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GC-MS analysis

The GC-MS analysis was performed on a combined GC-MS instrument (Finnigan Voyager, San Jose, CA, USA) using a HP-INNOWax (bondable polyethylene glycol) fused silica capillary column (30 m length, 0.25 mm diameter, 0.25 μm film thickness). A 1 μl aliquot of oil was injected into the column using a 15:1 split injection, the temperature was set up at 250 °C. The GC program was initiated by a column temperature set at 60 °C for 2 min, increased to 250 °C at a rate of 10 °C/min, held for 10 min. Helium was used as the carrier gas (1.0 ml/min). The mass spectrometer was 00002erated in the 70 eV EI mode with scanning from 41 to 450 amu at 0.5 s, and the mass source was set up 200 °C. The compounds were identified by matching their mass spectral fragmentation patterns with those stored in the spectrometer database using the National Institute of Standards and Technology Mass Spectral database (NIST-MS).

Results and Discussion

The steam distillation of raw materials of *M. punicea* and *M. delavayi* yielded clear and yellowish essential oils. The chemical constituents of the essential oils from the two species are shown in Table I.

In *M. punicea*, 33 compounds (about 94.6% of the oil) were identified, in which major compounds were hexadecanoic acid (16.8%), 1,2-dimethyl naphthalene (11.4%), 1,4-dimethyl naphthalene (6.6%), 1,3-dimethyl-5-ethyl naphthalene (5.9%), and 3-methyl biphenyl (5.6%). In another species, *M. delavayi*, 32 components (about for 92.8% of the oil) were identified. The major com-

Table I. Chemical constituents of the essential oils from Chinese *M. punicea* and *M. delavayi*.

Compound	Retention time [min]	*M. punicea* (%)	*M. delavayi* (%)
Tetradecane	11.18	3.0	5.9
Trimethyl dodecane	12.22	1.1	2.4
Pentadecane	13.70	2.7	6.6
n-Cetane	16.10	1.2	3.5
1,2,3,4-Tetrahydro-6,7-dimethyl naphthalene	20.10	1.2	0.9
1,2,3,4-Tetrahydro-6,8-dimethyl naphthalene	20.21	1.4	2.3
1,2,3,4-Tetrahydro-2,6,7-trimethyl naphthalene	20.82	1.0	0.7
2-(phenylmethyl)-methyl cyclohexanone	21.26	1.2	1.3
Benzocycloheptatriene-1-ol	21.44	3.0	2.2
Cyclohexylethyl-benzene	21.55	1.1	1.0
1,2,3,4-Tetrahydro-5-butyl naphthalene	21.71	0.9	0.8
2-(butenyl)-phenyl propanoic acid	22.00	0.7	0.9
Methyl naphthalene	22.18	1.5	1.0
Pentamethylindan-1,2-dione	22.72	0.8	1.3
Ethyl naphthalene	23.37	1.3	0.9
1,4-Dimethyl naphthalene	23.74	6.6	4.3
1,3-Dimethyl naphthalene	24.34	3.0	2.3
1,2-Dimethyl naphthalene	24.48	11.4	7.9
Ethyl benzothiophene	24.98	0.9	–
1-Methyl-5-ethyl naphthalene	25.10	1.3	0.7
4-Methyl-5-ethyl naphthalene	25.23	3.0	1.2
Isopropylnaphthalene	25.57	1.6	1.9
1-Methyl-2-ethyl naphthalene	25.75	1.3	1.5
3-Methylbiphenyl	26.35	5.6	4.9
1,4-Dimethyl-5-ethyl naphthalene	26.52	1.8	2.2
1,3-Dimethyl-5-ethyl naphthalene	26.66	5.9	6.2
Trimethyl ethyl benzothiophene	27.12	2.2	3.3
1,2-Dimethyl-5-ethyl naphthalene	27.31	2.6	3.9
1,4-Dimethyl-8-ethyl naphthalene	27.86	2.0	2.3
Dimethyl isopropyl naphthalene	28.40	1.5	1.8
Hexyl cinnamaldehyde	31.27	3.7	5.5
Hexadecanoic acid	40.04	16.8	9.9
9-Octadecenoic acid	43.45	1.3	1.4

pounds were hexadecanoic acid (9.9%), 1,2-dimethyl naphthalene (7.9%), 1,3-dimethyl-5-ethyl naphthalene (6.2%), tetradecane (5.9%), and hexyl cinnamaldehyde (5.5%).

It is noteworthy that relatively high naphthalene compounds were detected in the two species (49.4% of the oils for *M. punicea* and 42.6% for *M. delavayi*), suggesting that they may be potential resources of natural naphthalene. In addition, since these Chinese endemic species of *Meconopsis* are distributed in the high cold regions with more than 3000 m elevation, further investigation on the relationships between chemical composition and varying environmental factors should be of interest.

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