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Research Article

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Volatile constituents and biological activities of the leaf essential oil of *Jasminum mesnyi* growing in Nepal

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ABSTRACT

The essential oil from the leaf of Jasminum mesnyi, collected from Kirtipur, Kathmandu, Nepal, was obtained by hydrodistillation and analyzed by GC-MS. From a total of 31 peaks, 25 compounds were identified in the oil, accounting for 91.1% of the oil. The majority of the essential oil was dominated by the benzopyrone coumarin (48.9%). The oil also contained major amounts of monoterpenols including linalool (14.8%), α-terpineol (5.2%), and geraniol (3.3%). Other components of the essential oil found in smaller proportion included (Z)-asarone (3.5%) and (E)-phytol (3.4%). The oil was screened for antimicrobial activity against Bacillus cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Aspergillus niger, but showed no appreciable activity (MIC ≥ 1250 μg/mL). Jasminum mesnyi oil did show marginal activity in the brine shrimp lethality test (LC_{50} = 27.03 μg/mL).

Keywords: *Jasminum mesnyi*, essential oil composition, coumarin, linalool, brine shrimp lethality, primrose jasmine.

INTRODUCTION

Jasminum mesnyi Hance, commonly known as primrose jasmine, is an evergreen shrub native to the Himalayan region in Southwest Asia [1]. The genus *Jasminum* or Jasmine is comprised of 200 species of flowering vines and shrubs of the Oleaceae [2]. Although known mostly for their flowers and strong fragrances, they are used medicinally in aromatherapy for stress, anxiety and depression and are also used to treat rashes and minor irritations [2]. Antioxidant testing conducted on *n*-butanol leaf extract of *J. mesnyi* has shown significant reducing potential and effective free radical scavenging activity [3]. To our knowledge this is the first analysis of the leaf essential oil of *Jasminum mesnyi*.

EXPERIMENTAL SECTION

Plant Material

The leaves of *Jasminum mesnyi* Hance were collected from city of Kirtipur (27.67° N, 85.28° E, 1360 m above sea level) in Kathmandu district in Bagmati Zone in Nepal on 18 May 2011. The plant was identified by Miss Samjhana Maharjan, and a voucher specimen (TUCH 69) has been deposited in the herbarium of the Tribhuvan University Central Herbarium, Kirtipur, Nepal . The dry leaf sample (80 g) was crushed and hydrodistilled using a Clevenger type apparatus for 4 h to give 0.04 g of a clear pale yellow essential oil, which was stored at 4ºC until analysis.

Gas Chromatographic – Mass Spectral Analysis

The essential oil of *J. mesnyi* was analyzed by GC-MS using an Agilent 6890 GC with Agilent 5973 mass selective detector [MSD, operated in the EI mode (electron energy = 70 eV), scan range = 45-400 amu, and scan rate = 3.99 scans/sec], and an Agilent ChemStation data system. The GC column was an HP-5ms fused silica capillary with a (5% phenyl)-polymethylsiloxane stationary phase, film thickness of 0.25 μm, a length of 30 m, and an internal diameter of 0.25 mm. The carrier gas was helium with a column head pressure of 48.7 kPa and a flow rate of 1.0 mL/min. Injector temperature was 200°C and detector temperature was 280°C. The GC oven temperature program was used as follows: 40°C initial temperature, hold for 10 min; increased at 3°C/min to 200°C; increased 2°/min to 220°C. A 1% w/v solution of the sample in CH_2Cl_2 was prepared and 1 μL was injected using a splitless injection technique.

Identification of the oil components was based on their retention indices determined by reference to a homologous series of *n*-alkanes, and by comparison of their mass spectral fragmentation patterns with those reported in the literature [4] and stored on the MS library [NIST database (G1036A, revision D.01.00)/ChemStation data system (G1701CA, version C.00.01.080)]. The percentages of each component are reported as raw percentages based on total ion current without standardization. The essential oil composition of *J. mesnyi* from Nepal is summarized in Table 1.

Table 1: Chemical composition of the leaf essential oil of *Jasminum mesnyi* Hance from Nepal

RI	Compound	%	RI	Compound	%
856	(3*Z*)-Hexenol	1.1	1251	Geraniol	3.3
867	(2*Z*)-Hexenol	0.2	1258	(2*E*)-Decenal	0.1
869	1-Hexanol	0.2	1285	Isobornyl acetate	1.0
1008	(3*Z*)-Hexenyl acetate	0.5	1290	Unidentified	0.6
1070	1-Octanol	0.3	1321	Unidentified	0.9
1100	Linalool	14.8	1323	(3*Z*)-Hexenyl tiglate	1.0
1104	Nonanal	0.2	1356	Eugenol	2.5
1112	2-Phenylethyl alcohol	0.1	1384	(3*Z*)-Hexenyl hexanoate	1.0
1124	Chrysanthenone	0.2	1390	Unidentified	0.7
1172	Unidentified	0.3	1400	(*Z*)-Jasmone	0.4
1187	(3*Z*)-Hexenyl butanoate	1.7	1435	Coumarin	48.9
1189	α-Terpineol	5.2	1451	Unidentified	1.3
1201	Unidentified	0.2	1558	Unidentified	4.4
1208	Unidentified	0.6	1623	(*Z*)-Asarone	3.5
1226	Nerol	0.8	2108	(*E*)-Phytol	3.4
1231	(3*Z*)-Hexenyl 2-methylbutanoate	0.4		Total Identified	91.1

Antimicrobial Screening

The essential oil was screened for antimicrobial activity against Gram-positive bacteria, *Bacillus cereus* (ATCC No. 14579) and *Staphylococcus aureus* (ATCC No. 29213); Gram-negative bacteria, *Pseudomonas aeruginosa* (ATCC No. 27853) and *Escherichia coli* (ATCC No. 10798). Minimum inhibitory concentrations (MICs) were determined using the microbroth dilution technique [5]. Dilutions of the crude extracts were prepared in cation-adjusted Mueller Hinton broth (CAMHB) beginning with 50 μL of 1% w/w solutions of crude extracts in DMSO plus 50 μL CAMHB. The extract solutions were serially diluted (1:1) in CAMHB in 96-well plates. Organisms at a concentration of approximately 1.5×10^8 colony-forming units (CFU)/ mL were added to each well. Plates were incubated at 37°C for 24 hours; the final minimum inhibitory concentration (MIC) was determined as the lowest concentration without turbidity. Geneticin was used as a positive antibiotic control; DMSO was used as a negative control. Antifungal activity against *Aspergillus niger* (ATCC No. 16888) was determined as above using YM broth inoculated with *A. niger* hyphal culture diluted to a McFarland turbidity of 1.0. Amphotericin B was the positive control.

Brine Shrimp Lethality Assay

The brine shrimp (*Artemia salina*) lethality test was carried out using a modification of the procedure by McLaughlin [6]. *Artemia salina* eggs were hatched in a sea salt solution (Instant Ocean®, 38 g/L) with an incandescent light bulb as the heat source. After 48 hours, the newly hatched nauplii were counted using a

micropipette and transferred to 20-mL vials. Nine vials each containing 10 *A. salina* nauplii in 10 mL of sea salt solution (same as the hatching solution) were prepared. Three vials were labeled as controls with first one containing no DMSO, another with 10 µL, and the last one with 100 µL DMSO. Three replicate vials contained 10 µL of 1% essential oil solution in DMSO, and the other three were prepared by adding 100 µL of 1% essential oil solution in DMSO. Surviving *A. salina* were counted after 24 hours.

RESULTS AND DISCUSSION

Leaf essential oil of *Jasminum mesnyi* was obtained in 0.054% yield. A total of 23 compounds were identified accounting for 91.1% of the oil composition. The major components of the essential oil were the benzopyrone coumarin (48.9%) and linalool (14.8%) with smaller quantities of α-terpineol (5.2%), (*Z*)-asarone (3.5%), (*E*)-phytol (3.4%), and geraniol (3.3%). The composition of *J. mesnyi* oil likely accounts for the traditional use of this plant in aromatherapy to relieve stress. Coumarin and linalool are major components of lavender oils, which are well-known aromatherapeutics with sedative and anxiolytic properties [7]. Other anxiolytic components in *J. mesnyi* oil include (*Z*)-asarone, geraniol, and α-terpineol [8].

The essential oil of *J. mesnyi* was screened for potential antimicrobial activity against *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Aspergillus niger*, but showed no activity against any of the microorganisms (MIC ≥ 1250 µg /mL). *J. mesnyi* leaf oil, however, did show moderate activity in the brine shrimp (*Artemia salina*) lethality test (LC_{50} = 27.03 µg/mL).

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