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Bioactivity and Chemical Composition of the Leaf Essential Oil of *Talauma gloriensis* Pittier (Magnoliaceae) from Monteverde, Costa Rica

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Abstract: The leaf essential oil of *Talauma gloriensis* was obtained by hydrodistillation and analyzed by gas chromatography-mass spectrometry (GC-MS). The most abundant essential oil components were myrcene (31.7%) and germacrene D (43.5%). The leaf oil showed notable brine shrimp toxicity (LC_{50} = 14.1 μg/mL) and slight cruzain inhibitory activity (IC_{50} = 98.6 μg/mL), but was devoid of cytotoxic activity or antibacterial activity.

Key words: *Talauma gloriensis*; essential oil composition; myrcene; germacrene D; brine shrimp lethality; cruzain inhibition

1. Introduction

The genus *Talauma* (Magnoliaceae) is made up of approximately 50 species, found mostly in Asia [1]. *T. mexicana* is used in Mexico to treat gastrointestinal disorders [2] and is a source of the quinoline alkaloid liriodenine [3]. *T. ovata* has yielded the cytotoxic sesquiterpene lactone costunolide

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[4], alkaloids [5], and neolignans [6]. *T. hodgsonii* has also yielded lignans [7]. There is only one species, *Talauma gloriensis* Pittier, found in the Monteverde region of northwestern Costa Rica [8] and this tree ranges from Nicaragua to Panama. Two other species of *Talauma* have been investigated for volatiles, *T. gioi* [9] and *T. ovata* [10], but to our knowledge this is the first investigation of *Talauma gloriensis* leaf essential oil.

2. Materials and Methods

2.1 Plant material

Leaves of *T. gloriensis* were collected from a mature tree on May 15, 2007, from Monteverde, Costa Rica (10° 18.8' N, 84° 48.6' W, 1420 m asl). The tree was identified by W. A. Haber and a voucher specimen (Haber 574) has been deposited in the Missouri Botanical Garden Herbarium. The fresh leaves (65.8 g) were chopped and hydrodistilled with continuous extraction with chloroform for 4 h using a Likens-Nickerson apparatus to give the pale yellow essential oil (106 mg).

2.2 Gas Chromatography-Mass Spectrometry

The leaf essential oil of *T. gloriensis* was subjected to GC-MS analysis on an Agilent system consisting of a model 6890 gas chromatograph, an HP-5ms fused silica capillary column, and a model 5973 mass selective detector as described previously [11]. Identification of oil components was achieved based on their retention indices (RI, determined with reference to a homologous series of normal alkanes), and by comparison of their mass spectral fragmentation patterns with those reported in the literature [12] and stored on the MS library [NIST database (G1036A, revision D.01.00)/ChemStation data system (G1701CA, version C.00.01.08)].

2.3 Bioactivity Screening

In-vitro cytotoxic activity against MCF-7 (ATCC No. HTB-22) cells was carried out using the MTT method for cell viability as previously described [13]. Antibacterial screening was carried out against *Bacillus cereus* (ATCC No. 14579), *Staphylococcus aureus* (ATCC No. 29213), *Pseudomonas aeruginosa* (ATCC No. 27853) and *Escherichia coli* (ATCC No. 25922), using the microbroth dilution techniques as described previously [14]. Brine shrimp (*Artemia salina*) lethality tests were carried out as previously described [15]. Enzyme inhibitory activity against recombinant cruzain was determined as previously described [16].

3. Results and Discussion

The fresh leaves of *T. gloriensis* yielded 0.161% pale yellow essential oil. The chemical composition of the leaf oil is presented in Table 1. A total of 36 compounds were identified in the oil accounting for 98.8% of the composition. The most abundant compounds were the monoterpene myrcene and the sesquiterpene germacrene D. The leaves, bark, and fruit of *T. gioi* from Vietnam revealed only minor amounts of myrcene in the fruits and no germacrene D [9]. The leaves of *T. gioi* did have abundant (*E*)-caryophyllene (16.9%) and elemicin (46.3%). The headspace volatiles from the fruits of *T. ovata* from Brazil were rich in naphthalene (35.1%) and α-bulnesene (10.1%), contained some germacrene D (7.0%), and no myrcene [10].

Table 1. Chemical composition of *Talauma gloriensis* leaf essential oil.

RI[a]	Compound	% Composition
939	α-Pinene	1.0
979	β-Pinene	3.7
994	Myrcene	31.7
1007	α-Phellandrene	0.2
1012	δ-3-Carene	0.7
1018	α-Terpinene	0.1
1026	*p*-Cymene	t
1030	Limonene	0.8
1040	(*Z*)-β-Ocimene	1.8
1050	(*E*)-β-Ocimene	0.1
1059	γ-Terpinene	0.2
1088	Terpinolene	t
1374	α-Copaene	0.1
1389	β-Cubebene	0.1
1392	β-Elemene	0.1
1408	α-Gurjunene	t
1418	(*E*)-Caryophyllene	0.9
1427	β-Copaene	t
1452	α-Humulene	0.1
1459	Alloaromadendrene	0.1
1462	*cis*-Cadina-1(6),4-diene	t
1478	Germacrene D	43.5
1493	*trans*-Muurola-4(14),5-diene	0.9
1495	γ-Amorphene	t
1497	Bicyclogermacrene	2.1
1501	α-Muurolene	1.7
1514	γ-Cadinene	1.6
1524	δ-Cadinene	3.3
1531	*trans*-Cadina-1,4-diene	0.8
1536	α-Cadinene	t
1549	Elemol	t
1598	Guaiol	0.6
1613	$C_{15}H_{26}O$	1.2
1640	τ-Cadinol	1.5
1645	Torreyol (= α-Muurolol)	0.1
1648	α-Eudesmol	0.1
1665	Intermediol	1.0
	Total identified	98.8
	Monoterpene hydrocarbons	40.3
	Sesquiterpene hydrocarbons	55.2
	Oxygenated sesquiterpenoids	4.5

t: trace

[a] Retention indices were determined by comparison of retention times with a homologous series of alkanes using an HP-5MS column.

The leaf essential oil of *T. gloriensis* showed notable activity in the brine shrimp lethality test with an LC_{50} of 14.1 μg/mL and slight inhibition of the cysteine protease cruzain (IC_{50} = 98.6 μg/mL), but was devoid of *in-vitro* cytotoxic activity (MCF-7 cells) or antibacterial activity (*Bacillus cereus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*). The slight cruzain inhibitory activity is puzzling because the abundant components myrcene (IC_{50} = 46.5 μg/mL) and germacrene D (IC_{50} = 22.1 μg/mL) are both active and show positive synergistic activity together (IC_{50} = 11.9 μg/mL) [16]. There may be antagonistic interactions due to other, minor, essential oil components.

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