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Chemical composition of the floral essential oil of *Tabernaemontana longipes* from Monteverde, Costa Rica

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Abstract

The floral essential oil of *Tabernaemontana longipes* Donn. Sm. (Apocynaceae) from Monteverde, Costa Rica, was isolated by hydrodistillation and analyzed by gas chromatography – mass spectrometry. The floral oil was dominated by the monoterpene (*E*)-β-ocimene (30.0%), the sesquiterpene germacrene D (12.5%), and the normal alkane heneicosane (12.9%).

Keywords: *Tabernaemontana longipes,* essential oil composition, β-ocimene, germacrene D, heneicosane.

1. Introduction

Tabernaemontana longipes Donn. Sm. is one of about 110 species of *Tabernaemontana* in the Apocynaceae [1]. The plant ranges from Nicaragua to Colombia and Ecuador in very humid forests, secondary forests, as well as windy and cloud forests, 0-1900 m elevation. The inflorescences have many sweet-smelling flowers, which have white or cream-colored cylindrical corollas, 8-14 mm long, with brown lobes [2, 3]. Several alkaloids [4] and triterpenoids [5, 6] have been isolated and characterized from the plant. Apparently, however, the floral essential oil has not been previously examined.

2. Materials and methods

2.1 Plant Material

Flowers of *T. longipes* were collected on 9 May, 2009, from several treelets growing in the Monteverde region of northwestern Costa Rica (10° 18′ 3.53″ N, 84° 48′ 39.43″ W, 1350 m elevation). The plant was identified by William A. Haber. A voucher specimen has been deposited with the Missouri Botanical Garden herbarium (Haber Collection No. 7104). The fresh flowers (92.0 g) were hydrodistilled using a Likens-Nickerson apparatus with continuous extraction of the distillate with dichloromethane to give a clear colorless essential oil (15.4 mg).

2.2 Gas Chromatography – Mass Spectrometry

The floral essential oil of *T. longipes* was subjected to GC–MS analysis on an Agilent system consisting of a Model 6890 gas chromatograph, a Model 5973 mass selective detector (EIMS, 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)-methylpolysiloxane stationary phase (30 m × 0.25 mm i.d., film thickness 0.25 μm). The carrier gas was helium with a column head pressure of 48.7 kPa and flow rate of 1.0 ml/min. Inlet temperature was 200 °C and interface temperature was 280 °C. The GC oven temperature program was used as follows: 40 °C initial temperature held for 10 min; increased at 3 °C/min to 200 °C, then 2 °C/min to 280 °C. The sample was dissolved in CH_2Cl_2 to give a 1% w/v solution; 1 μl injections using a splitless injection technique were used.

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 [7] and stored on the MS library [NIST database (G1036A, revision D.01.00)/ChemStation data system (G1701CA, version C.00.01.08)]. The percentages of each component are reported as raw percentages without standardization.

3. Results & Discussion

A total of 37 compounds representing 86.6% of the essential oil composition were identified (Table 1). The major components in the floral essential oil were the monoterpene (*E*)-β-ocimene (30.0%), the sesquiterpene germacrene D (12.5%), and the normal alkane heneicosane (12.9%). Several members of the Apocynaceae have floral essential oils rich in (*E*)-β-ocimene, including *Funastrum odoratum*, *Gonolobus barbatus*, *Oxypetalum ostenii*, *Sarcostemma viminale* [8], *Fockea edulis*, *Hoya incrassata*, *Marsdenia linearis*, and *Secamone afzelii* [9]. Like *T. longipes*, *Catharanthus roseus* floral essential oil was rich in alkanes, particularly heneicosane and tricosane [10]. Germacrene D has apparently not been previously identified as an abundant component of Apocynaceae floral essential oils, but it is a major constituent of *Magnolia grandiflora* (Magnoliaceae) floral essential oil [11, 12].

Table 1: Chemical composition of *Tabernaemontana longipes* floral essential oil

RI	Compound	%
1001	Dehydro-1,8-cineole	1.9
1037	1,8-Cineole	0.1
1061	(*E*)-β-Ocimene	30.0
1293	Indole	2.2
1373	α-Copaene	0.9
1376	Daucene	trace
1382	β-Cubebene	0.4
1393	β-Elemene	2.2
1401	(*Z*)-Jasmone	0.3
1419	(*E*)-Caryophyllene	1.7
1437	α-*trans*-Bergamotene	2.2
1451	α-Humulene	0.3
1459	Sesquisabinene	0.4
1466	*cis*-Muurola-4(14),5-diene	0.2
1486	Germacrene-D	12.5
1489	β-Selinene	1.3
1494	Ledene (= Viridiflorene)	0.7
1498	Bicyclogermacrene	1.3
1503	Isodaucene	0.4
1507	β-Bisabolene	1.1
1509	(*Z*)-α-Bisabolene	0.7
1520	δ-Cadinene	0.2
1560	(*E*)-Nerolidol	0.4
1573	Dendrolasin	2.0
1900	Nonadecane	0.6
2000	Eicosane	0.2
2100	Heneicosane	12.9
2115	Unidentified diterpenoid	2.5
2119	Unidentified diterpenoid	4.3
2200	Docosane	0.4
2300	Tricosane	3.5
2400	Tetracosane	0.1
2500	Pentacosane	1.2
2600	Hexacosane	0.1
2700	Heptacosane	2.6
2800	Octacosane	0.2
2832	Unidentified diterpenoid	5.7
2900	Nonacosane	1.3
2946	Unidentified diterpenoid	0.9
3000	Triacontane	trace
3100	Untriacontane	trace

Indole (2.2%) was the only nitrogen-containing compound identified in *T. longipes* floral essential oil. This compound has been identified in the floral volatiles of a few members of the Apocynaceae, including *Apteranthes joannis* (11.2%), *Hoodia gordonii* (4.6%), *Orbea variegata* (5.7%) [13], *Oxypetalum ostenii* (1.5%), *Sarcostemma brevipedicellatum* (4.5%), *Sarcostemma* *viminale* (14.3%) [8], *Marsdenia engleriana* (3.0%) [9], *Caralluma europaea* (0.8%) [14], and *Plumeria rubra* (trace amount) [15]. Interestingly, *T. longipes* floral essential oil was devoid of the "typical" essential oil components that contribute to floral fragrance, linalool and linalool derivatives, benzyl alcohol, and 2-phenylethanol, which have been observed in other floral essential oils from the Apocynaceae [15-17]

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