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Full Length Research Paper

Volatile constituents from *Samanae saman* (Jacq.) Merr. Fabaceae

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In this work, we report on the constituents identified from the fruits volatile oil of *Samanae saman* (Jacq.) Merr., Fabaceae. The volatile oil was obtained by hydrodistillation in an all glass Clevenger-type apparatus. The oil content was 0.23% (w/w), on a dry weight basis. The oil was analyzed by GC-MS. Altogether, 32 compounds were identified accounting for 99.7% of the total oil content. Fatty acids comprised 69.1% of the oil content; with palmitic acid (55.6%) being the most singly abundant constituent. 1,8-Cineole (15.9%) was the quantitatively significant constituent of the terpenoids.

Key words: *Samanae saman*, Fabaceae, volatile oil, fatty acids, terpenoids, palmitic acid, 1,8-cineole.

INTRODUCTION

Samanae saman (Jacq.) Merr. [syn. *Albizia saman* (Jacq.) F. v. Muell.] or Rain tree, a member of the Fabaceae family, is a large tree, native to tropical America. It has now become widespread throughout the humid and sub humid tropics. It is commonly referred to as 'monkey pod' or 'cow tamarind'. Rain trees may attain heights of 80 ft (24 m) with a branch spread of up to 100 ft (30 m). The evergreen leaves are alternate bipinate, while the flowers are small pinkish-green. Rain tree has flat oblong seedpods containing oblong brown seeds. The edible pods are rich with protein. The tree provides excellent protective shade, and produces highly palatable pods that are suitable as a dry season feed supplement (Flores, 2002; Durr, 2001). The sticky licorice- flavored pulp is a minor food item for humans, mostly eaten by children in South-west Nigeria. There are several folk remedies prepared from various parts of the plant. The boiled bark is applied as a poultice to cure constipation. A decoction of the plant is used for the treatment of microbial infections and inflammation. In the Philippines, a decoction of the inner bark and fresh leaves is used for diarrhea. In Venezuela, the roots are made into a hot bath for stomach cancer. In the West Indies, the seeds are chewed for sore throat.

The plant is rich in tannins and other phytochemicals and has been reported to posses potent antimicrobial and molluscicidal (Lim et al., 2001; Ahn et al., 1989), nematicidal (Nigg and Seigler, 1992), hypercholesterolemic (Spiller, 1996) and hemolytic (Bisset, 1994) properties. Little is known about the chemical constituents of the volatile and non-volatile of this plant. The only report of Misra et al. (1971) described the isolation and characterization of octacosanol, α-spinasterol, β-D-glucose of α-spinasterol, the flavonoid kaempferol and an alkaloid pithecolobine from the various parts of the plant.

This paper reports on the constituents identified from the essential oil hydrodistilled from the fruits of *S. saman*. This is part of an extensive research program aimed at the characterization of the volatile compositions of the underutilized and poorly studied species of Nigerian flora (Ogunwande and Olawore, 2006).

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MATERIALS AND METHODS

Plant materials and oils isolation

Fresh fruits of *S. saman* were collected from the trees cultivated at the Department of Chemistry, University of Ibadan, Ibadan, Nigeria,

Table 1. Chemical Composition of *Samanae saman* fruits essential oil.

RI[a]	Compounds[b]	Area (%)
941	α-Pinene	1.8
1026	ρ-Cymene	2.2
1032	1, 8-Cineole	15.9
1190	α-Terpineol	0.5
1375	α-Copaene	0.4
1397	Cyperene	0.1
1418	β-Caryophyllene	1.5
1452	α-Humulene	0.3
1456	Geranyl acetone	0.2
1480	Germacrene-D	0.2
1484	*ar*-Curcumene	0.3
1486	β-Ionone[+]	0.2
1501	Pentadecane	0.2
1509	β-Bisabolene	0.2
1523	δ-Cadinene	0.6
1564	Nerolidol [+]	0.3
1580	Spathulenol	1.7
1599	Hexadecane	0.3
1640	τ-Cadinol	0.2
1683	α-Bisabolol	0.5
1699	Heptadecane	0.4
1772	Myristic acid	0.4
1793	Octadecane	0.1
1840	6,10,14-Trimethyl-2-pentadecanone	2.1
1894	Nonadecane	0.4
1999	Palmitic acid	55.6
2153	Oleic acid	7.4
2158	Ethyl linoleate	1.7
2165	Ethyl oleate	3.1
2296	Tricosane	0.1
2397	Tetracosane	0.1
2893	Nonacosane	0.7
Total		**99.7**

[a]Linear Retention index based on a homologous series of alkanes on a HP-5ms column.
[b]Class of compounds: Fatty acids (69.1%), aliphatic compounds (3.5%), monoterpene hydrocarbons (4.0%), oxygen containing monoterpenes (16.8%), sesquiterpene hydrocarbons (3.6%), oxygen containing sesquiterpenes (2.7%).
[+]Correct isomer not determined.

in July 2004. Mr. Ogunduyile of the Herbarium, Department of Botany and Microbiology of the University authenticated the plant, where a voucher specimen was deposited. Essential oils were obtained by hydrodistillation of the air-dried plant materials for 4 h in a Clevenger-type apparatus. The percentage yield was 0.23% w/w.

Gas chromatography – mass spectrometry analyses (GC/MS)

The volatile oil sample was subjected to GC-MS analyses on an Agilent system consisting of a model 6890 Gas Chromatograph, a model 5973 Mass selective detector (MSD) and an Agilent ChemStation data system. The GC column was an HP-5ms fused silica capillary with a (5% phenyl)-methylpolysiloxane 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 7.07 psi and flow rate of 1.0 mL/min. Injector and detector temperatures were maintained at 200°C and 230°C, while the MS transfer-line temperature was 280°C. The GC oven temperature program was used as follows: 40°C initial temperature, hold for 10 min; increased at 3°/min to 200°C; increased 2°/min to 220°C. The oil was dissolved in CH_2Cl_2 and a split injection technique was used.

Identification of each individual constituent of the essential oils was achieved based on their retention indexes (determined with a reference to a homologous series of normal alkanes), and by comparison of their mass spectral fragmentation patterns [NIST database (G 1036A, revision D.01.00/ChemStation data system] and with data previously reported in the literature (Adams, 2001).

RESULTS AND DISCUSSION

The contents of the volatile oil are presented in Table 1. The chemical analysis permitted the identification of 32 compounds comprising of 6 monoterpenes (20.8%), 12 sesquiterpenoids (6.3%), 6 aliphatic (3.5%) and 8 fatty acids (69.1%). The total identified component amounted to 99.7% of the oil contents. As could be seen in the table, fatty acids are the dominant class of compounds in the oil. Palmitic acid (55.6%) occurred in the highest amount, with significant proportion of oleic acid (7.4%) and ethyl oleate (3.1%). Oxygenated monoterpenes (16.8%) constituted another important class of compounds identified in the oil. 1, 8-Cineole (15.9%) had the largest proportion in this class. Terpene hydrocarbons are less common among the volatile constituents. ρ-Cymene (2.2%), α-pinene (1.8%), spathulenol (1.7%) and β-caryophyllene (1.5%) are the other terpenoid compounds occurring above 1%. 6,10,14-Trimethyl-2-pentadecanone (2.1%) was the most prominent of the aliphatic compounds identified from the oil.

Palmitic acid, the main constituent of the essential oil in this study, is an important constituent of most vegetable fats such as sunflower and soybean oils. This compound has also been described in higher quantity form the essential oils of some plant species such as *Prunus mahaleb* (Mastelic et al., 2006), *Salvia microstegia* (Senatore et al., 2006), *Capsicum chinense* (Pino et al., 2006) and *Anthemis altissima* (Javidnia et al., 2004). In higher animals as well, it is one of the compounds which is thought to be responsible for the strong odour of *Giraffa camelopardalis reticulata* (Wood and Weldon, 2002). In addition, it is well known to exhibit a variety of biological and physiological activities of importance. These include oviposition-deterring pheromone (Guoqing et al., 2001), mosquito larvicide (Rahuman et al., 2000) and sex pheromone (Fu et al., 2005). Industry makes use of this chemical (i.e. palmitic acid) in the manufacture of products as diverse as soap and food additives. Many shaving creams use palmitic acid as an emulsifier to prevent separation of the oil and water constituents.

1,8-cineole has been described as a quintessential molecule. It is useful as antimicrobial, exhibited potentials in the treatment of Alzheimer disease (Houghton, 2004), effective in reducing inflammation and pain (Santos and Rao, 2000) and in promoting leukemia cell death (Moteki et al., 2002). 1,8 Cineole is both a CNS stimulant and a sedative and reduces cardiovascular effects (Lahlou et al., 2002). The compound significantly enhanced the pseudo steady state flux permeation and penetration across human skin (Narishetty and Panchagnula, 2005; Cornwell et al., 1996). It is also toxic when used on head lice (Veal, 1996).

This compositional pattern may have influenced the biological activities of the plant. These effects, when combined together may point out new possibilities for the exploitation of the volatile oils of *S. saman*. It is probable that the volatile oils of *S. saman* may thus be exploited for a variety of purposes. There are no literature reports on the constituents of the volatile oil of the plant. The present report is the first of its kind aimed at the comprehensive characterization of the volatile oil of *S. saman*.

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