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CHEMICAL ANALYSIS OF VOLATILE CONSTITUENTS OF *FLACOURTIA MONTANA* J. GRAHAM (SALICACEAE) : AN EDIBLE AND WILD FRUIT OF WESTERN GHATS OF INDIA

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Abstract

The volatile constituents of dichloromethane extract of wild edible fruit *Flacourtia montana* J. Graham was analyzed with the aid of GC-MS. 36 compounds were identified, which included alcohols, esters, aldehydes, ketones, furans and nitrogen compounds. The most predominant volatile organic compounds detected were alcohols followed by alkanes, alkenes and esters. Results revealed that the fruit possessed a fruity, citrus like odor with a fatty flavor.

Key words : *Flacourtia montana*, volatile constituents, wild fruit, aroma, flavor.

Introduction

Flacourtia montana is an wild fruit found across Western Ghats in India. The fruit is red globose berry which is sweet to taste and astringent in flavor. Profiling of volatile constituents is necessary to ascertain aroma and flavor of fruits. Wide array of volatile compounds are found in fruits which include alcohols, esters, ketones and aldehydes (Wilson *et al*., 1985). The occurrence of either individual or multiple constituents influences the characteristic flavor of a fruit. Several studies have highlighted the prominence of volatile constituents and their significance (Franco and Janzantii, 2005). Moreover, several biological activities have been attributed to volatile constituents, which find potential applications in food and cosmetics industries. Generally, the volatile profile often differs from fruit to fruit and extraction methods employed (Charles *et al*., 2000). Hence, assessment of volatile constituents provides a deeper insight in determining the aroma and flavor profile of fruit and fruit based products (Sagrero-Nieves and Pooter, 1992; Santos *et al*., 1998). However, till date, no reports exist on volatile constituents of fresh or processed *F. montana* fruits. Hence, the present study for the first time reports volatile constituents of ripened *F. montana*.

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Materials and Methods

Ripened fruits of *F. montana* were harvested from the forest area of Uttara Kannada district in Karnataka, India. Seeds were separated and the pulp from the fruits was extracted using an electric grinder (TTK, Prestige, India). The obtained pulp was stored at -20°C until further processed for chemical analysis. Liquid-liquid extraction was carried out using dichloromethane as solvent following the protocol described (Solis-Solis *et al*., 2007) at 4°C. Further, organic layer was separated and concentrated using rotary evaporator (Ika, Bangalore). Finally, 0.2 µl was injected in gas chromatography-mass spectroscopy (GC-MS).

Gas chromatography–mass spectrometric (GC-MS) analysis of volatile constituents were analyzed using GC (Perkin Elmer, USA) coupled with mass spectrometer (turbo mass) using Helium as a carrier gas with a flow rate of 1 ml/min. 0.2 µl of sample extract was injected into a fused silica column coated with poly di methyl siloxane (30.0 m × 320 µm × 0.25 µm). Column temperature was programmed from 50 to 250°C at an incremental of 2°C/min. Injection temperature was maintained at 150°C and the detector temperature was maintained at 260°C. A split ratio of 1:20 and ionization voltage of 70 eV were maintained. Retention indices for

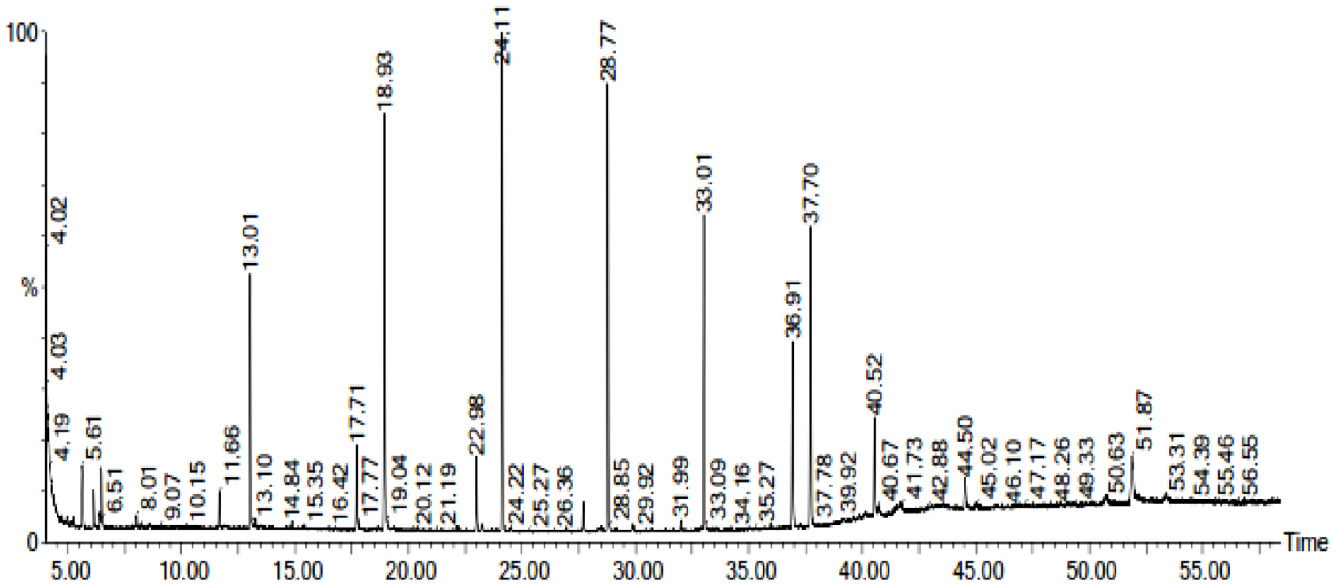

Fig. 1 : Gas chromatogram (GC) profiles of dichloromethane extract of *Flacourtia montana* fruits on DB-5 column.

the compounds were identified by comparison with updated NIST library.

Results and Discussion

Volatile constituents of dicholoromethane extract of *F. montana* are given in table 1 along with their retention times and relative area percentages. Fig. 1 represents a GC chromatogram of the identified compounds. The analysis indicated that *F. montana* comprised a total of thirty six compounds. Higher abundance of alcohols was observed followed by alkanes, alkenes, esters and hydrocarbons. Among alcohols, 1-Undecanol was found to be the most prominent with a concentration of 8.45% of the total volatiles. This compound is reported to have a floral, citrus-like odor and fatty flavor (Burdock, 2010). Minor volatile constituents such as phenylethyl alcohol, are known to give strong rose-like aroma with a floral note. n-Hexyl-2-butenoate is responsible for fruity, pineapple and tropical fruit aroma (Burdock, 2010). Fatty acids such as dodecanoic acid, hexadecanoic acid, octanoic acid and tetradecanoic acid were also detected. Octanoic acid is reported to have a faint fruity-acid odor and slightly sour taste (Burdock, 2010). Some of volatile constituents observed in the present study were similar to the earlier findings of Franco and Janzantii (2005), wherein they reported the aroma profiles of tropical minor fruits such as acerola, cupuaçu, soursop, bacuri, genipap, umbu-cajá, araçá-boi, camu-camu, umbu, murici and cashew apple. However, the presence of these compounds gave a complex aroma to the ripened fruits of *F. montana*. Nevertheless, recent studies have highlighted that newer technique like headspace solid

Table 1 : Volatile compounds identified in *Flacourtia montana* fruit.

Retention time (min)	Compound name	Relative area (%)
4.944	2-Pentanol	0.161
5.234	Decane	0.162
6.109	1,5-Heptadiene-3-yne	0.850
6.454	Octylcyclopropane	1.180
8.015	2,4-Dimethyl-Heptane	0.293
11.661	Undecane	0.636
13.012	1-Hexadecanol	4.270
14.848	Tridecane	0.170
17.709	Dodecane	1.471
18.929	(Z)-3-Tetradecene	7.561
22.976	Tetradecane	1.281
23.231	Butyrolactone	0.184
24.111	1- Undecanol	8.405
28.768	*trans*-9-Hexadecen-1-ol	7.554
29.864	Phenylethyl Alcohol	0.204
31.990	Farnesane	0.183
33.010	E-15-Heptadecenal	5.534
36.911	2-Ethyl-1-dodecanol	3.402
37.702	2,4-bis(1,1-Dimethylethyl)-phenol	5.494
39.137	1,4,7,10,13,16-Hexaoxacycloo-ctadecane	0.143

Table 1 continued....

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40.523	9-Hexacosene	1.953
40.683	Terpinen-4-ol, acetate	0.188
40.708	Dodecanoic acid	0.227
41.433	Pyrrolo[1,2a]pyrazine-1,4-dione, hexahydro-3-(2-methylpropyl)-	0.149
41.673	(Z)-1-(1-Ethoxyethoxy)-3-hexene	0.694
42.884	n-Hexyl-2-butenoate	0.437
43.209	1-Octene, 3-(methoxymethoxy)-	0.169
43.474	2-Methyl-5-isopropyl-1,3-oxathiane	0.152
43.499	Methyl octanoate	0.125
43.599	2-Methyl-3-hexanol	0.134
44.519	2-Hexadecanol	1.019
44.985	Tetradecanoic acid	0.185
50.737	*trans*-2-Hexen-1-ol	0.455
51.872	n-Hexadecanoic acid	2.362
53.348	Octanoic acid	0.235
53.408	2-Isopropoxyethylamine	0.144

microextraction (HS-SPME) coupled with GC-MS is a most preferred method and could yield more precise and accurate results corresponding to volatile organic compounds (Forney, 2001). Thus, the present study provided preliminary information for future exploitation and utilization of volatile constituents of *F. montana*.

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