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Chemical Composition of *Abroma augusta* Linn. Seed Oil

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Abstract: The seed oil of *Abroma augusta* Linn., extracted with *n*-hexane, was studied for chemical composition. The fatty acid composition of the oil was determined using Gas Chromatography-Mass Spectrometric (GCMS) technique. Out of six identified fatty acids, four were saturated (66.6%) and two were unsaturated (33.3%). The structures of various fatty acids were confirmed on the basis of comparison with those reported in literature.

Key words: *Abroma augusta*, fatty acids, gas chromatography-mass spectrometry

Introduction

Abroma augusta Linn (Sterculiaceae), commonly known as Ulatkambal (Bengali and Hindi), is a large spreading bushy shrub with fibrous barks and irritant hairs, widely distributed (native or cultivated) throughout the hotter parts of India, in U.P., Sikkim (3,000 ft.), Khasia Hills (4,000 ft.) and Assam. It is also found in Java, Philippines and China (Watt, 1972; Hooker, 1982). The fresh viscid sap of the root bark is considered to be a valuable emmenagogue and uterine tonic, useful in the congestive and neuralgic varieties of dysmenorrhoea, (Kirtikar and Basu, 1918). 'Minofil', an herbal formulation containing *Abroma augusta* may be an alternative to HRT in the treatment of post menopausal syndrome (Nanda, 1997). Chemical constituents that have been identified from the various parts of this plant include choline, betaine, β -sitosterol, stigmaterol (Dasgupta and Basu, 1970); L-rhamnose, L-arabinose, D-xylose, D-mannose, D-galactose, D-glucose, D-galacturonic acid and D-glucuronic acid (Majumder *et al.*, 1994). The present study was undertaken to explore the seed oil of *Abroma augusta* for its fatty acids composition.

Materials and Methods

Plant material: The seeds of *Abroma augusta* (2 kg) were purchased from the local market, Qissa Khawani Bazar, Peshawar, Pakistan. The identification was confirmed by Prof. Dr. Jahandar Shah, Plant Taxonomist, Islamia College, Peshawar, University of Peshawar, Pakistan.

Extraction of oil: The seeds were pulverized into powder

and extracted with *n*-hexane in Soxhlet apparatus. The solvent was evaporated at low temperature under reduced pressure in rotary evaporator to obtain the oil (100 g).

Esterification: The oil (1 g) was treated with boiling methanol (50 ml) in the presence of concentrated hydrochloric acid (5 ml) and was refluxed (5 h) at 150°C. After cooling to room temperature, the methyl esters thus formed were extracted with ethyl acetate (30 ml x 3). The ethyl acetate was evaporated under reduced pressure in a rotary evaporator to obtain the esterified oil.

Analysis: The fatty acids composition of the esterified oil was determined by gas chromatograph-mass spectrometer. The analysis was performed using gas chromatograph coupled with a mass spectrometer (JMS-HX 110, Jeol). The capillary column (OV-101) with an internal diameter of 0.25 mm was used. The column temperature was raised from 70 to 260°C with a gradient of 10°C min⁻¹, injection block temperature, 270°C. Helium was used as the carrier gas at a flow rate of 2 ml min⁻¹, split ratio 1:80. The significant ions in the mass spectra of these acids are as follows:

***n*-Hexadecanoate, methyl ester:** 270 (M⁺, C₁₇H₃₄O₂), 239 (M⁺-31), 227 (M⁺-43), 213 (M⁺-57), 199, 185, 171, 157, 143, 129, 115, 101, 87, 74 (base peak).

2-Methyl hexadecanoate, methyl ester: 284 (M⁺, C₁₈H₃₈O₂), 255 (M⁺-29), 241 (M⁺-43), 227 (M⁺-57), 213, 199, 185, 171, 157, 143, 129, 115, 101, 88 (base peak).

***n*-Octadecanoate, methyl ester:** 298 (M^+ , $C_{19}H_{38}O_2$), 267 (M^+ -31), 255 (M^+ -43), 241 (M^+ -57), 227, 213, 199, 185, 171, 157, 143, 129, 101, 87, 74 (base peak).

2-Methyl octadecenoate, methyl ester: 312 (M^+ , $C_{20}H_{40}O_2$), 283 (M^+ -29), 269 (M^+ -43), 115, 101, 88 (base peak).

9-Octadecenoate, methyl ester: 296 (M^+ , $C_{19}H_{36}O_2$), 264 (M^+ -32), 222 (M^+ -74), 180 (M^+ -116), 151, 137, 123, 109, 87, 67.

10-Nonadecenoate, methyl ester; 310 (M^+ , $C_{20}H_{38}O_2$), 265 (M^+ -45), 235 (M^+ -74), 222, 180, 155, 137, 123, 109, 95, 81, 67.

Results and Discussion

To the best of our knowledge and from the literature survey, no earlier studies exist on the fatty acid composition of seed oil of *Abroma augusta* Linn. Table 1 shows the relative percentages of fatty acids in the total seed oil of the *Abroma augusta* Linn. A total of six fatty acid methyl ester were identified, four of them being the saturated (66.6%) and two unsaturated (33.3%), in the seed oil of *Abroma augusta* Linn by employing the GC-MS technique. Saturated fatty acids constitute 75% of the total oil, whereas the unsaturated fatty acids constitute 25%. *n*-Hexadecanoate methyl ester was found to be the most abundant fatty acid which comprised 33% of the total peak areas for the *Abroma augusta* Linn. seed oil. The structures were confirmed on the basis of comparison with the various fragment ions reported in literature (Watson, 1976; Ryhage and Stenhagen, 1963; McLafferty, 1973; Beynon *et al.*, 1968; Budzikiewicz *et al.*, 1967; Odham and Stenhagen, 1972).

The EIMS exhibited the molecular ion peaks for *n*-Hexadecanoate methyl ester, 2-Methyl hexadecanoate methyl ester, *n*-Octadecanoate methyl ester, 2-Methyl octadecanoate methyl ester, 9-Octadecenoate methyl ester and 10-Nonadecenoate methyl ester, respectively at m/z 270, 284, 298, 312, 296 and 310 corresponding to molecular formulae $C_{17}H_{34}O_2$, $C_{18}H_{36}O_2$, $C_{19}H_{38}O_2$, $C_{20}H_{40}O_2$, $C_{19}H_{36}O_2$ and $C_{20}H_{38}O_2$.

The base peaks at m/z 74 (McLafferty ion peak) in the EIMS of *n*-Hexadecanoate methyl ester and *n*-Octadecanoate methyl ester are the characteristic peaks for long chain methyl ester fatty acids (Ryhage and Stenhagen, 1963; Beynon *et al.*, 1968). The base peaks at m/z 88 for 2-Methyl hexadecanoate methyl ester and 2-Methyl octadecanoate methyl are the characteristic peaks for a methyl substitution next to the carbonyl carbon (Ryhage and Stenhagen, 1963; Beynon *et al.*, 1968). The peaks at m/z 264 in the mass spectra of 9-Octadecenoate methyl ester [M^+ -32] and 10-

Table 1: Fatty acids identified in the seedoil of *A. augusta* Linn

| Fatty acids | MOL. WT. | % of Whole oil |
|--|----------|----------------|
| Saturated fatty acids | | |
| <i>n</i> -Hexadecanoate, methyl ester | | |
| CH ₃ -(CH ₂) ₁₄ -CO ₂ CH ₃ | 270 | 33 |
| 2-Methyl hexadecanoate, methyl ester | | |
| CH ₃ (CH ₂) ₁₃ -CH-CO ₂ CH ₃ | 284 | 28 |
| <i>n</i> -Octadecanoate, methyl ester | | |
| CH ₃ -(CH ₂) ₁₅ -CO ₂ CH ₃ | 298 | 13 |
| 2-Methyl octadecanoate, methyl ester | | |
| CH ₃ -(CH ₂) ₁₅ -CH-CO ₂ CH ₃ | 312 | 01 |
| Unsaturated fatty acids | | |
| 9-Octadecenoate, methyl ester | | |
| CH ₃ -(CH ₂) ₇ -CH=CH-(CH ₂) ₇ -CO ₂ CH ₃ | 296 | 23 |
| 10-Nonadecenoate, methyl ester | | |
| CH ₃ -(CH ₂) ₇ -CH=CH(CH ₂) ₈ -CO ₂ CH ₃ | 310 | 02 |

Nonadecenoate methyl ester [M^+ -46] were due to ions formed with the loss of methanol and ethanol], respectively, which is highly characteristics for monoenoic esters (Ryhage and Stenhagen, 1963).

The ions of m/z 227 in the EIMS for *n*-Hexadecanoate methyl ester and 2-Methyl hexadecanoate methyl ester are formed almost exclusively through the expulsion mechanism. The other peaks in the EIMS spectra of all the identified fatty acids are formed through simple cleavage of the long hydrocarbon chain.

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