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FATTY-ACID COMPOSITION OF SOME MANGROVES

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India has 3% of the world's mangrove area [1]. In Tami Nadu, it has an area of 21 sq. km, and the Pichavaram mangrove is one of the recognized tropical ecosystems because it is used in folkl medicine for the treatment of several diseases [2, 3]. Fatty acids are the constituents of all plant cells, where they function as membrane components, storage products, metabolites, and as a source of energy [4], and they also important nutrient substances and metabolites in living organisms [5]. The aim of this investigation was to determine the fatty acid composition of some mangroves by gas chromatography.

The fatty acid composition of eight mangrove species was determined, and their relative percentage are presented in Table 1. The fatty acids, viz., myristic, pentadecanoic, palmitic, heptadecanoic, oleic, linoleic, and linolenic acids, were found in all the plant species tested. When compared to other tested plants, the highest relative percentage of oleic acid (16.62%), linolenic acid (16.32%), arachidic acid (2.06%), and pentadecanoic acid (1.53%) were detected in *A. officinalis;* myristic acid (8.58%) and heptadecanoic acid (1.27%) in *B. cylindrica;* tridecanoic acid (0.76%) in *C. decandra*; linoleic acid (12.03%), behenic acid (1.38%), and heneicosanoic acid (0.03%) in *A. corniculatum*; palmitic acid (61.45%) in *L. racemosa*; lauric acid (38.58%) and stearic acid (1.76%) were detected in *A. ilicifolius*. Lauric acid has been found in all the plant species tested except *A. officinalis*; tridecanoic acid was not found in *R. apiculata, R. mucronata*, and *A. corniculatum*; nonadecanoic acid was found only in *B. cylindrica* and *L. racemosa.* Arachidic and behenic acids were not found in *A. corniculatum* and *A. ilicifolius*, respectively.

Analysis of the fatty acid composition by gas chromatography revealed the presence of higher amounts of saturated fatty acids than the unsaturated fatty acids. The highest relative percentage of palmitic acid (61.5%) was detected in *L. recemosa.* Palmitic acid seems to be a major fatty acid common to wax esters of *A. officinalis*, *B. gymnorhiza*, *A. ilicifolius*, *R. mucronata*, *C. decandra*, *D. trifoliate*, and *S. maritima* [6] and the leaves of *Ipomea pescaprae* [7].

In the previous reports, lauric acid was present in much lower amounts in the fresh leaves of some mangroves such as *Avicennia marina, A. marina* var. *resinifera, Rhizophora stylosa, R. apiculata, R. mucronata, Ceriops tagel, Bruguiera sexangula, B. gymnorhiza, Acanthus ilicifolius, Xylocarpus grantum*, and *Sonneratia caseolaris* [8]. Myristic acid was reported in the shoot, root, and seed of *Salicornia bigelovii*, and heptadecanoic acid was reported only in the root and seed of *S. bigelovii* [9]. Linolenic acid seems to be the major fatty acid, and arachidic acid was present in much lower amounts in fresh leaves of some mangroves [8]. Palmitic, lauric, stearic, myristic, heptadecanoic, arachidic, linolenic, behenic, and oleic acids were detected in steryl esters and triglycerides of some mangroves [6–10], and myristic, heptadecanoic, pentadecanoic, stearic, nonadecanoic, oleic, and behenic acids were reported in the fresh leaves of some mangroves [8].

Fatty acids play an important role in many functions of the skin [11]. The role of fatty acids in transepidermal water loss via the skin indicates that a number of fatty acids have a specific function in restoring the permeability barrier [11, 12]. Some polyunsaturated fatty acids such as linoleic acid, linolenic acid, and arachidonic acid, known as vitamin F, are necessary for growth and protection of the skin. Also, lauric acid is a potential antimicrobial agent, suitable for external application. It is inexpensive and useful for infection control in hospitals [13]. So, the present investigation justifies the use of mangroves in traditional medicine.

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TABLE 1. Relative Percentage of Fatty Acids in Some Mangroves

Fatty acid	*Avicennia officinalis*	*Bruguiera cylindrica*	*Ceriops decandra*	*Rhizophora apiculata*	*Rhizophora mucronata*	*Aegiceras corniculatum*	*Lumnitzera racemosa*	*Acanthus ilicifolius*
12:0	N.d.	12.17	24.93	19.29	12.50	37.84	8.97	38.58
13:0	0.75	0.64	0.76	N.d.	N.d.	N.d.	0.69	1.54
14:0	1.50	8.58	7.17	2.40	3.08	2.15	7.87	1.48
15:0	1.53	1.26	0.61	0.26	0.65	0.54	1.51	1.21
16:0	30.91	56.27	45.64	55.02	59.05	34.05	61.45	31.95
17:0	0.28	1.27	0.99	0.85	0.91	0.71	1.12	0.56
18:0	0.15	0.48	0.12	0.05	0.60	N.d.	0.03	1.76
19:0	N.d.	0.01	N.d.	N.d.	N.d.	N.d.	0.01	N.d.
20:0	2.06	0.25	0.37	0.01	0.03	N.d.	0.02	0.39
21:0	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01
22:0	0.62	0.61	0.42	0.20	0.31	1.38	0.92	N.d.
18:1	16.62	9.62	9.51	5.02	7.66	0.75	10.86	4.80
18:2	3.60	2.95	4.16	6.95	4.31	12.03	2.67	7.82
18:3	16.32	2.34	3.73	8.32	8.81	5.56	2.67	5.24

N.d.: not detected.

The leaves of eight mangroves species, viz., *Avicennia officinalis* L. (Avicenniaceae), *Bruguiera cylindrica* (L.) Blume, *Ceriops decandra* (Griff) Ding Hou, *Rhizophora apiculata* Blume and *Rhizophora mucronata* Lamk. (Rhizophoraceae), *Aegiceras corniculatum* (L.) Blanco (Myrsinaceae), *Lumnitzera racemosa* Willd. (Combretaceae), and *Acanthus ilicifolius* L. (Acanthaceae), were collected from the mangrove forest of Pichavaram (11°24′ N and 79°44′ E) in the Vellar-coleroon estuarine complex during November, 2007 and used for the investigation.

Sample Preparation and Gas Chromatographic Analysis. Twenty grams of plant powder was refluxed with a mixture of dry methanol–benzene–concentrated sulfuric acid (200:100:10 v/v) for two hours. The filtrate was transferred to a separating funnel and 60–70 mL of distilled water was added. Then a small amount of hexane was added and pooled. The hexane fraction was separated into two layers, and the lower layer was removed. The upper layer was washed with 50 mL of 10% sodium bicarbonate solution and shaken vigorously two times, and the lower layer was removed. The upper layer was washed with saturated 0.9% sodium chloride solution two times. The upper layer was saved and passed through sodium sulfate and saved for further analysis. The extract so obtained was evaporated under vacuum. The residue was dissolved in hexane and analyzed by gas chromatography (Varian GC# 1). The capillary column used to separate the fatty acids was CP-Wax 5 g (chrompack) (50 m × 0.20 mm). The temperature of the injector was 210°C, and of the detector 220°C. The temperature of the oven was programmed from 180°C, and the carrier gas was N_2, H_2 and zero air, and attenuation was 3^{-11} A/mV. A small quantity of methyl ester solution (2 μL) was introduced onto the column. The fatty acids were identified by comparison of the relative retention times with authentic standards from Sigma Chemical Company.

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REFERENCES

1. M. L. Wilkie and S. Fortuna, *Forest Resource Assessment Working,* Forest Resource Division, FAO, Rome, Paper No. 63, 2003.
2. R. N. Chopra, S. L. Nayer, and Chopra, *Glossary of Indian Medicinal Plants,* 3rd edn., Council of Scientific and Industrial Research, New Delhi, 1956, pp. 240–246.

3. K. R. Kirtikar and B. D. Basu, *Indian Medicinal Plants*, Lalit Mohan Basu, Allahabad, 1991, pp. 1–496.
4. H. Wada, Z. Gombos, and M. Murata, *Contribution of Membrane Lipids to the Ability of the Photosynthetic Machinery to Tolerance Temperature Stress,* Proc. Natl. Acad. Sci., USA, 1994.
5. S. H. Chen and Y. J. Chuang, *Anal. Chim. Acta,* **465**, 145 (2002).
6. S. Misra, A. K. Datta, S. Chattopadhyay, A. Choudhury, and A. Ghosh, *Phytochemistry*, **26**, 3265 (1987).
7. M. Chandrasekaran, V. Venkatesalu, M. Anantharaj, and S. Sivasankari, *Indian Drugs*, **42**, 275 (2005).
8. R. W. Hogg and F. T. Gillan, *Phytochemistry*, **23**, 93 (1984).
9. I. D. Weete, W. G. Rivers, and D. J. Weber, *Phytochemistry*, **9**, 2041 (1970).
10. S. Misra, A. Choudhury, P. K. Pal, and A. Ghosh, *Phytochemisry*, **25**, 1083 (1986).
11. P. M. Elias, *J. Invest. Dermatol.,* **80**, 44 (1983).
12. M. Puniras, *Precis de Cosmetologie Dermatologique*, Masson Eds., Paris, 1989, pp. 220–222.
13. T. Kitahara, Y. Aoyama, Y. Hirakata, S. Kamihira, S. Kohno, N. Ichikawa, M. Nakashima, H. Sasaki, and S. Higuchi, *Int. J. Antimicrob. Agents*, **27**, 51 (2006).