J Am Oil Chem Soc (2009) 86:1017–1019
DOI 10.1007/s11746-009-1430-3

ORIGINAL PAPER

Fatty Acid Composition of *Baccaurea courtallensis* Muell. Arg Seed Oil: an Endemic Species of Western Ghats, India

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Received: 8 January 2009 / Accepted: 15 June 2009 / Published online: 2 July 2009

Abstract *Baccaurea courtallensis* Muell. Arg., a moderately sized evergreen tree of the Euphorbiaceae, is endemic to Western Ghats. Its fruits are edible, sour in taste, and contain 2–4 seeds. The native residents harvest the fruits for their medicinal value and for pickling. The seed weight is 0.28 g or 1.0 kg contains 3,500 seeds with a seed coat. The fruit to seed weight ratio is 34:1. Virtually, no work on the chemistry of the seeds or fruit of the species has been reported. Seeds of the species contain 22.5% oil on a dry kernel weight basis. Analysis of the composition of the oil revealed two major fatty acids palmitic acid (42.59%) and oleic acid (36.15%). Stearic acid content was 16.20% and myristic acid was 4.28% of the oil. Two minor acids present were lauric acid (0.40%) and linoleic acid (0.38%) and also including traces of linolenic acid. Physico-chemical properties of the oil showed an acid value of 1.402, a saponification value of 166.89, a refractive index of 0.4239, a specific gravity of −0.938, and an optical rotation of α at 29 °C + 0.35° ($\lambda = 589$ nm).

Keywords *Baccaurea courtallensis* · Fatty oil · Fatty acid composition · Seed weight · Esterification

Introduction

Of the estimated 17,000 species of flowering plants reported from India, about 4,500 species are found in the Western Ghats region, of which 1,720 (> one-third) species are endemic. In other words, these endemic plants are found only in this region and nowhere else in the world. *Baccaurea courtallensis* Muell. Arg is one such tree species, which is endemic to Western Ghats.

Baccaurea courtallensis is a moderately sized evergreen tree of the Euphorbiaceae distributed from South Konkan to South Kerala and adjoining western parts of Tamil Nadu in the evergreen forests up to an altitude of 900 m. Its fruits are crimson and acidic. It is locally known as Kolikukku in Karnataka and Mootipazham in Kerala. It is edible but sour. So far, only the local tribal population of the region consumes this fruit and its use is not widely known to others. The fruits are harvested for their medicinal value and/or for pickling, leaving less chance for natural regeneration [1]. The bark of *B. courtallensis* contains stigmasterol [2]. Kalash et al. [3] studied the novelty of this species. Little work has been reported on the chemistry of this fruit or its seeds especially with regards to fruit value or the oil content in seeds. This paper deals with the oil content of the seeds and fatty acid composition of the oil.

Experimental Procedures

The fruits of *B. courtallensis* were removed of their rind. The juicy fruits inside were squeezed and the seeds removed. The seeds with their coat were dried and later the seed coats were removed. 400 g of the kernels were powdered and extracted in a Soxhlet apparatus using 1,000 ml of hexane. The seed powder was extracted for 18 h until all the fatty oil was completely extracted.

Physico-chemical properties such as the refractive index was determined using Abbe's refractometer [4], the

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specific gravity by using a standard (pycnometer) specific gravity bottle [5] following AOAC official methods. The optical rotation (α) at 29 °C was determined using an ATAGO AP-300 automatic polarimeter. The acid value was determined by directly titrating the oil/fat in an alcoholic medium against standard potassium hydroxide/sodium hydroxide solution [6]. The saponification value was determined by refluxing the oil with a known excess of alcoholic potassium hydroxide solution and titrating the excess potassium hydroxide against a standard hydrochloric acid solution [7].

Esterification

A 0.5-g sample of *B. courtallensis* seed oil was placed in a 100-ml round-bottomed flask and 5 ml of alcoholic potash (0.5 g of KOH dissolved in 5 ml of ethyl alcohol) was added. The mixture was refluxed for 4 h on a mantle by fitting a condenser to the round bottomed flask. The contents were cooled and the mixture was acidified with conc. H_2SO_4 to get the fatty acid. The contents of the round-bottomed flask were placed in a separating funnel by dissolving in diethyl ether and adding distilled water to wash out the excess alkali. The ether layer was collected separately and dried with anhydrous Na_2SO_4. The solvent ether was evaporated and the fatty acid obtained. An FTIR spectrum of the fatty acid mixture was obtained using a Nicolet Impact 400 FTIR Spectrophotometer. The viscous liquid was used directly and the infrared absorption spectra observed.

The fatty acid mixture was put into a 100-ml round bottomed flask and 10 ml of methanol was added. Also added was 0.5–1 ml of conc. H_2SO_4 to acidify it and it was refluxed for 2 h. The condenser was removed and the entire excess methanol evaporated. Then the contents were placed in a separating funnel and diethyl ether and water added. The layers were separated and washed with water 2–3 times to ensure that the esterified fatty acids were free of acid (H_2SO_4) and the esterified mixture of acids was collected in a bottle. This was taken for IR study. The methyl ester mixture was then analysed by GC. The instrument used was a Varian Star #1, the column was a CP WAX 58 FFAP-CD (nitro-terephthalic acid modified chemically bonded polyethylene glycol), injector temperature was 230 °C, column oven temperature was initially 80 °C, this was held for 1 minute and then raised to 230 °C at a rate of 10 °C per minute and held for 20 min. Under the same column conditions, individual standard fatty acid methyl esters (FAMES) were introduced and their retention times were matched for identification of the fatty acids. The whole experiment was replicated five times drawing different seed samples from a large seed lot kept after processing of fruits.

Results and Discussion

The seeds of *B. courtallensis* contain 22.5% fatty oil on a dry kernel weight basis (Standard deviation- $\sigma = 1.041$). The completeness of the esterification reaction was determined by the peak in the IR spectrum at 1,737 cm^{-1}. Further, the IR spectrum of the methyl ester showed a characteristic ester peak at 1,744 cm^{-1}. Also the hydroxyl group peak at 3,472 cm^{-1} disappeared during the esterification reaction.

Analysis of the fatty acid methyl esters from *B. courtallensis* seed oil by GC showed the presence of fatty acid methyl esters and indirectly the fatty acids. Table 1 gives the fatty acid composition of *B. courtallensis* seed oil. Two of the fatty acids were major fatty acids one of them being a saturated fatty acid, namely palmitic acid (42.59%) (σ-0.2575) and the other unsaturated fatty acid was namely oleic acid (36.15%) (σ-0.1498). The stearic acid content was 16.20% (σ-0.1284) and the myristic acid was 4.28% (σ-0.2575). Two minor acids were lauric acid (0.40%) (σ-0.0158) and linoleic acid (0.38%) (σ-0.0775).

In total, the saturated fatty acids are 63.47% while the unsaturated fatty acids are 36.53% of the seed oil. Physico-chemical properties of the oil are as shown in the Table 2 below.

Table 1 Fatty acid composition of *Baccaurea courtallensis*

Sl. No	Fatty acid	Chain length	Seed dry weight (%)
1	Lauric acid	$C_{12:0}$	0.40
2	Myristic acid	$C_{14:0}$	4.28
3	Palmitic acid	$C_{16:0}$	42.59
4	Stearic acid	$C_{18:0}$	16.20
5	Oleic acid	$C_{18:1}$	36.15
6	Linoleic acid	$C_{18:2}$	0.38
7	Linolenic acid	$C_{18:3}$	Traces

Table 2 Physico-chemical properties of the fatty oil of *Baccaurea courtallensis*

Sl. no	Physical properties	Value
1	Refractive index	0.4239
2	Specific gravity	0.938
3	Optical rotation α at 29 °C	$+0.35^{o}$ ($\lambda = 589$ nm)
4	Acid value	1.402
5	Saponification value	166.89

Conclusion

The fatty acid composition of the seed oil revealed a ratio of saturated to unsaturated fatty acids of 3:2. The presence of palmitic and oleic acid are important because they can be of use as lubricants and also as an additive in industrial preparations.

It was found in earlier studies by the author that forest tree species i.e. tree-borne oilseeds yielding 20% oil or more on dry weight of seed can be commercially exploited [8–10]. Thus *Baccaurea courtallensis* is a potential tree species for oil extraction. Also *B. courtallensis* is a second storey tree species in an evergreen forest and endemic to the Western Ghats in India and no work on cultivation practices has been attempted. It may be possible that the local residents and tortoises consume most of the fruits and hence the regeneration is very poor. The chemical investigation of the fruit including nutritional aspects of the fruits may bring out a vast scope of the edible nature of the species. The judicial use of this forest produce will not only save the species but also help in adding one more species to the list of useful plants.

Acknowledgments The author is grateful to the Director, IWST, Bangalore for extending facilities. Funding: The project was funded by the Indian Council of Forestry Research & Education, New Forest (PO), Dehradun-248006.

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