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OIL FROM OZOROA INSIGNIS DEL FRUITS: TOWARD A NEW SOURCE OF NATURAL OIL

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This study examined the oleaginous potential of fruits of *Ozoroa insignis* Del., a plant located in the western part of Burkina Faso. The extraction of the oil was done by the soxhlet method using petroleum ether as solvent. An average oil yield of 27.2 ± 2.3% was obtained, mainly from the mesocarp of the fruit. The fatty acid composition was determined by gas chromatography. This oil contains six saturated fatty acids and six unsaturated fatty acids at different concentrations. In terms of proportion, this oil contained monounsaturated fatty acids (58.5%), polyunsaturated fatty acids (17.1%) and saturated fatty acids (24.4%). This oil mainly contains oleic acid (32.9%), palmitic acid (16:0) (19.3%), linoleic acid (18:2) (16.1%) and vaccenic acid (18:1-n-7) (23.6%). With regard to essential fatty acids, in addition to linoleic acid, this oil also contained small quantities of the omega-3 alpha-linolenic acid (18:3-n-3) (1.0%). No earlier study mentioned this plant as an oleaginous species. The composition in fatty acids of this oil suggests that it could be used in the diet and cosmetics after further study such as the profile of glycerides and vitamins or dyes and its safety.

Keywords: *Orozoa insignis* Del, Fatty acid, Bobo-Dioulasso, Burkina faso

INTRODUCTION

Many oilseed plants in sub-Saharan Africa are used in food, pharmaceutical and cosmetic industries (Arbonnier, 2002; and Leray, 2010). However, many other species found in Africa's natural vegetations are still under-exploited and even unrecognized by populations (Ouoba, 2006). This is the case of *Ozoroa insignis* Del. of which no earlier study mentioned its oleaginous potential.

This species belongs to the family *Anacardiaceae*. It is a small tree up to 3 to 5 m in height, but more commonly encountered as a shrub up to 1 to 2 m in height. The fruits are flattened drupes, shining and black at maturity, 5 to 8 mm wide, 5 to 6 mm high (Berhaut, 1972). The ripe fruits are available from November to March. The species is quite common in the Sudano-Guinean area. Its geographical area extends from Senegal to South Africa (Berhaut, 1972). The roots are traditionally used as a medicinal treatment against worms and ulcers, and leafy branches are used against high blood pressure (Berhaut, 1972; and Malgras, 1992). The use of the fruits is not mentioned in the literature. In South Africa, fruits are crushed and used by Zulu women to perfume their hair (Oyen, 2007).

The aim of this work is to assess whether or not the mesocarp of *Ozoroa insignis* fruits are potential source of

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in oil and to analyze the profile of the fatty acids. This work is part of the characterization and valorization effort of plant resources around Bobo-Dioulasso city, whose flora is very rich in plants that are not well known from a chemical point of view.

MATERIALS AND METHODS

Plant Material

Our work has focused on the dried fruits of *Orozoa insignis* Del harvested at *Dindérosso* (Itm:30p: X = 0347000; Y = 1241500), Kua (itm:30p: X = 367237; Y = 1233166) and Darsalamy (Itm:30p: X = 0349155; Y = 1219060), three places around the city of Bobo-Dioulasso. In this area *the* flowering of this species begins in September and ripe fruits are available from December to March (Figure 1).

Fruits Dampling

The fruits were harvested during the months of December and January. From 200 to 500 g of fruit were taken per individual depending on the availability of the fruit. In the Plant Biology Laboratory the fruits were dried away from light for at least two weeks.

Extraction of Crude Oil from Ozoroa insignis Del Fruits

After drying the fruits away from light, they were crushed with a GM-200 Retsch grinder. The crushed products obtained were used for the extraction of lipids. The extraction was carried out using a soxhlet type extractor according to the standard NF EN ISO 659,2009. For this purpose the cartridges (HM1004-33x94 mm) were filled with 200g of crushed fruits and placed in the column of the extractor. Petroleum ether (CARLO ERBA REAGENT-SDS) was used for extraction. After 4 hours, the extract (mixture of solvent and fat) was subjected to rotary evaporation (BUCHI ROTAVAPOR R-200) to remove the solvent. The experiment was repeated three times. The crude oil was recovered and the average yield of the extraction calculated according to

Figure 1: Ripe Fruits of *Ozoroa insignis* Del

the following formula: (m/M) × 100; with m the mass of oil and M the mass of fruits. The oil obtained was stored at 4 °C before analyzing the profile of fatty acids by gas chromatography.

Analysis of the Fatty Acids Profile

The crude oil obtained by sohxlet extraction was analyzed by gas chromatography after derivatization (Surette *et al*., 2003). The method can be described as follows: a mixture of 2 ml of methanol, 0.9 ml of chloroform, 20 ml of acetic acid, 800 µl of milliQ H_20, 20 µl of the crude oil of *Ozoroa insignis* and 100 ml of internal standard (Hexadecanoic acid:C17:0) were mixed. After 15 min incubation at room temperature, 2 ml of chloroform and 1 ml of milliQ H_20 were added to the mixture. The tubes were gently inverted twice and centrifuged for 5 min at 1000 RPM to separate the two phases. The lower phase (chloroform) was transferred to a new glass tube and a second extraction was made on the first tube with 2 ml of chloroform and the two lower phases combined. The lipids were dried and hydrolyzed with 400 ml of KOH (0.5 M) at 100 °C for 15 min. The fatty acids were then transmethylated with 1 ml of 14% boron trifluoride at 100 °C for 10 min. The resulting Fatty Acid Methyl Esters (FAMEs) were then extracted by partitioning between 2 ml of hexane and 1.6 ml of HCl (0.125 M).

The hexane extract was transferred to a GC vial and analyzed by gas chromatography using a Thermo Trace gas chromatograph (Thermo Electron Corporation, Mississauga, ON, Canada). The volume injected was 1 ml. The injection was made in split mode 1/40 onto a Trace-FAME column (Thermo) with flame ionization type detector. The fatty acids were identified by comparing their retention times with those of authentic standards, and a standard curve was used for quantification (Surette *et al*., 2003). All analyses were performed in triplicate.

Data Analysis

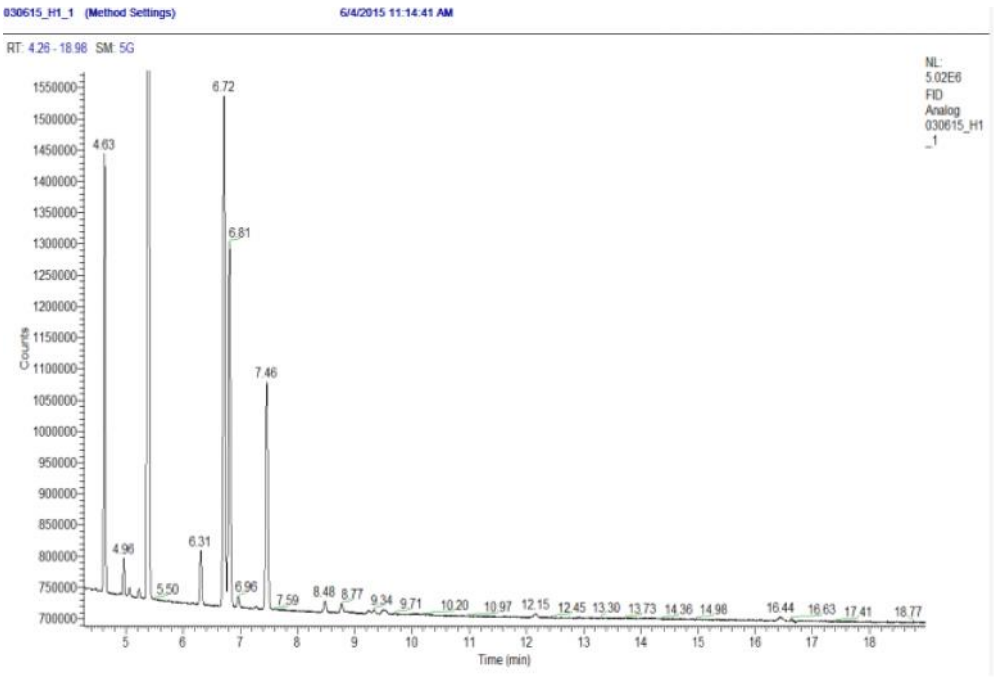
Microsoft Excel was used as data analysis software. The oil extraction yields and percentages of fatty acids are expressed as mean plus or minus standard deviation values.

RESULTS

Extracting Yield

After three separate extractions, we obtained an average oil yield of 27.2 ± 2.3%. In the *Ozoroa insignis* species, the seeds are not oleaginous; the oil is located in the mesocarp of the fruit. This oil extracted from the mesocarp is of black-violet color. This yield is quite high compared to that of several commercially-produced oilseeds.

Figure 2: Chromatogram of *Orozora insignis* Fruits Oil Giving Retention Time and Relative Abundance of Fatty Acids and Internal Standard (17:0, RT:5.50 min)



Profile of Fatty Acids

Figure 2 shows the chromatogram of the derivatized oil, peaks representing fatty acids present in the extracted oil. The integration of these peaks allowed us to determine the relative abundance of each fatty acid; which made it possible to determine the percentage of each of these fatty acid in relation to the total of the fatty acids.

Table 1 shows the result of the analysis of the fatty acid profile of *Ozoroa insignis* crude oil. A total of twelve fatty acids, six saturated fatty acids and six unsaturated

Table 1: Fatty Acids of *Orozora insignis* Fruits Oil

Fatty Acides		Percentage of Total Means ± SD	Retention Time (min)
14:00	Myristic acid acid	0.19 ± 0.01	3.51
14:01	Myristoleic acid acid	ND	
16:00	Palmitic acid	19.3 ± 3.1	4.63
16:01	Palmitoleic acid	1.7 ± 0.3	4.96
18:00	Stearic acid	3.2 ± 0.6	6.31
18:1 n-9	Oleic acid	32.9 ± 5.4	6.72
18:1 n-7	Vaccenic acid	23.6 ± 3.8	6.81
18:02	Linoleic acid	16.1 ± 2.6	7.46
18:3 n-6	Gamma-linolenic acid	ND	
18:3 n-3	Alpha-linolenic acid	1.0 ± 0.2	8.48
20:00	Arachidic acid	0.7 ± 0.1	8.77
18:4 n-3	Stearidonic acid	ND	
20:01	11-eicosenoic acid	0.4 ± 0.04	9.34
20:2 n-6	11,14-eicosadienoic acid	ND	
20:3 n-6	dihomo-γ-linolenic acid	ND	
20:4_n-6	Arachidonic acid	ND	
20:3 n-3	11,14,17-eicosatrienoic acid	ND	
22:00	Behenic acid	0.4 ± 0.1	12.15
22:01	Erucic acid	ND	
20:5 n-3	Eicosapentaenoic acid	ND	
22:04	Docosatetraenoic acid	ND	
24:00:00	Lignoceric acid	0.6 ± 0.1	16.43
24:01:00	Nervonic acid	ND	
22:05	Docosapentaenoic acid	ND	
22:06	Docosahexaenoic acid	ND	

Note: SD = Standard Deviation; ND = Not detected.

fatty acids, were found at different concentrations. However, in terms of proportion, this oil is more concentrated in unsaturated fatty acids (75.6%) than in saturated fatty acids (24.4%), which mainly contains the following compounds: oleic acid (18:1-n-9) (32.9 %), palmitic acid (16:0) (19.3%), linoleic acid (18:2) (16.1%) and vaccenic acid (18:1-n-7) (23.6%). In addition, fatty acids in low proportions in descending order are: stearic acid (18:0) , palmitoleic acid (16:1), alpha-linolenic acid (18:3-n-3), arachidic acid (20:0), lignoceric acid(24:0), behenic acid (22:0) and eicosanoic acid (20:1). Two essential fatty acids, namely linoleic acid (w6) in larger amounts and linolenic acid (w3) in lower amounts were measured noted in this oil. Monounsaturated fatty acids account for 58.53% of the total fatty acids versus 17.1% for polyunsaturated fatty acids.

DISCUSSION

Taking into account the extraction yield (27.2 ± 2.3%) of *Ozoroa insignis* fruits oil we can say that it has an interesting oil potential since this yield is high compared to that of several oilseeds. For example, cotton and soybean seeds contain 15-25% and 15-22% of oil, respectively (Ribier and Rouzière, 1995).

The analysis of the fatty acids by gas chromatography allowed us to detect a total of twelve fatty acids, six of which were saturated and the other six are unsaturated. However, in terms of proportion, this oil is more concentrated in unsaturated fatty acids with monounsaturated fatty acids accounting for 58.5% of the total fatty acid versus 17.1% for polyunsaturated fatty acids, with saturated fatty acids accounting for (24.4%) of the total. The mean relative abundance of the main fatty acid measured were oleic acid (32.9 ± 5.4%), palmitic acid (19.3 ± 3.1%), linoleic acid (16.1 ± 2.6%) and vaccenic acid (23.6 ± 3.7%). In addition, the more minor fatty acids detected were stearic acid, palmitoleic acid, alpha-linolenic acid, arachidic acid, lignoceric acid, behenic acid and eicosanoic acid which ranged from 3.2% to 0.4% of total fatty acids. Two essential fatty acids were measured, namely linoleic acid (w6) in large quantities and alpha-linolenic acid (w3) which was a minor fatty acid accounting for 1% of the total.

The ratio of polyunsaturated fatty acids to saturated fatty acids was 0.7 which is considered by some authors as ideal for an edible oil (Fossati, 2000). The omega 6/ omega 3 fatty acid ratio was 16.4. According to Lambert (2005), the omega 6/omega 3 fatty acid ratio desired for a dietary oil is 5, thus the omega 6/omega 3 ratio of oil from *Ozoroa insignis* fruit is closer to this value compared to that of several edible oils consumed in Burkina Faso and Africa such as cotton oils (omega 6/omega 3 = 567) and groundnut (omega 6/omega 3 = 333) (Lambert, 2005). Until now, no study has mentioned the existence of this oil, but according to Arbonnier (2002), the fruits of this species are consumed by children. The composition in fatty acids of this oil suggests that it could be used in the diet after further study to characterize parameters such as the profile of glycerides, vitamins or dyes as well as its safety profile.

Moreover, this oil could be exploited in cosmetics for the beneficial effects that it could have on the skin. It contains two the essential fatty acids, linoleic acid (w6) and linolenic acid (w3), which according to Abdou Bouba (2009), are known as vitamin F and can afford protection of the skin. This so-called vitamin F is incorporated to about 5% in some dermatological creams.

One of the special features of this oil is that it contains a significant proportion of vaccenic acid, an isomer of oleic acid (w9) which is generally found in animal fats and dairy products (Mozaffarian *et al*., 2006; and Field *et al*., 2009). According to some authors, unlike industrial trans fatty acids, vaccenic acid would has a beneficial effect on human health (Field *et al*., 2009).

CONCLUSION AND PERSPECTIVES

This prospective study allowed us to show the oleaginous character of fruits of *Orozoa insignis* and to establish the fatty acid profiles of the crude oil. One of the features of this crude oil is that it contains a high proportion of unsaturated fatty acids with the presence of two essential fatty acids, as linoleic acid and linolenic acid, which are not synthesized by animals and human. The next step of the study of this oil as a product for use in humans would be to characterize the profile of glycerides, vitamins and dyes likely to be present in this oil. It would be also necessary to assess its safety. This would allow us to take stock of the nutritional potential of this oil that is obtained in significant quantities form the fruit of this common plant.

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EFFECT OF BOILING TIME AND SUN DRYING ON THE NUTRIENT COMPOSITION OF MORINGA OLEIFERA LEAF POWDER

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Equal quantities of Moringa leaves were boiled for varying length of time - 2½ min (2½ BSU), 5 min (5 BSU), 7½ min (7½ BSU) and 10 min (10 BSU) at 100 °C and sun dried (32 °C±1) for two days. Fresh moringa leaves (FRESH) and unboiled sun dried leaves (SU) served as controls. The dried samples were milled, sieved and used for analyses. The crude protein content decreased ($p<0.05$) from 28.64% for SU to 27.06% for 10BSU with boiling time. The ash content of the dried samples also decreased (10.54%-8.50%) with boiling time. Boiling time also had a significant ($p<0.05$) negative effect on the crude fibre content (8.20%-2.20%) of the MLP samples. The FRESH had lower ($p<0.05$) values for all the proximate composition. All the vitamins determined decreased with boiling time except for vitamin B1. Vitamin A content decreased from 18.64 mg/100 g to 18.00 mg/100 g for SU and 10 BSU. Vitamin C content reduced from 22.50 mg/100 g to 5.28 mg/100 g while vitamin B1 content increased from 1.46 mg/100 g to 1.96 mg/100 g. All the minerals determined decreased ($p<0.05$) with boiling time. Iron and zinc contents decreased from 16.47 mg/100 g to 15.13 mg/100 g, 31.52 mg/100 g to 26.03 mg/100 g respectively. The fresh sampled had lower ($p<0.05$) values for all the minerals determined.

Keywords: Moringa leaf powder, Sun drying, Boiling, Nutrient

INTRODUCTION

Moringa oleifera Lam is a native of eastern India but now found throughout the semi-arid tropics. *Moringa oleifera* is a small, fast-growing evergreen or deciduous tree that usually grow up to 10 to 12 m in its height, it belongs to the family Moringaceae (Ramachandran *et al*., 1980; and Morton, 1991). It is a perennial, erect, slender and medium sized with many arching branches. The tree has been said to grow well in the humid tropics or hot dry lands, can survive destitute soils, and is little affected by drought (Morton, 1991). It is widely cultivated and naturalized in tropical India, Africa, tropical America, Sri lanka, Mexico, Malaysia and the Philippine Islands (Sabale *et al.,* 2008) The moringa tree is cultivated and the various plant parts such as leaves, pods, flowers, roasted seeds are used as vegetables, roots mainly for spice, seeds for cooking and cosmetics oil; all plant organs are used in medicine (Rebecca *et al.,* 2006).

Moringa leaves are consumed in different parts of the world both as food and as medicine. The leaves of this plant are used as vegetables in soup preparation or cooked and mixed with grounded groundnut cake and other spices, and then eaten as food (Kawo *et al.,* 2009). In Nigeria, moringa leaves are used in soup preparation especially in the dry season when there is scarcity of other more popular vegetables. The leaves are also utilized in folk medicine in the treatment of various ailments like treating of wounds, stabilizing blood pressure and blood sugar. Moringa leaves have been described to be rich in both nutrients and phytochemicals. It has been reported that dried mornga

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