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Research Paper

Aleurites moluccana Seeds: A rich source of Linolenic acid

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ABSTRACT

Aleurites moluccana (kukui tree) belongs to family *Euphorbiaceae* and native to Indo-Malayan region. Kukui tree, like other oilseeds, is a potentially valuable source of fatty acid which is rich in alpha-linolenic acid (ALA), linoleic acid (LA) and oleic acid (OC). The fatty oil content in the kernels of *Aleurites moluccana* was found to be 58.15% on air dried basis and 60.68% on the moisture free basis. GLC analysis of kukui seed oil shows the presences of eleven fatty acids and linolenic (49.55%) was identified to be the major constituent of its seed oil. Linolenic acid is also reported as an essential omega-3 fatty acid and needed for normal human growth and development.

Key words: *Aleurites moluccana;* Seed oil; GLC; Linolenic acid.

INTRODUCTION

Aleurites moluccana (L) Wild (Family-*Euphorbiaceae*), commonly known as the kukui tree, jungle akrot, candlenut and wild walnut. Kukui is one of the great domesticated multipurpose trees of the world.

It has been extensively used in folk medicine for the treatment of ulcers, headache, fevers, diarrhea and hypercholesterolemia (Niazi et al., 2010). The bark and flowers are used for asthma, sores, ulcers and tumors, and as laxative. The fruit is tonic and found to be useful in diseases of heart and blood. It is carminative and expectorant, used in piles, hydrophobia and ring warm. The oil is purgative and sometimes used like castor oil. Kernels of *A. moluccana* are laxative, stimulant and sudorific. The oil is rubbed on scalp as a hair stimulant. Malayans apply boiled leaves to the temples for headache and to the pubes for gonorrhea (Anon, 1985). The candlenut stem bark is traditionally used for diarrhea (Wiart, 2006). It is also used in East Borneo to cure typhoid. They have been screened for their potential uses as alternative medicines for many infectious diseases in other countries (Acharyya et al., 2010). In Japan, the stem bark was used for tumors while in Malaysia; decoction of the leaves was used in treating coughs, diarrhea, and pain in the chest. Boiled leaves were used for headaches, fever, ulcers, and gonorrhea. The candlenut fresh sap was

used to treat thrush and candidiasis (Krisnawati et al., 2011; Scott, 2000). The fruit juice was squeezed into the mouths of new born babies to make them vomit and to clear their throats (Han, 1998). *Aleurites moluccana* seeds contain glycerides, linoleic, palmitic, stearic, myristic acid, oil, protein, vitamin B1 while the stem bark contains alkaloids, polyphenols, flavonoids, coumarins, tannins, steroids and triterpenoids (Silva et al., 1997; Samah et al., 2010)

A number of secondary metabolites have been isolated and characterized from different parts of *A. moluccana*. Three novels 3, 4-seco-podocarpane-type trinorditerpenoids, moluccanic acid, moluccanic acid Methylester, and 6, 7-dehydromoluccanic acid were isolated from the twigs and leaves (Liu et.al. 2008). A new phorbol diester, 13-O-myristyl-20-O-acetyl-12-deoxyphorbol was isolated from the benzene extract of the heartwood. In addition, hentriacontane, 6, 7-dimethoxycoumarin, 5, 6, 7-trimethoxycoumarin and β-sitosterol have been reported for the first time from this species (Satyanarayana et al., 2001). Two compounds swertisin and a flavonoid C-glycoside from leaves and bark have been isolated and characterized. A new coumarinolignoid moluccanin (I) was isolated from stem chips of *A. moluccana* (Shamsuddin et.al., 1988). Kukui nut oil acts in synergy as an adjunct to the therapeutic agent to promote the alleviation of the medical condition being treated. The oil is extracted on a large scale in China and in Philippines, but it does not appear to be expressed anywhere in India. The kukui nuts are being used for constipation or cleansing. The oil is starting to become a source of ingredients for cosmetics preparation and quicker drying than linseed oil. It is used as a wood preservative, in varnishes and paint oil, as an illuminant, for soap making, water proofing paper, rubber substitutes and insulating material. Oil is also painted on bottom of small crafts to protect against marine borers. Oil is also used topically to stimulate hair growth in Fiji (Darmstadt et.al, 2002). Linolenic acid is principal unsaturated fatty acids in plants and an essential fatty acid in mammals that cannot be synthesized by tissues and must be obtained in the diet. It helps in reducing inflammation and prevents chronic diseases, such as heart disease and arthritis. In the body, it is particularly important for cognitive and behavioral health as well as normal growth and development (Angerer et.al, 2007). Therefore, seeds of *A. moluccana* were explored chemically.

MATERIALS AND METHODS

The seeds of *Aleurites moluccana* were collected from the campus of Forest Research Institute, Dehradun. The kernels from the seeds were removed and crushed to obtain a coarse powder. The powdered seeds were extracted separately with petroleum ether (60^0-80ºC) by using a soxhlet apparatus. The solvent was removed under reduced pressure to recover fatty oil (Sawhney, 2005). The oil was saponified with 0.5N alcoholic potassium hydroxide (KOH) for two hours and the mixture of fatty acids and unsaponifiable matter of the oil was separated by using routine methodology (Hilditich, 1956). Fatty acid methyl esters were prepared by refluxing the mixture of fatty acid with 1% sulphuric acid /MeOH on water bath for 4 hr, cooled and usual work up yielded methyl esters.

The fatty acid methyl esters were analyzed using Agilent 6850 Gas chromatograph unit equipped with FID. A non-bonded cyanosilicone column SP-2330 (30 m x 25 mm, id x 0.20 mm, film thickness) was used for the purpose. The oven temperature was programmed from 170 to 220ºC at 5ºC/min and the flow rate of carrier gas (N2) was 1.5ml/min. The injector and detectors were maintained at 230

and 250°C respectively, and the area percentages were recorded with a HP Chemstation data system.

RESULTS

The fatty oil content obtained from the seeds of *A. moluccana* was found to be 58.15% on air dried basis and 60.68% on the moisture free basis. The oil ranges in colour from pale yellow to orange. Physico-chemical properties were determined (Table 1).

Table- 1: Physico-chemical Characteristics of *Aleurites moluccana* seed oil.

Characteristics	*Aleurites moluccana*
Oil (wt. %)	60.68
Specific gravity (d^{19})	1.0860
Refractive Index (η_D^{20})	1.479
Acid value	6.148
Saponification value	195.508
Ester value	172.8
Unsaponifiable matter (wt. %)	0.891
Protein content	20.337

Table-2: Fatty Acid composition (wt %) of *Aleurites moluccana.*

Fatty acid	Composition (wt %)
C:9	2.54
C:10	2.37
C:12	1.09
C:14	1.40
C:16:0	16.42
C:17	0.75
C:18:1	6.02
C:18:3	49.55
C:20:0	16.76
C:21:0	2.35
C:22:0	0.754

GLC analysis of a mixture of methyl esters of the fatty acids prepared from the fatty oil showed the presence of eleven fatty acids in the oil. The identified fatty acids constituted 100% of the mixture of fatty acids obtained from the fatty oil. The fatty acid composition indicated that Linolenic acid (49.55%) is the major constituent of the oil followed by arachidic acid (16.76%), palmitic acid (16.42) while oleic acid (6.02%), pelargonic acid (2.54%), capric acid (2.37%) etc. are the minor components (Table2). Literature survey reveals that in an earlier report, *A. moluccana* seed oil was reported to contain palmitic acid (5.5%), stearic acid (6.7%), oleic acid (10.5%), linoleic acid (48.5%) and linolenic acid (28.5%) (Anon, 1985) but in our study, we found linolenic acid (49.55%), arachidic acid (16.76%) and palmitic acid (16.42%) as major constituents.

DISCUSSION

The present study revealed that *A. moluccana* seed (Kukui nut) oil is a promising source of linolenic acid. It is the major constituent of fatty oil and constitutes 49.55% which is significantly very high. As reported earlier, linolenic acid is an essential omega-3 fatty acid. In the human body, linolenic acid is used to make substances called eicosanoids, which regulate inflammation. It is also a component of cell membranes and is converted to the longer chain omega-3 fatty acids eicosapentaenoic acid, or EPA, and docosahexaenoic acid, or DHA. The omega-3 fatty acids deliver

numerous health benefits, according to the National Institutes of Health Office of Dietary Supplements (Strak et.al, 2008). Along with linolenic acid, fatty oil of kukui nut also contains some other important fatty acid like arachidic acid, palmitic acid, oleic acid and pelargonic acid in significant amount which have various therapeutic applications. Therefore, this study would lead to the exposure of *A. moluccana* as a very important and rich source of fatty acid (linolenic acid) in the category of tree born oil seeds (TBOS).

REFERENCES

Acharyya S., Dash G.K., Mondal S., Dash S.K., (2010): Antioxidative and Antimicrobial Study of Spondias Mangifera Willd Root, *Int. J. Pharmacy and Pharmaceutical Sci.*, 2 (4): 68.

Angerer P., Von Schacky C., (2007): n-3 polyunsaturated fatty acids and the cardiovascular system. *Curr. Opin. Lipidol.*, 11(1):57-63.

Anonymous, (1985): The wealth of India, Raw material. New Delhi: Publication and information Directorate, CSIR: IA: 136-137.

Darmstadt G.L., Mao-Qiang M., Chi E., Saha S.K., Ziboh V.A., Black R.E., Santosham M., Elias P.M., (2002): Impact of tropical oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatrica*, 91(5): 546–554.

Haiyang L, Yingtong D., Junyun Y., Teng F., Lu Y., Wei, N., Changxiang C., Xiaojiang H., (2008): Three novel 3, 4-seco-podocarpane trinorditerpenoids from *Aleurites moluccana*, *Tetrahedron Lett.*, 49(35): 5150-5151.

Han S.T., (1998): Medical Plants in the South Pacific. World Health Organization (WHO) Regional Publication, Manila Philippines, 19: 7.

Hilditich T.P., (1956): The Chemical Constituents of Natural Fats, Chapman and Hall, London, 573-574.

Krisnawati H., Kallio M., Kanninen M., (2011): Ecology, Silviculture and Productivity *Aleurites moluccana* (L.)Wild. Center for International Forestry Research, 3-4.

Niazi J., Gupta V., Chakarborty P., Kumar P., (2010): Anti-inflammatory and antipyretic activity of *aleuritis moluccana* leaves. *Asian Journal of Pharmaceutical and Clinical Research*, 3(1): 35-37.

Samah O.A., Razar R.M., (2010): Antibacterial Activity of *A. moluccana* (*Euphorbiaceae*) Against Some Clinical Isolates, *Res. J. of Biotec.*, 5 (3):1.

Satyanarayana P., Kumar K., Singh S.K., Rao G.N., (2001): A new phorbol diester from *Aleurites moluccana*. *Fitoterapia*, 72(3): 304-306.

Sawhney S.K., Singh R., (2005): Introductory Practical Biochemistry, Narosa Publishing House 3: 35-47.

Scott S., Craig T., (2000): Poisonous Plants of Paradise (First Air and Medical Treatment of Injuries from Hawai's Plants). University of Hawaii Press, pp. 1.

Shamsuddin T., Rahman W., Khan Suroor A., Shamsuddin K.M., Kintzinger J., (1988): Moluccanin, a coumarinolignoid from *Aleurites moluccana*, *Phytochemistry*, 27(6): 1908-1909.

Silva C.M., Mora T.C., Santos A., Soares R., (1997): A Triterpene and A Flavonoid C-Glycoside from *A. moluccana* L Willd (*Euphorbiaceae*). *Acta Farmaceutica Bonaerense*, 3: 169-172.

Stark A.H., Crawford M.A., Reifen R., (2008): Upadate on α- Linolic acid. *Nutrition Reviews*, 66(6):326-332.

Wiart C., (2006): Medicinal Plants of the Asia Pasific, Drugs for the Future.World Scientific Publishing, pp. 337.

