Pak J Sci Ind Res 1999 42 (6) 339-341

Lipid Components from the Seeds of *Sapindus mukorossi* L

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(Received 24 August 1994; accepted 16 July 1999)

Seed lipids of *Sapindus mukorossi* L. were classified and fatty acid composition was determined. The fatty acid composition of the total lipids was $C_{12:1}$ (0.3%), $C_{14:0}$ (traces), $C_{16:0}$ (4.6%), $C_{18:0}$ (traces), $C_{20:0}$ (3.5%), $C_{18:1}$ (56.0%), $C_{18:2}$ (5.8%), $C_{18:3}$ (1.4%) and $C_{20:1}$ (28.4%). The hydrocarbon fraction contained main components pentacosane $C_{25}H_{52}$ with 11.75% and hentriacontane $C_{31}H_{64}$ with 17.20%. Odd number *n*-alkanes were predominant (70.95%).

Key words: Lipids, Sapindaceae, Hydrocarbons, Hentriacontane ($C_{31}H_{64}$).

Introduction

Sapindus mukorossi L. (Sapindaceae) is a deciduous tree growing in Rawalpindi district, Kashmir and Mirpur (Nasir and Ali 1972). Previously Singh *et al* (1974) and Sengupta *et al* (1975 & 1982) reported the fatty acid composition of the oil from kernels of *Sapindus mukorossi* L. They established the presence of palmitic, stearic, arachidic, oleic, linoleic, linolenic and icosenoic acid. Sengupta *et al* (1975 & 1982) also noticed the presence of a component more polar than ordinary triglyceride which was identified as a cyanolipid. Smith and Mikolajezak (1975) reported later that the cyanolipid claimed by Sengupta *et al* (1975 & 1982) was not a triglyceride but a derivative of five carbon hydroxynitrile with a long chain fatty acid. Kim *et al* (1977) studied the seeds of the plant and analysed fatty acids, sterols and amino acids.

Previously rutin, quercetin and kaempferol had been isolated from the leaves; quercetin, rutin and luteolin had been reported in the stem and a sapogenin hedragenin in the pericarp of the fruit (Kirtikar and Basu 1935; Dymock 1972; Nadkarni 1976). The present investigation is in continuation of our previous work (Akhtar *et al* 1988 a & b; Akhtar *et al* 1994) in search of new sources of commercially important lipids. It is also for the first time that seed lipids of *Sapindus mukorossi* have been fractionated into classes and fatty acid composition of each fraction has been determined. The composition of hydrocarbon fraction of the neutral lipids has not been reported previously in the literature.

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Experimental

Plant material. The fruits used in this work were collected from the plants in the Rawalpindi district of the province of Punjab, Pakistan. The slightly sticky outer pericarp was removed by hand. The seeds were ground whole for kernels which were separated from the shells by manual sorting.

Seed lipid extraction, classification and fatty acids composition determination. Since it is well known that different methods of extraction of seed oil remove different kinds and proportions of other substances, the seed lipids in the study were extracted with a mixture of chloroform methanol (2:1 v v^{-1}) according to the procedure of Folch *et al* (1957). The usual physical and chemical constants (Table 1) were determined by standard methods (Paquot 1979) unless otherwise specified.

The lipids were fractionated into different classes by TLC (Table 2) and the fatty acid composition of the total lipids and lipid classes were determined by GC according to the procedures referred in the previous papers (Akhtar *et al* 1988 a & b, 1994). Percent peak areas are quoted as composition percent weight (Table 3).

Composition of hydrocarbons fraction. Hydrocarbons were separated by the gas chromatography technique. The GC was done on a Shimadzu 9-A model instrument equipped with a flame ionization detector and SE30 packed column (0.25 mm id x 10 m). The column temperature was programmed from 150°C at 50°C min^{-1}. rise in temperature. The injector temperature was 250°C. Nitrogen gas was used as the carrier gas with a flow rate of 40 ml min^{-1}. The peaks were identified by comparison of their retention times with

Table 1
Physico chemical characteristics of the seeds of *Sapindus mukorossi* L.

Characteristics	Values
Oil (Lipid) Yield	7.84% (whole seed) 37.40% (kernel)
Specific gravity	0.9024
Refractive Index (Abbe's 40°C)	1.4678
Saponification value	215-217
Acid value	0.3
Iodine value (Wij's)	87
Acetyl value	12.40
Unsaponifiable matter	1.6%

Table 2
Weight percent of lipid fractions of seed oil of *Sapindus mukorossi* L.

Lipid fraction	Percent
Neutral Lipids	67.60
Polar Lipids	32.40
Fractions of Neutral Lipids	
Hydrocarbons	5.70
Triglycerides	39.80
Free fatty acids	4.30
1, 2-Diglycerides	6.40
1, 3-Diglycerides	5.60
1-Monoglycerides	3.20
2-Monoglycerides	2.60
Fractions of Polar Lipids	
Glycolipids	18.10
Phospholipids	14.30

those of the standard hydrocarbons under the same conditions. Percent peak areas are quoted as composition percent weights (Table 4).

Results and Discussion

The seeds of *Sapindus mukorossi* contained 7.84% oil on whole seed basis, whereas kernel contained 37.40% oil. The seed lipid was analysed for its physico-chemical characteristics and are reported in Table 1.

The total lipids were fractionated into different lipid classes by thin layer chromatography. The percentage of neutral lipids and polar lipids was found to be 67.60% and 32.40% (Table 2). Triglycerides were the major fraction which constituted 39.80% of the total lipids. The fatty acid composition of the total lipids and lipid fractions except hydrocarbons showed that the seed lipids were rich in unsaturated fatty acids. The unsaturated fatty acids present were oleic, linoleic, linolenic and icosenoic acids. The whole oil contained 91.6% unsaturated fatty acids and 8.4% saturated acids comprising mainly lauric, palmitic and arachidic acids.

Sengupta *et al* (1975, 1982) fractionated *Sapindus mukorossi* seed oil by column chromatography and got two fractions, A (30.0%) and B (13.3%). Fraction A was found to be consisting of normal glycerides and composed of palmitic, stearic, arachidic, oleic, linoleic, linolenic, iconsenoic and other fatty acids in minor quantities. The fraction B showed the presence of nitrogenous constituent cyanolipid and contained fatty acids palmitic, stearic, arachidic, behenic, oleic, linoleic, icosenoic, doconsenoic and two unidentified acids. Gowrikumar *et al* (1976) also isolated a cyanolipid from the seed oil of *Sapindus emarginatus.* Smith and Mikolajezak (1975) reported their reservations with respect to the cyanolipids which occurred in the seed oil of the species of Sapindaceae family.They claimed that the cyanolipid was not a triglyceride but was the derivative of a five carbon

Table 3
Percent fatty acid composition of *Sapindus mukorossi* L.oil and fractions

	Lauric $C_{12:0}$	Myristic $C_{14:0}$	Palmitic $C_{16:0}$	Stearic $C_{18:0}$	Arachidic $C_{20:0}$	Oleic $C_{18:1}$	Linoleic $C_{18:2}$	Linolenic $C_{18:3}$	Icosenoic $C_{20:1}$
Oil	0.3	Traces	4.6	Trace	3.5	56.0	5.8	1.4	28.4
Triglycerides	-	-	5.5	-	1.2	64.1	5.9	1.0	22.3
Free Fatty Acids	3.3	1.0	6.5	-	0.6	39.5	2.2	0.2	46.7
1, 2-Diglycerides	2.4	Traces	10.4	2.2	2.3	36.8	6.5	1.9	37.5
1, 3-Diglycerides	Traces	1.0	12.6	1.8	4.1	35.6	4.0	1.3	39.6
1-Monoglycerides	1.6	2.1	22.3	0.9	5.4	55.1	3.7	2.8	6.1
2-Monoglycerides	0.3	0.2	29.5	1.1	2.8	46.9	Traces	3.0	16.2
Polar Lipids	1.4	2.6	26.2	5.9	1.3	30.4	0.9	1.5	29.8

Table 4
Comparison of percent fatty acid composition of *Sapindus mukorossi* oil

Fatty acids	Present investigations	Sengupta *et al* (1975)	Hopkins *et al* (1967)
$C_{12:0}$	0.3	--	--
$C_{14:0}$	Traces	--	--
$C_{16:0}$	4.6	4.0	5.0
$C_{18:0}$	Traces	0.2	1.0
$C_{20:0}$	3.5	4.4	5.0
$C_{22:0}$	--	--	--
$C_{18:1}$	56.0	62.8	54.0
$C_{18:2}$	5.8	4.6	14.0
$C_{18:3}$	1.4	1.6	6.0
$C_{20:1}$	28.4	22.4	15.0

Table 5
n-Alkane components of hydrocarbon fraction from *Sapindus mukorossi* oil

No. of Carbon atoms	Peak areas (%)	No. of Carbon atoms	Peak areas (%)
14	3.10	25	11.75
15	0.20	26	2.90
16	1.80	27	5.60
17	2.60	28	3.60
18	1.50	29	7.30
19	6.00	30	3.40
20	1.40	31	17.20
21	6.80	32	4.00
22	3.45	33	8.20
23	5.00	34	1.40
24	2.50	35	0.30

hydroxynitrile esterified with a long chain fatty acid. Nitrogen was not detected in any of the lipid fractions isolated in these studies even though the lipids were extracted with a polar solvent mixture. Our results showed the same pattern of individual fatty acids as compared with the literature reported compositions (Table 4).

Hydrocarbon fraction. Fraction of the neutral lipids was also analysed for hydrocarbons by GC (Table 5). It contained only saturated *n*-alkanes in a series of C_{14} to C_{35}. Main components were pentacosane (C_{25} H_{52}) with 11.75% and hentriacontane (C_{34} H_{64}) with 17.20%. Odd numbered *n*-alkanes were predominant 70.95%.

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