Studies on Glycolipids of Kenaf, English Walnut, Myrobalan and Manila Tamarind Seeds of the Vidarbha Region (India)

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Studies on the glycolipid compositions of Kenaf, English walnut, Myrobalan and Manila tamarind seeds found in the Vidarbha region of Central India have been carried out by silicic acid column chromatography and thin-layer chromatography (TLC). The total glycolipids have been separated into individual components such as monogalactosyldiglycerides 20–28%, digalactosyldiglycerides 40–41%, sterylgalactosides 15–18%, acylated sterylgalactosides 8–15% and unidentified components 0.8–2%. The fatty acid composition of total and component glycolipids as determined by gas-liquid chromatography (GLC) showed the predominant fatty acids to be palmitic, stearic and oleic acids. Sugar in the component glycolipids was found to be exclusively galactose.

KEY WORDS: Acylated sterylgalactosides, digalactosyldiglycerides, galactose, glycolipid composition, monogalactosyldiglycerides, sterylgalactosides.

Seeds like Kenaf (*Hibiscus cannabinus*), English walnut (*Juglans regia*), Myrobalan (*Terminalia bellirica*) and Manila tamarind (*Pithecellobium dulce*), which are found in abundance in the Vidarbha region of Central India, have vast potential for economic utilization. Some work has been reported on the physicochemical composition of these oils (1–4). However, the present investigation reports on the glycolipid composition of these seed oils, fatty acid compositions of total oil as well as of the component glycolipids and the sterol composition of sterylgalactosides and acylated sterylgalactosides.

EXPERIMENTAL PROCEDURES

The seeds were collected from forests in nearby areas. Standard glycolipids and methyl esters were obtained from Analabs, North Haven, CT. Ground seeds were extracted with chloroform:methanol (2:1, v/v) by the method of Folch *et al.* (5) to obtain the total lipids, which were then fractionated on a silicic acid column and eluted successively with chloroform, methanol and acetone. The total glycolipids were eluted in methanol and were then separated by preparative thin-layer chromatography (TLC) (6). The fractions of glycolipids were spotted on the TLC plates with the solvent system (6) chloroform-methanol-28% ammonia (70:20:2, v/v/v). The spots were visualized by periodate-benzidine reagent (7). The R_f values were compared with authentic samples. Sugars were identified by the method of Yasuda (7). Sterols were analyzed by gas-liquid chromatography (GLC) after their conversion into trimethylsilyl derivatives (8). Fatty acid methyl esters of glycolipids of respective oils were prepared by the Christie procedure (9) and were analyzed by GLC with a flame-ionization detector at 280°C. The column was packed with 15% EGSS-X on Chromosorb-w (40–60 mesh). The conditions of GLC were: chart speed 60 cm/hr; injection port temperature and column temperature 200°C and 300°C, respectively; and nitrogen flow rate 60 mL/min. Glycerol in the lipid fraction was also estimated (10).

RESULTS AND DISCUSSION

The glycolipid fraction was resolved into four major components, namely monogalactosyldiglycerides (MGDG), digalactosyl-diglycerides (DGDG), sterylgalactosides (SG) and acylated sterylgalactosides (ASG) in the percent range of 20–28, 40–47, 15–18 and 8–15 for Kenaf, English walnut, Myrobalan and Manila tamarind seed oils (Table 1), respectively, along with unidentified components in the range of 0.9–1.3%. MGDG and DGDG components were predominant.

The sugar in the component glycolipids was exclusively galactose. The fatty acid composition of total oil as well as of component glycolipids showed the predominant fatty

TABLE 1

Glycolipid Composition (% by wt) of Seed Oils[a]

	Glycolipid[b] composition (wt%)				
Seed oil	MGDG[b]	DGDG[b]	SG[b]	ASG[b]	Unidentified components
Kenaf	25.1	45.1	16.5	12.3	1.0
English walnut	20.0	41.2	21.5	16.9	1.2
Myrobalan	23.2	47.2	15.4	13.2	0.9
Manila tamarind	28.1	42.0	18.2	10.7	0.9

[a]All values are means of triplicate analyses.

[b]MGDG, monogalactosyldiglycerides; DGDG, digalactosyldiglycerides; SG, sterylgalactosides; and ASG, acylated sterylgalactosides.

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TABLE 2

Fatty Acid Composition (by wt%) of Total and Component Glycolipids of Seed Oils[a]

Seed oils	Glycolipids[b]	Fatty acids (wt%)					
		16:0	18:0	18:1	18:2	18:3	Others[c]
Kenaf	GL	20.3	18.2	35.6	15.9	8.8	1.2
	ASG	17.1	20.2	30.0	20.0	3.3	1.2
	MGDG	20.5	17.2	36.0	22.2	1.1	Trace[d]
	DGDG	16.6	20.1	30.1	19.1	6.7	1.3
English walnut	GL	19.0	20.5	34.9	15.8	8.7	1.5
	ASG	22.1	21.5	36.2	20.2	4.0	1.0
	MGDG	19.5	18.3	34.1	22.5	2.4	Trace
	DGDG	18.2	17.5	33.0	20.8	9.6	1.1
Myrobalan	GL	20.8	20.2	33.4	15.3	7.1	0.9
	ASG	30.2	19.2	30.1	15.1	3.5	0.9
	MGDG	20.3	17.3	30.3	21.3	8.9	Trace
	DGDG	23.2	18.0	35.2	21.1	2.2	Trace
Manila tamarind	GL	22.5	25.1	30.4	18.1	8.7	2.3
	ASG	28.0	18.4	28.0	20.5	2.4	1.0
	MGDG	24.0	18.2	30.5	19.2	8.0	Trace
	DGDG	20.2	18.2	28.1	17.3	15.4	0.8

[a]All values are means of triplicate analysis.

[b]GL, total glycolipids; ASG, acylated sterylgalactosides; MGDG, monogalactosyldiglycerides; and DGDG, digalactosyldiglycerides.

[c]"Others" means 20:0, 22:0, and 24:0 fatty acids.

[d]"Trace" means <0.5%.

TABLE 3

Sterol Composition of SG and ASG Components of Total Glycolipids of Seed Oils[a]

Seed oils	Sterols (wt%)							
	SG[b] components				ASG[c] components			
	I[d]	II[e]	III[f]	IV[g]	I	II	III	IV
Kenaf	70.0	5.2	18.6	6.2	70.7	5.3	13.9	3.1
English walnut	73.1	5.2	16.6	5.1	72.5	5.1	19.2	3.2
Myrobalan	74.3	6.3	14.5	4.0	71.3	5.2	17.7	85.8
Manila tamarind	75.6	6.7	11.6	6.1	74.1	6.1	15.8	4.0

[a]All values are means of triplicate analyses.

[b]SG means sterylgalactosides.

[c]ASG means acylated sterylgalactosides.

[d]I means β-sitosterol with relative retention time, 1.00.

[e]II means stigmasterol with relative retention time, 0.88.

[f]III means campesterol with relative retention time, 0.81.

[g]IV means brassicasterol with relative retention time, 0.71.

acids to be palmitic, stearic and oleic acid (Table 2). The ASG fraction showed high proportions of oleic acid, which was nearly 1.5 times more in the MGDG and DGDG fractions. Palmitic and linoleic acids followed nearly the similar pattern of distribution. The DGDG fraction was found to contain a high proportion of linoleic acid besides containing 14:0, 20:0, 22:0 fatty acids in the 0.5–1.0% range. The sterol composition (Table 3) of SG and ASG fractions showed the presence of β-sitosterol as the predominant sterol and followed a similar pattern of distribution in the component glycolipids of all seed oils. In general, the glycolipid composition of these seeds followed a pattern similar to ricebran (11), soyabean (12), and *Briza spicata* seeds (13).

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[Received February 27, 1991; accepted August 5, 1991]