Short Communication

Chemical Composition of *Acacia* Seeds

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ABSTRACT

Several plants of Acacieae (family Leguminosae) have been recommended under aforestation programs. The seeds of some such plants have been examined for their fatty acid composition with special reference to epoxy acids. Epoxy 18:1 in *Acacia auriculiformis, A. catechu, A. coriacea* and *A. mellifera* was 4.9, 0.1, 2.1, and 0.6%, respectively.

INTRODUCTION

Acacia, belonging to the order Acacieae of the subfamily Mimosoideae (family Leguminosae) is a large genus comprising ca. 800 species. They are abundant in savannas and arid regions of Australia, Africa, India and America (1). Many of the acacias are exceedingly robust and grow under the most severe conditions. *A. auriculiformis*, a vigorously growing small tree, is now considered by foresters to be an ideal tree (1).

In India, there are ca. 22 species distributed throughout the plains. Indian acacias yield three major products, i.e., tannin, gum and timber (2). *A. catechu* and *A. pennata* are valued for their tannin. The gum from *A. catechu* is said to be of high quality and is regarded as the best substitute for true gum arabic (2). The seeds of the trees and shrubs of family Leguminosae were evaluated for the presence of epoxy acids. Fatty acid composition, protein and mineral composition of 8 species of *Acacia* are reported here.

EXPERIMENTAL

The seed samples collected from different parts of the country were authenticated by taxonomists. The oil was extracted from the seed with petroleum ether (bp 40-60 C) in a soxhlet apparatus. To remove phospholipids, if any, the oils were treated with large excess of acetone. In the case of *A. coriacea*, the bright yellow-orange aril was removed from the black seeds prior to the extraction of the oil. All the oil samples were tested for the presence of epoxy function (3), carbonyl component (4) and cyclopropenoid moiety (5,6). The fatty acid methyl esters were prepared from the oils as described elsewhere (7). For gas liquid chromatographic (GLC) analyses, a Chromatography and Instruments Co. gas chromatograph was used. The GLC unit was equipped with a dual flame ionization detector and a 3 m × 3 mm stainless steel column (10% DEGS on chromosorb W, 85-100 mesh). The temperatures at the injection port, detector block and column were 250, 300 and 190 C, respectively. The flow rate of nitrogen was 50 mL/min. Fatty acid methyl ester standards were obtained from Sigma Chemicals Co. (St. Louis, MO). The GLC data were quantified by triangulation without any correction factor (7).

The defatted seeds were extracted with ethanol to remove secondary plant constituents. The seed meals thus obtained were analyzed for total nitrogen and ash (8). The mineral compositions of the ash were determined using a Perkin-Elmer Model 1272 atomic absorption spectrograph.

RESULTS AND DISCUSSION

The oil content of the seeds of the 8 species of *Acacia* was rather low. The oil content ranged from 2.8 to 8.6%, the highest being in *A. minhassi*. An interesting aspect of the fatty acid analyses was the presence of epoxy acid in 4 seed samples, viz., *A. auriculiformis* (4.9%), *A. catechu* (0.1%), *A. coriacea* (2.1%) and *A. mellifera* (0.6%). The presence of epoxy acid in the family Leguminosae is rare, although epoxy 18:1 has been reported in *A. auriculiformis* by Gunstone et al. (9). The results of the GLC analyses of the oils are recorded in Table I. The predominant acids in 7 seed oils were octadecenoic (18:1) and octadecadienoic (18:2). The sum of the concentration of 18:1 and 18:2 was 89.5% in *A. minhassi* and 80.4% in *A. coriacea*. *A. pennata* is notable for its high content of palmitic (16:0) acid (44.1%) and in having 0.3% pentadecanoic (15:0) acid.

A. auriculiformis, A. farnesiana and *A. nilotica* seed oils have also been studied by Gunstone (9) and Shone (10) and their results are in close proximity with ours. The climatic factor does not seem to have much effect on the fatty acid composition.

The protein contents in *A. catechu, A. coriacea* and *A. mellifera* were 46.6, 46.6 and 40.2%, respectively (Table I). The mineral compositions of the total ash (Table

TABLE I

Chemical Composition of *Acacia* Species

Name of the seeds	Oil[a] (%)	Protein[a] (%)	Ash[a] (%)	Fatty acid composition[b]								
				14:0	16:0	18:0	20:0	16:1	18:1	18:2	Epoxy 18:1	Others
A. auriculiformis	6.8	14.43	4.23	–	18.6	4.4	2.2	–	24.4	44.3	4.9	20:1, 1.3
A. catechu	4.9	46.62	5.90	–	24.6	2.2	1.3	0.9	29.2	41.7	0.1	–
A. coriacea	7.8	46.62	3.36	–	12.6	2.8	1.9	–	42.4	38.0	2.1	–
A. farnesiana	2.5	7.34	3.26	0.4	15.8	8.3	2.0	–	13.2	43.1	–	–
A. mellifera	7.9	40.27	3.64	0.6	18.3	8.4	3.5	0.5	23.9	44.0	0.6	–
A. minhassai	8.6	23.10	3.59	0.6	6.6	0.9	2.3	–	17.8	71.7	–	–
A. nilotica	3.8	14.01	4.62	0.4	15.7	9.0	1.2	–	29.0	44.5	–	–
A. pennata	2.1	18.63	3.03	1.5	44.1	9.4	1.6	–	25.3	17.9	–	12:0, tr. & 15:0, 0.3

[a]% by weight.
[b]% by area.

TABLE II

Mineral Concentration in the Seed Meal of *Acacia* Species[a]

Name of the seeds	Na	K	Ca	Mg	Fe	Mn	Cu	Zn	Pb	Ni
A. auriculiformis	0.5000	1.7000	0.4230	0.1800	0.0850	0.0210	0.0042	0.0042	0.0042	0.0042
A. catechu	0.4000	1.8200	0.2950	0.1750	0.0890	0.0191	0.0035	0.0059	0.0029	0.0029
A. coriacea	0.4000	1.9300	0.0670	0.0470	0.0950	0.0036	0.0036	0.0016	0.0067	0.0025
A. farnesiana	0.5150	1.8100	0.0530	0.0220	0.0990	0.0011	0.0064	0.0061	0.0018	0.0008
A. mellifera	0.4550	1.0000	0.0910	0.0480	0.0800	0.0036	0.0036	0.0039	0.0016	0.0002
A. minbassi	0.4620	0.4800	0.0830	0.2010	0.0980	0.0036	0.0069	0.0034	0.0069	0.0042
A. nilotica	0.4110	0.4600	0.1510	0.2000	0.0750	0.0151	0.0020	0.0051	0.0030	0.0029
A. pennata	0.4950	1.1800	0.1270	0.0590	0.0770	0.0082	0.0081	0.0035	0.0036	0.0042

[a]Concentrations are given in g/100 g of dry material.

II) were consistent with the reported values of *Bauhinia* spp. (11) and also of *Glycine max* (8).

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The Lipid Composition of Karaka Seeds (*Corynocapus laevigatus*)

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ABSTRACT

The kernels of karaka seeds (*Corynocapus laevigatus*) contained 9.6% oil by wt. The lipid constituents were characterized by silicic acid column chromatography and thin layer chromatography, and their individual fatty acid compositions by gas liquid chromatography. Of the seed oil, triacylglycerol was the major component which contained high proportions of linoleic (45%) and oleic (26%) acids. The major component of husk oil (0.9% of husk by wt) was polar lipid (glycolipids and pigments).

INTRODUCTION

Little is known of the lipid compsotion of the seeds from the only extensive nut-bearing tree, "Karaka" (*Corynocapus laevigatus*) (15 m tall), endemic to the New Zealand forests (1). The Maori used the kernel of this fruit as a source of carbohydrate but they respected the toxic effects of the raw fruit (orange-colored elliptic shape, 2.5-4.0 cm long). Extensive baking and washing procedures removed the toxin, β-nitropropionic acid (2), which is the hydrolyzed product of karakin [1,4,6-*tris*-0-(3-nitropropanyl)-β-D-glucopyranoside] (3).

This communication presents the fatty acid composition of the individual lipid constituents isolated from the kernel and husky-skin layer of Karaka seeds.

EXPERIMENTAL PROCEDURES

Fallen ripe seeds were collected from a mature Karaka tree growing in a pastural area near Palmerston North. Whole seeds were washed, air-dried at 50 C, weighed and measured. The husky-skin layers were removed from the kernels by hand and both were separately mechanically ground into fine powders. These were extracted with $CHCl_3$/MeOH (2:1, v/v) according to the procedures of Folch et al. (4) to yield the respective total oil extracts from both sources.

The lipid extracts were fractionated with silicic acid column chromatography (5) and the recovered fractions were identified by comparing their chromatographic properties with authentic standards by thin layer chromatography (TLC) (5).

The fatty acid methyl esters were recovered as transesterification products with the BCl_3/MeOH reagent (6) from their different lipid constituents and analyzed by gas liquid chromatography (GLC) (7).

RESULTS AND DISCUSSION

The average size and weight of a seed were 3.0 ± 0.2 × 1.4 ± 0.1 cm and 2.81 ± 0.66 g, respectively. By weight, the kernels represented 80.4% of the seed to yield 6.9% oil and the remaining husks (19.6%) contained very little oil (0.9%). By comparison (Table I) the kernel oil was predominantly triacylglycerol, whereas the major lipid constituents of the husks were polar lipids (glycolipids and pigments).

The fatty acids (Table II) of the kernel triacylglycerols were high in linoleic acid (45%) and oleic acid (27%) and resembled those of corn oil (9). Considering the husks, although the range of fatty acids (between C_{14} and C_{24}) in