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COMPOSITION OF TOTAL LIPIDS FROM *ACACIA ARABICA* AND *ACACIA FARNESIANA* SEED OILS

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Total purified lipid fractions (4 % on the dry weight basis) obtained from the seeds of *Acacia arabica* and *A. farnesiana* were found to be 69.9 % and 78.5 % neutral and 31.1 % and 21.5 % polar lipids respectively. Fatty acid composition of all separated lipid classes was also determined. The triglyceride percentage in *A. farnesiana* was higher (58.28 %) than in *A. arabica* (39.5 %), whereas the percentage of hydrocarbon-wax-ester was lower (0.31 %) in *A. farnesiana* and higher (9.6 %) in *A. arabica*. Other lipid classes of the two species were quantitatively similar in their relative percentages. The major fatty acids in all the lipid classes were found to be $C_{16:0}$, $C_{18:0}$, $C_{18:1}$ and $C_{18:2}$. Lipid classes of *A. farnesiana* contained relatively higher amounts of $C_{18:2}$, while those of *A. arabica* contained higher amounts of $C_{18:1}$.

Key words: Acacia, Lipids, glycerides.

INTRODUCTION

Acacia arabica and *Acacia farnesiana* (N.O. Leguminosae) are perennial trees (or shrubs) and found all over Pakistan. Locally they are known as "kikar" and "vilaiti kikar" respectively. The former is generally found in the plains whereas the latter is more abundantly available at higher altitudes. The young leaves of the trees are relished by goats and camels and farmers use the wood of the trees for different purposes. For these reasons large plantations of both types of plant are available in the country.

Both *A. arabica* and *A. farnesiana* bear flowers and fruits in the months of February and April. The fruits of *A. arabica* are straight, strap-shaped pods (3-6' by ½ to 5/8") and are distinctly stalked and contain 8-12 seeds. In case of *A. farnesiana*, which is mainly a shrub, the fruit pod is smaller in size (2-3" by ½") and cylindrical in appearance. Inside the pod there are usually 6-20 small brown coloured seeds [1-4]. The ripe fruits open along the sutures and shed the seeds which are invariably a waste.

In view of the abundant availability of these trees and their fruit seeds, it was desired to study their lipids with the view to evaluating them for any useful application. Hilditch [5], Chaudhry [6] and Mandal [7] have studied the total lipids of *A. arabica* and *A. farnesiana*, but no worker has published reports on the lipid classes of these species.

The present study describes the fatty acid composition of the total as well as the individual lipid constituents isolated from the seeds of *A. arabica* and *A. farnesiana*. It has been found that the seeds contain rather small percentage of oil (4 %) and therefore, may not be considered as a source of oil. However, the fatty acids of the various lipid classes coupled with the presence of proteins in the seeds, the whole seed may be used as a constituent of animal feed.

MATERIALS AND METHODS

Authentic seeds of *A. arabica* and *A. farnesiana* were obtained from the Forestry Department, Government of Pakistan and all the reagents used in this study were prepared according to standard methods [8]. Standard lipids were prepared by the method of Thomas, Scharon and Ralston [9].

Extraction and estimation of the oil. The seeds (250 g) of *A. arabica* and *A. farnesiana* were finely ground in a micromill separately and then extracted in a Soxhlet apparatus using chloroform: methanol (2:1, v/v) mixture as the solvent. The extracts were freed from the solvent and the residual oils from *A. arabica* (10 g) and *A. farnesiana* (12 g) respectively were dissolved in chloroform alone and then washed with a saturated solution of sodium chloride. The aqeuous phase was further extracted twice with chloroform and the combined organic extracts were

dried over anhydrous sodium sulphate and filtered. The volume of the solvent was reduced under nitrogen and adjusted to 100 ml. The percentage of oil extracted was estimated from duplicate and oven dried (400°) aliquots of the extract till constant weight [10].

TLC and GLC analysis of lipids. Aliquots of the oil (75-80 mg) of each species were streaked on to glass plates (20 x 20 cm), coated with silica gel (0.5 mm). The chromatograms were developed in hexane/diethyl ether/acetic acid (80:20:1, v/v/v) solvent system and the resulting bands were made visible under UV lamp by spraying with 2, 7-dichlorofluorescein in methanol. The lipid classes of the two species were hydrocarbon-waxesters; triglycerides; free fatty acids, partial glyceride and poplar lipids. The lipid classes were identified by comparison of their R_f values with those of the standards under identical conditions. The bands, made visible under UV lamp by spraying 2, 7-dichlorofluorescein, were marked and then scraped from the plates.

Lipids were eluted three times with pure chloroform/methanol (2:1, v/v) solvent mixture and methyl esters of the fatty acids of each class were separately prepared by the method of Kumar and Tsunoda [11].

The gas chromatographic analysis was carried out on a Pye Unicam 204 Series unit using a glass column (1.5 mm x 4 mm) packed with PEGS (20 %) on diatomite (80-100 mesh). The column temperature was maintained at 200° and nitrogen was used as the carrier gas at a flow rate of 40 ml/min. Detection was made by hydrogen flame ionisation detection and the detector was maintained at a temperature of 250°. The GC data were quantified by triangulation without any correction factor [12].

Data for the weight percentages of each class of lipids, their typical R_f values and the results of gas chromatographic analyses are given in Table 1 and 2 respectively.

RESULTS AND DISCUSSION

The lipid classes along with their percentages and R_f values, estimated in the oil fractions of *A. arabica* and *A. farnesiana*, are recorded in Table 1, while their fatty acid composition is given in Table 2. These experimental data, in both Tables, show significant differences not only in the weight percentage yields of neutral and polar lipid classes but also in their fatty acid composition.

Analysis of the results recorded in Table 1 indicate that for *A. arabica* and *A. farnesiana* respectively the ratios of neutral to polar lipids are 2.2:1 and 3.7:1. Similarly in both species it is observed that in the neutral fraction the triglycerides are predominant, averaging 58.28 % and 39.5 %. The other neutral lipid fractions are partial glycerides (9.6 % and 13.1 %), free fatty acids (10.2 % and 6.77 %) and hydrocarbon-wax esters (9.6 % and 0.31 %). The polar lipid contents in both the species were found to be 31.1 % and 21.5 %.

Table 1. Weight percentage composition and R_f values of lipid classes in *A. arabica* and *A. farnesiana*.

S. No.	Lipid fractions	Weight percentage of *A. arabica*	Weight percentage of *A. farnesiana*	Typical R_f values
1.	Hydrocarbon-waxester	9.6	0.31	0.97-0.96
2.	Triglyceride	39.5	58.28	0.91
3.	Free fatty acid	10.2	6.77	0.43
4.	Partial glyceride	9.6	13.14	0.3-0.02
5.	Polar lipid	31.1	21.5	0.0

It will thus be seen from these data that in certain respects lipid fractions are similar (e.g. partial glycerides), while in others they are markedly different (e.g. FFA and hydrocarbon-wax esters).

Apparently these differences can be ascribed to the environmental conditions in which both the species grow.

The fatty acid composition of various lipid classes isolated from *A. arabica* and *A. farnesiana* is given in Table 2. A comparison of the data shows that the fatty acid distribution in all lipid classes, in both the species, is similar. In both species the amount of unsaturated fatty acid is higher than that of the saturated fatty acids. However, within lipid classes the amounts of saturated fatty acids are higher in the polar lipids as compared to the neutral lipid.

However, the overall fatty acid composition thus indicates that by and large the seed oils from *A. arabica* and *A. farnesiana* have higher amounts of unsaturated fatty acids. Since the oil contents of the seeds are rather low, it is suggested that the whole seed as such may be used in the formulation of cattle feed to utilize not only its oil but also the protein of the seed.

Commercial exploitation of the seeds for the recovery of oil will not be economical because of low oil content ($\simeq$ 4 %).

Table 2. Fatty acid composition in the principal classes of non-polar and polar lipids in *A. arabica* and *A. farnesiana* by GLC analysis[a]

Lipid fractions	Species	$C_{14:0}$	$C_{16:0}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$
1. Hydrocarbonwax esters	*A. arabica*	0.85	15.34	17.71	34.99	31.12
	A. farnesiana	1.33	20.12	21.40	20.10	37.05
2. Triglycerides	*A. arabica*	1.10	18.94	12.37	40.24	27.37
	A. farnesiana	1.12	22.23	22.55	21.25	32.85
3. Free fatty acid	*A. arabica*	0.88	16.99	15.79	36.87	29.47
	A. farnesiana	1.31	19.14	20.05	22.40	37.10
4. Partial glycerides	*A. arabica*	0.90	15.35	16.41	41.23	26.11
	A. farnesiana	2.10	19.65	19.73	22.95	35.57
5. Polar lipids	*A. arabica*	1.72	23.41	17.32	32.23	25.33
	A. farnesiana	2.40	18.24	19.15	22.35	37.86
Total lipids	*A. arabica*	0.11	18.12	14.24	37.51	30.02
	A. farnesiana	0.45	22.80	18.65	19.25	38.85

a = % by area.

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