

Chemical Composition of *Acacia* Seeds

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The seeds of 12 species of *Acacia*, although rich in C-18 unsaturated acids (47.9–93.5%), have low oil content (2.5–10.2%). Highest concentration of octadecatrienoic acid was in *A. lenticularis* (80.3%), *A. suma* (76.8%) and *A. tortilis* (71.7%) oils. *A. mollissima* was rich in octadecadienoic (69.1%) and *A. senegal* in octadecenoic (42.5%) acids. All the seed oils showed the presence of epoxy 18:1 acid, 0.6–3.8%. The protein content of the processed seed meals ranged from 13.4–37.2%, the highest being in *A. senegal*. Fiber content varied from 8.8–11.9%.

Acacia (Mimosaceae) seed oils contain unusual fatty acids (1–8) along with the usual ones. Earlier, we reported the presence of epoxy oleic acid in four species of *Acacia* (9). It was identified in seven species of *Acacia* as coronaric acid (3,4), and in four others as vernolic acid (5–8). In continuation of such studies, the fatty acid compositions of yet another 12 species of *Acacia* have been worked out and reported here.

EXPERIMENTAL

Authentic seed samples were procured from M/S Pratap Nursery and Seed Stores, Dehra Dun, India. The oils were extracted with petroleum ether (bp 40–60 C) and examined for the presence of the epoxy function (10). The methyl esters were prepared directly from the oils by means of $\text{FeCl}_3\text{-CH}_3\text{OH}$ reagent (11). The GC analyses were carried out on 10% DEGS on chromosorb W (85–100 mesh) and on 15% carbowax-20M on chromosorb G (80–100 mesh), at a column temperature of 180 C and 230 C, respectively. For injector and detector blocks the temperature of 270 C was maintained. For epoxy acid, oil of *A. auriculiformis* (9) was used as the standard. The UV spectra (12) of the fatty acids from *A. latronum*, *A. lenticularis*, *A. suma* and *A. tor-*

tilis were recorded along with that of *Linum utissimum* for conjugated triene, and the λ max was observed at 260, 270 and 280 nm for the samples.

The defatted seed meals, after extraction with ethanol to remove secondary plant constituents, were analyzed for total nitrogen, fiber and ash contents by the standard methods recommended by AOAC (13).

RESULTS AND DISCUSSION

The oil content of all seed samples was low, ranging from 2.5–10.2% (Table 1). The results of the GC analyses of the seed oils are recorded in Table 2. The acids 18:1, 18:2 and 18:3 were predominant in most of the seed oils. Those rich in 18:3 acid were *A. lenticularis*, 80.3%; *A. suma*, 76.8%, and *A. tortilis*, 71.7%. *A. mollissima* and *A. senegal* oils were found to be rich in 18:2 (68.1%) and 18:1 (42.5%) acids, respectively. The sum of C-18 unsaturated acids ranged from 47.9% in *A. mollissima* to as high as 93.5% in *A. suma*. The seed oils from *A. senegal* and *A. planifrons* were notable for their higher contents of 16:0, which were 36.4 and 31.3% respectively. The epoxy acid content in the seed oils ranged from 0.6–3.8%, with the highest value in *A. concinna* (Table 2).

The epoxy acid from *A. albida* (7.6%), *A. cochlearis* (8.6%), *A. coriacea* (4.6%), *A. farnesiana* (6.5%), *A. minhassi* (8.2%), *A. mollissima* (6.2%) and *A. pennata* (3.1%) stands characterized as coronaric (*cis*-9,10-epoxyoctadec-*cis*-12-enoic) acid (3,4), whereas that from *A. catechu* (10.3%), *A. sinuata* (6.9%), *A. mellifera* (8.1%) and *A. auriculiformis* (4.2%) as vernolic (*cis*-12-13-epoxyoctadec-*cis*-9-enoic) acid (5–8). When small amounts of epoxy acyl groups are found in oils, they usually are of the 9,10-variety and are most likely a product of aging; they are not produced by the primary fatty acid biosynthetic process. In the present study the seed oil from *A. auriculiformis* (8,9) was taken as

TABLE 1

Analytical Data on Seeds and Oils of *Acacia*

Species	Seed analysis					Oil properties		
	Moisture content (%)	Fat content (%)	Protein content (%)	Fiber content (%)	Ash content (%)	Ref. Index n_D^{30}	Iodine value	Sapn. value
<i>Acacia concinna</i> DC.	8.5	3.4	19.5	9.6	3.25	1.4813	102.5	193.2
<i>A. dealbata</i> Link.	7.9	10.2	28.9	9.8	3.10	1.4680	111.3	194.5
<i>A. decurrens</i> Willd.	7.1	7.9	25.3	9.8	3.94	1.4780	106.4	193.6
<i>A. latronum</i> Willd.	4.8	9.2	21.5	10.1	3.03	1.4860	145.4	194.1
<i>A. lenticularis</i> Buch. Ham.	10.3	6.9	29.5	11.3	2.61	1.4700	225.2	193.5
<i>A. leucophloea</i> Willd.	6.5	8.1	25.1	9.8	3.15	1.4750	95.4	195.0
<i>A. modesta</i> Wall.	6.7	7.9	24.6	10.1	3.01	1.4745	89.2	180.5
<i>A. mollissima</i> Willd.	5.7	8.0	30.6	10.1	4.75	1.4875	139.5	192.3
<i>A. planifrons</i> Wight and Arn.	9.0	2.5	30.7	11.9	3.07	1.4755	84.6	196.7
<i>A. senegal</i> Willd.	8.8	4.9	37.2	8.8	2.91	1.4700	50.6	195.9
<i>A. suma</i> Buch. Ham.	10.7	3.8	13.4	9.9	4.20	1.4710	230.8	192.6
<i>A. tortilis</i> Hayne	8.4	3.3	27.1	10.2	2.94	1.4745	203.0	193.0

TABLE 2

Fatty Acid Composition (% area) of Seed Oils from *Acacia* Species

Species	14:0	15:0	16:0	18:0	18:1	18:2	18:3	20:0	Epoxy 18:1	Others
<i>Acacia concinna</i>	0.1	—	18.0	8.2	29.5	36.8	3.4	—	3.8	—
<i>A. dealbata</i>	1.9	0.2	18.0	1.9	30.9	39.9	5.8	tr	1.2	—
<i>A. decurrens</i>	tr	tr	21.2	4.9	30.7	41.9	0.9	—	1.1	—
<i>A. latronum</i>	tr	—	16.9	2.7	19.8	31.9	26.0	0.9	1.0	12:0, 0.4; 20:1, 0.3
<i>A. lenticularis</i>	0.5	0.4	7.1	1.1	7.1	1.0	80.3	tr	2.1	14:1, tr; 16:1, 0.3; 17:0, tr
<i>A. leucophloea</i>	0.4	tr	23.7	3.7	31.6	38.6	—	1.4	0.6	—
<i>A. modesta</i>	0.1	—	14.5	24.1	26.6	26.3	6.9	—	1.5	—
<i>A. mollissima</i>	0.1	tr	10.5	0.8	16.6	68.1	0.8	0.6	2.2	20:1, 0.1
<i>A. planifrons</i>	0.4	0.1	31.3	3.2	33.7	22.8	4.9	0.5	2.1	12:0, 0.9; 20:1, tr
<i>A. senegal</i>	0.1	—	36.4	10.3	42.5	2.4	3.0	2.5	2.5	12:0, 0.1
<i>A. suma</i>	0.4	0.1	3.0	0.5	4.5	12.2	76.8	—	1.6	12:0, 2.5; 13:0, 2.5; 14:1, 0.1; 16:1, 0.1; 17:0, tr
<i>A. tortilis</i>	0.1	0.3	9.5	2.4	6.1	2.0	71.7	1.1	2.1	12:0, 2.5; 13:0, 2.5; 14:1, 0.1; 16:1, 0.1; 17:0, tr; 20:1, 0.2

standard for the epoxy acid and hence it can be safely concluded that vernolic acid is the constituent of these *Acacia* seed oils.

The defatted and detoxified seed meals were analyzed for protein results ranged from 13.2 to 37.2%, the highest being in *A. senegal*. The fiber content ranged from 8.8–11.9%, whereas the ash content varied from 2.61–4.75%. The mineral composition compared well with those of other species of *Acacia* (9).

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