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Note

Essential oil composition of *Aframomum korarima*

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Aframomum korarima (Per.) Engler, family Zingiveraceae, is a perennial plant endemic to Ethiopia[1]. Its seeds, which are brown and shiny, have a diameter of 3–4 mm, and have a strongly aromatic but slightly burning taste that could be matched closely to Indian cardamoms.

Cufodontis[1] reported that the name for the spice crop in Ethiopia is *Aframomum korarima* (Per.) Engler and that the name *A. angustifolium* Schum has been used by the Kew Herbarium and by Mooney[2], but that he himself had seen no specimen corresponding to *A. angustifolium*. *A. angustifolium* has been used interchangeably with *A. korarima* by Mooney[2]. It therefore seems that *A. angustifolium* was used in error and further studies by Cufodontis on the plant in Ethiopia around 1969 seem to have established that the two species are distinct.

Aframomum spp. yield the rarer essential oils applicable in perfumery[3], but little chemical analysis on the essential oils of these species has been carried out. The oil of *A. amoniense* ("natural geraniol") from Tanzania was reported to have constituents similar to those of commercial geranium oil[4]. Analysis of the oils of *A. mala* and *A. amaniense* by Lee and Worsely[5] showed that it was composed of kajene, caryophylene, β-pinene, terpineol, cineol, geraniol, geranyl acetate and other unidentified compounds. The composition of the essential oil of *A. angustifolium* was studied by Coomes *et al.*[6], who reported the results of the analysis of seeds collected from Tanzania. The seeds were found to contain 1.1% of volatile oil and the constituents identified were α-pinene (9.9%), β-pinene (22.8%), limonene and dipentene (8.4%), cineole (18.1%), alcohols (10.7%), sesquiterpenes (12.6%) and esters (1.4%).

This paper reports the results of the gas chromatographic (GC) and gas chromatographic–mass spectrometric (GC–MS) analysis of samples of *Aframonum korarima* Engler.

EXPERIMENTAL

Materials

Essential oil was obtained from *A. korarima* by steam distillation of commercial-grade seeds (moisture content 13.7%) from the Gamo-Gofa Administrative Region of Ethiopia.

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Gas chromatography

A Hewlett-Packard Model 5710A gas chromatograph equipped with a flame-ionization detector was used. The operating conditions that gave the best separation are shown in Table I.

TABLE I

OPERATING CONDITIONS FOR HEWLETT-PACKARD MODEL 5710A GAS CHROMATOGRAPH

Stationary phase	Carbowax 20M (10%)
Solid support	Chromosorb W AW, DMCS treated, 80–100 mesh
Column length	6 ft.
Column diameter	1/8 in. O.D.
Column material	Stainless steel
Column temperature:	
Initial	70°C
Final	200°C
Programming rate	4°C/min
Detector	Flame ionization
Injection port temperature	200°C
Detector oven temperature	200°C
Carrier gas (N_2) flow-rate	66 ml/min
Hydrogen flow-rate	33 ml/min
Air flow-rate	330 ml/min
Sample size	0.5 μl

Combined gas chromatography–mass spectrometry

The GC–MS system was a Finnigan Model 3200 instrument equipped with a linear temperature programmer and a Model 6400 data system. The operating conditions of the GC–MS system are given in Table II. The ion beam current was recorded and used as the gas chromatography trace. Mass spectra (at 70 eV) corresponding to the peak maxima were recorded. Each component was identified by comparison of the retention times and mass spectra with those of standard samples.

TABLE II

OPERATING CONDITIONS FOR FINNIGAN MODEL 3200 GC–MS INSTRUMENT

Stationary phase	Carbowax 20M (10%)
Solid support	Chromosorb W AW, DMCS treated. 80–100 mesh
Column length	6 ft.
Column diameter	1/8 in. O.D.
Column material	Glass
Column temperature:	
Initial	70°C
Final	200°C
Programming rate	4°C/min
Detector	MS ion beam detector
Injection port temperature	200°C
Carrier gas (He) flow-rate	*ca.* 40 ml/min
Sample size	0.5 μl

RESULTS AND DISCUSSION

The essential oil composition of *A. korarima* determined by comparison of retention data and MS fragments with those of authentic samples and the percentage composition calculated from peak areas are given in Table III.

TABLE III

ESSENTIAL OIL COMPOSITION OF *AFRAMOMUM KORARIMA*

Peak No.	*Retention time (min)*	*m/e*	*Composition (%)*	*Compound*
1	2.22	136	2.2	α-Pinene
2	3.31	136	21.4	β-Pinene
3	3.64	136	0.9	Myrcene
4	4.14		1.0	
5	4.49	136	9.1	Limonene
6	4.86	154	33.9	Cineole
7	5.23	136	2.7	γ-Terpinene
8	7.73		0.8	
9	5.94		0.5	
10	9.78		0.3	
11	11.48		0.2	
12	11.91		0.4	
13	12.31		0.2	
14	13.36	154	3.2	Terpinene-4-ol
15	15.84	154	9.3	Terpinyl acetate
16	17.02		4.5	Geranyl acetate
17	19.52	154	3.9	Geraniol
18	28.06	204	5.4	(Sesquiterpene)

It was found that *A. korarima* yields a higher percentage of essential oil (3.2 %) than previously reported by Coomes *et. al.*[6] in other *Aframomum* spp.

GC analysis showed eighteen separate peaks and the major constituents (eleven peaks comprising 91.1 % of the total) were characterized. Of these peaks, five were monoterpenes, two were monoterpene alcohols, two were esters, one was an ether and one was a sesquiterpene whose structure was not identified. The major components of the oil, cineole, limonene, terpinyl acetate and the pinenes, were present at approximately the same concentrations as in Indian cardomom seeds[8]. In addition, the difference in chemical composition between *A. angustifolium* and *A. korarima* indicate that the two species are indeed distinct.

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