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Short communication

THE ESSENTIAL OILS OF *CORIANDRUM SATIVUM* L. GROWN IN ETHIOPIA

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ABSTRACT: The essential oils of coriander, *Coriandrum sativum* L. (Apiaceae) from Bale and Gonder which are the major commercial sources of coriander in Ethiopia, were analyzed by GC and GC/MS. Twenty one compounds comprising 97% of the oils were identified. The composition of the oils was dominated by the monoterpene alcohol, d-linalool (70–76%).

Key words/phrases: Apiaceae, coriander oil, *Coriandrum sativum* L., linalool

INTRODUCTION

Coriander sativum L. (coriander) is an annual herb, belonging to the family Apiaceae. The genus *Coriandrum* L. has two species, which are native to the eastern Mediterranean region (Mabberly, 1987). It is only *Coriandrum sativum* L. (coriander) which is cultivated for its fruits. It grows extensively in India, the countries of the former USSR, Central Europe, Asia and Morocco. The leaves of coriander are used for flavouring soups and other foods. Since ancient times, whole or ground fruits are used to flavour foods and beverages, and are also used medicinally for a number of purposes, particularly as carminative (Purseglove *et al.*, 1981). The essential oil of the fruits is used for flavouring foods and alcoholic drinks, especially gin. It provides a very attractive natural source of linalool in natural fruit flavours (Ashurst, 1991). It is also used in

perfumes, soaps, detergents and in pharmaceutical preparations (Jansen, 1981; Plummer and Plummer 1993; Afiti *et al.*, 1994; Gora *et al.*, 1994; Pelletier, 1994).

In Ethiopia, coriander can be found in almost every market, and the main supplies come from Bale and Gonder regions. Coriander is used locally for flavouring purposes in the preparation of red pepper powder, bread and sauces. The fruits of coriander are boiled in water and drunk on an empty stomach to treat stomachache (Jansen, 1981).

The essential oil of coriander has been the subject of extensive study. The oil of coriander from Russia (Ille, 1971), Bulgaria (Ramusen *et al.*, 1972), Egypt (Mahran *et al.*, 1967), India (Gupta *et al.*, 1977), Cuba (Pino and Rosado, 1996), and other sources (Lawrence, 1991) is reported to contain d-linalool as the major constituent. The Turkish coriander oil which is reported to be comparable with coriander oils of commerce from other geographical origins is relatively high in its linalool content (78.40–84.67%) (Lawrence, 1991). The Russian oils have traditionally exhibited high linalool contents (69–75%) (Purseglove *et al.*, 1981). The linalool content of lab-distilled coriander oils produced from forty different cultivars all grown in the USA, ranged from 66.56–86.23% (Lawrence, 1991).

The essential oils of coriander grown in Ethiopia have not been investigated before. The study was conducted to determine the quality of the oils and to compare the results to those of coriander oil of commerce in the International market.

EXPERIMENTAL

Plant materials

The dried coriander fruit samples were obtained from the major commercial sources, Bale and Gonder. The samples were authenticated by Dr Sebsebe Demissew and voucher specimen are deposited at the National Herbarium, Biology Department of Addis Ababa University.

Isolation and characterization

The essential oils were obtained from the ground samples by hydro-distillation for three hours using a Clevenger apparatus to yield oils in 0.54% and 0.6% for Bale and Gonder, respectively.

The essential oils were analyzed on a GC fitted with FID and fused silica capillary column (25 m x 0.22 mm coated with SE-54). Column temperature was programmed from 70°C to 200°C at 10°C $(min)^{-1}$. Injector and detector temperatures were 220°C and 260°C, respectively. Nitrogen was used as carrier gas at a flow rate of 1.5 $ml(min)^{-1}$. GC/MS analysis was performed using a VG 12-250 system equipped with a Hewlett Packard 5790A GC. A Hewlett Packard fused silica capillary columns (50 m x 0.2 mm i.d.) coated with Methyl silicon (0.33 μm film) was used with a temperature program of 45°C (5 min), 45°C to 180°C [5°C$(min)^{-1}$], 180°C to 280°C [15°C $(min)^{-1}$] and 280°C (20 min), with the injector at 240°C.

Identification was made by comparison of Rt values with those of standard compounds as well as by computerized matching of acquired mass spectra with stored NBS mass spectral library in the data system of the GC/MS.

RESULTS AND DISCUSSION

It was observed that the yield of the oils from the local coriander was 0.54% and 0.6% for Bale and Gonder, respectively. The yield of essential oil obtained upon distillation can vary considerably according to the type and source, and usually ranges from 0.1 to 1.7% for consignments entering trade (Purseglove *et al.*, 1981). The preferred cultivars of the plant for essential oil production are the small seeded varieties grown in the former USSR and other European countries. The local samples are of the small seeded variety. However, the yield of oil is lower when compared with those of Russia, Poland, and Egypt. It is comparable with those of India, China and Romania, and better than those of Turkey and Yugoslavia (Table 1).

Table 1. The essential oil content of coriander by sources (Purseglove *et al.*, 1981; Mahran *et al.*, 1967).

Source	Volatile oil (%)
Russia	0.8–1.80
Poland	0.6–1.15
Romania	0.3–0.80
Egypt	0.8
China	0.3–0.70
India	0.1–0.60
Yugoslavia	0.4–0.50
Turkey	0.3–0.40

Twenty one compounds comprising 97% of the essential oils were identified by GC and GC/MS. The composition of the oils was dominated by a monoterpene alcohol, d-linalool, 70.7% and 76.6% for the oils from Gonder and Bale, respectively (Table 2). It was observed that the local coriander oils have lower hydrocarbon monoterpenes (6% for the Bale sample and 14% for that of Gonder) and higher oxygenated monoterpenes other than linalool (14% for the Bale sample and 13% for that of Gonder). For most European oils, the monoterpene hydrocarbon content is between 16 and 30%, the linalool ranges between 60 and 75%, and the remainder is largely comprised of other oxygenated monoterpenes (Purseglove *et al.*, 1981). The linalool content of the local coriander oils is comparable with the Russian oil which have exhibited high linalool content (69–75%), and higher than that of the Egyptian oil (Table 2).

The yield and composition of the local oils were found to be comparable with coriander oils of commerce from other geographical origin. Thus, the essential oils from both localities have the possibility of undergoing commercial exploitation either as source of linalool or as direct additive in the food industry. Although synthetic linalool is produced on an industrial scale,

naturally occurring linalool continues to be an essential ingredient in the manufacture of certain flavour and fragrance compositions, due to an increasing demand for flavours and perfumes based on natural materials.

Table 2. Chemical composition of coriander oils from Ethiopia and other sources.

Compound	Percentage composition				
	Ethiopia		USA*	Turkey*	Egypt*
	Gonder	Bale			
α-Pinene	4.54	1.54	0.02–6.67	1.11–4.12	5.99–10.53
Camphene	0.76	0.34	0.01–0.95	0.01–0.10	3.66–4.63
Sabinene	0.18	0.07	0.01–0.42		
β-Pinene	0.38	0.23	0.02–0.71	0.16–0.46	4.84–8.65
β-Myrcene	0.87	0.62	0.12–0.92	0.20–0.32	
p-Cymene	0.96	0.12	0.18–3.42	0.34–5.01	3.55–8.59
D-Limonene	2.23	2.15	0.24–3.27	0.22–3.22	
Ocimene (E)	0.94	0.02	<0.1	0.28–1.12	
γ-terpinene	2.62	0.91	1.63–9.12	0.07–0.96	
d-Linalool	70.70	76.61	66.56–86.23	78.40–84.67	58.95–61.95
Camphor	4.79	5.98	1.95–4.90		2.82–3.32
Borneol	0.40	0.01	0.13–0.39	0.06–0.51	0.43–0.84
Terpinen-4-ol	0.20	0.07	0.06–0.27	0.18	
α-Terpineol	0.40	0.33	0.13–2.22	0.42–0.73	
Citronellol	0.37	0.07			
Citral b	0.11	0.34			
Geraniol	2.58	2.74	2.55–5.11	2.25–5.28	0.32–0.48
Citral a	0.21	0.19			
Citronellyl acetate	0.05	0.07			
Geranyl acetate	4.03	4.21	0.34–2.69	0.06–0.58	1.83–3.10
β-Caryophyllene	0.15	0.20			

*, Lawrence (1991).

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