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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XIII. Peucedanum ferulaefolium Gilli (Wild Dill) seed oil

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Abstract. The essential oil distilled from the seeds of *Peucedanum ferulaefolium* with a yield of 2.9% has been examined for the first time with respect to its physico-chemical properties and chemical composition. The oil has been shown to contain santene (30.6%), eugenol acetate (2.6%), methyl eugenol (50.0%), unidentified hydroxy compounds (6.6%) and coumarins (10.2%). The hydrocarbon fraction of the oil mainly consists of a single component santene.

Peucedanum ferulaefolium which is native to Afghanistan and Pakistan grows wild in different places in Baluchistan.[1] It has a pleasant flavour and is variously known as "jangli sowa" (wild dill), "kasognat" or "arghbol". It is used in place of dill in the local materia medica. The plant is occasionally eaten by human beings either as a vegetable or as a remedy for indigestion, but is widely grazed by animals.

Although large quantities of *P. ferulaefolium* grow in Pakistan, the quality and chemical composition of its essential oil have not been studied. The present work, therefore, was carried out to evaluate the commercial importance of the species on the basis of the chemical composition of its essential oil.

Materials and Methods

Ripe seeds of the plant of *Peucedanum ferulaefolium* were collected from the Zardaloo Hills (Baluchistan). The recovery of the essential oil and the general methods employed for these studies have been reported in Parts I-II of this series[2]. The physico-chemical properties of the oil as determined according to the normal procedure[2,3] are shown in Table 1.

The essential oil (15 g.) was fractionated by column chromatography using a glass column (100 cm × 3.5 cm) packed with silica gel (250 g) as an adsorbent. The column was eluted with *n*-hexane and then with various ratios of diethyl ether in *n*-hexane (Table 2). The hydrocarbon fraction was studied by GLC using a copper column (3 mm × 3 m) filled with 7.5% carbowax on celite (60-80 mesh) and by preparing its nitrosite derivative[4]. The oxygenated fractions containing more than one component were rechromatographed to separate individual compounds which were then identified by GLC, ir, nmr and by making their known derivatives.

The chemical composition of the essential oil as determined by column chromatography coupled with GLC is shown in Table 2.

TABLE 1. PERCENTAGE YIELD AND PHYSICO-CHEMICAL PROPERTIES OF THE ESSENTIAL OIL OF *PEUCEDANUM FERULAEFOLIUM* SEED.

Distillation period	10 hr
Yield	2.9% including the water-cohobation oil.
Specific gravity	0.9912^{33}
Refractive index	1.5100^{33}
Optical rotation	$+3° 0'^{33}$
Acid value	5.95
Ester value	5.36
Ester value after acetylation	44.82

TABLE 2.—PERCENTAGE COMPOSITION OF THE ESSENTIAL OIL OF *PEUCEDANUM FERULAEFOLIUM* SEED.

Solvent used	Component	Percentage
n-Hexane	Santene	30.6
2% diethyl ether in *n*-hexane	Eugenol acetate and unidentified ester	2.6
2-5% diethyl ether in *n*-hexane	Methyl eugenol	50.0
	Unidentified hydroxy compounds	6.6
50-100% diethyl ether in *n*-hexane	Mixture of coumarins	10.2

Discussion

The essential oil from the seeds of *Peucedanum ferulaefolium* possesses sweet and pleasant flavour. The hydrocarbon fraction of the oil contained a

single monoterpene, santene, by GLC which was identified by ir and conversion into its nitrosite derivative, m.p., 124-26° (lit.[4] 123-26°).

The first fraction eluted from the column consisted of a mixture of three compounds by TLC and carbonylic in nature by ir. The fraction was rechromatographed which gave eugenol acetate (by ir), methyl eugenol (by TLC) and an unidentified ester.

The column was further eluted with the same ratio of the solvents and a single compound was recovered. Its ir spectrum gave the following absorption peaks : S (3.45, 8.0, 8.2, 8.8, 9.8 μm), M (6.4, 6.7, 7.0, 11.1, 11.9, 12.5 μm), W (8.4, 10.1, 13.15, 13.4, 16.0 μm) and nmr ($CDCl_3$) : τ 6.86 (s, 1H, allylic CH_2), τ 6.8 (s, 1H, allylic CH_2), τ 6.3 (s, 3H, OCH_3), τ 6.33 (s, 3H, CH_2), τ 4.8-5.05 (1, m, 2H, vinylic CH_2), τ 3.85 (1, m, vinylic $-CH=CH_2$) and τ 3.2-3.45 (m, 3H, aromatic H). The compound was interpreted as methyl eugenol. It was further identified by preparing its bromo-eugenol-methyl ether dibromide, m.p., 77-78° (lit.[5] 77.5-78°).

The next fraction was a mixture of three compounds by TLC. The major component of the fraction was identified as methyl eugenol by TLC. The remaining two compounds were hydroxy in nature according to ir examination. Their identification has to be carried out as yet.

The last fraction consisting of a mixture of coumarins also has to be worked out systematically as yet.

Peucedanum ferulaefolium is one of the best species of Umbelliferae as regards its flavour. Its essential oil can, therefore, find a suitable application in perfumery and cosmetics. The species can be commercialized quite easily because, as our experiments have shown, it can be successfully cultivated in the country.

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