

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

Part LIV. *Ferula jaeschkeana* Feeds and Stalk Oil

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The essential oil of *Ferula jaeschkeana* from the fresh mature seeds and stalks of Pakistani origin in 1.05 % yield has been characterised for the first time with respect to its physico-chemical properties and chemical composition. The oil contains α -pinene (8.32 %), Δ^3 carene (18.78 %), camphene (2.56 %), limonene (10.21 %), γ -terpinene (3.86 %), *p*-cymene (2.16 %), myrcene (1.21 %), cadrenene (1.06 %), geranyl acetate (7.45 %), terpinyl acetate (6.26 %), α -terpineol (5.23 %), geraneol (4.07 %), unidentified sesquiterpenes (7.44 %), unidentified acids (3.48 %) and a mixture of coumarins with tarry matter (14.56 %).

Key words: Umbelliferae, essential oil, *Ferula jaeschkeana*.

INTRODUCTION

Ferula is a genus of about 140 species found mostly from the Mediterranean region to Central Asia. Only 16 species have been found to occur in Pakistan [1]. The chemical composition of the essential oil of the species of Pakistan, namely, *Ferula assafoetida* [2,3], *F. costata* [4], *F. foetida* [5], *F. narthex* [6], *F. oopoda* [7], *F. ovina* [8] have been investigated and reported in the literature, but no studies have so far been carried out on the physico-chemical characteristics and chemical composition of the oil of *F. jaeschkeana* Vatke which commonly grows wild in the hill sides in the areas of Abbotabad, Swat, Chitral and Azad Kashmir. The plant excretes a gum resin used for wounds and bruises [9-12]. It is 2 m. tall perennial plant.

The present communication gives an idea of the chemical composition of the oil of *F. jaeschkeana* with the view to filling the gap in our knowledge of potentially useful raw materials of perfumery.

MATERIALS AND METHODS

The plant material was hand collected at fresh and mature fruiting stages from Parinah (Abbotabad). The essential oil was recovered from crushed seeds by dry steam distillation by the procedure reported in the literature [13]. The yield of the oil was 0.105 % and the physico-chemical evaluation of the oil was carried out according

to the methods already published [14]. The results have been given in Table 1.

The essential oil was resolved into different fractions by column chromatography using silica gel as a stationary phase and the identification of the individual components was studied by gas liquid chromatographic analysis as given in an earlier paper [15]. The results are given in Table 2.

RESULTS AND DISCUSSION

The genus *Ferula* is unique among Umbelliferae because its chemotaxonomical analysis of the species has shown quite different compositions. One species of this genus *F. assafoetida* has quite different composition of its essential oil than that of all the other species of this genus.

Table 1. Physico-chemical properties of the essential oil of seeds and stalks of *F. jaeschkeana*.

Distillation time	8 hours
Yield	1.05 %
Specific gravity	0.8696 ²⁰
Refractive index	1.4198 ²⁰
Optical rotation	+ 10.25 ⁰²⁰
Acid value	3.45
Ester value	43.87

The subscripts indicate the temperature at which these parameters were determined.

Table 2. Percentage composition of the essential oil of *F. jaeschkeana* seed and stalk.

Solvent used	Component	Percentage
<i>n</i> -Hexane	Hydrocarbons	55.60
	α-Pinene	8.32
	Camphene	2.56
	Δ ³ -Carene	18.78
	Limonene	10.21
	γ-Terpinene	3.86
	<i>p</i> -Cymene	2.16
	Myrcene	1.21
	Cadrenene	1.06
	Unidentified sesquiterpenes	7.44
1 % Diethyl ether in <i>n</i> -hexane	Geranyl acetate	7.45
	Terpinyl acetate	6.26
2.5 % Diethyl ether in hexane	α-Terpineol	5.23
	Geraneol	4.07
	Unidentified acids	3.48
50 % Diethyl ether in <i>n</i> -hexane	Mixture of coumarin and tarry matter	14.56
	Unrecovered material	3.35

The essential oil of *F. jaeschkeana* was fractionated and the hydrocarbon fraction (55.6 %) of the oil consisted of monoterpenes and sesquiterpene. The monoterpenes were separated from the sesquiterpenes by fractional distillation at 120° and being identified by GLC against their standard samples. The composition thus obtained is α-pinene (8.32 %), camphene (2.56 %), Δ³-carene (18.78 %); limonene (10.21 %), γ-terpinene (3.86 %), *p*-cymene (2.16 %), myrcene (1.21 %), caderenene (1.06 %), and an unidentified sesquiterpene (7.44 %).

The fraction eluted with 2.5 % diethyl ether in *n*-hexane was also found to contain two identifiable constituents by TLC which were determined to be terpineol (5.23 %) and geraneol (4.07 %) by IR and GC analysis. The unidentifiable component was acidic in reaction and its identification is under investigation.

The last fraction of the oil as eluted from the column with 50 % diethyl ether in *n*-hexane consists of a mixture of coumarins and tarry matter (14.56 %) because of its fluorescence in UV light and yellow spots on spraying with 1 % KMnO₄ solution by TLC analysis. Their separation and identification have not been effected yet.

From the present studies, it can be concluded that the essential oil of *F. jaeschkeana* does not contain sesquiterpenic alcohols which are the major oxygenated constituents of *F. costata* and *F. foetida*. On the contrary the essential oil of *F. jaeschkeana* is rich in cyclic terpenic alcohols and terpenic esters and the oil possesses acceptably pleasant smell on the basis of which it can find application in perfumery.

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