

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

Part XXIII. *Ferula narthex* Boiss (Rao) Seed Oil

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(Received September 4, 1978)

Abstract. The essential oil of the *Ferula narthex* distilled from the fresh mature seed of Pakistani origin in 1.1% yield has been characterized for the first time with respect to its physico-chemical properties and chemical composition. The oil contains α -pinene (7.32%), Δ^3 -carene (20.43%), camphene (1.81%), limonene (9.20%), γ -terpinene (2.78%), *p*-cymene (1.02%), geranyl acetate (7.20%), α -terpineol (16.24%), an unidentified acid (2.65%) and a mixture of coumarins with tarry matter (12.97%). No sulphur bearing compound was detected in the essential oil.

Introduction

Ferula narthex, an umbellifer, is native to Pakistan and India. It grows abundantly in Gilgit, Kurram and Doian in the North West Frontier Province and is also reported to grow in Kashmir Valley. It gives so much yield of gum resin as to offer the feasibility of being a substitute of *F. assafoetida* which is mostly imported from Afghanistan and Iran.

The essential oil of *F. narthex* is bacteriostatic and is effective against *Corynebacterium diphthiae*, *Streptococcus faecalis*, *Streptococcus pyogenus* and *P. scolonocearum*.¹

No investigations have so far been carried out on the physico-chemical characteristics or on the chemical composition of the essential oil of this species. The present work has, therefore, been pursued with a view to filling this gap in our knowledge of a potentially useful raw material of the country.

Materials and Methods

Mature seeds of the species were collected from Chitral for these studies. The recovery of the oil was effected from the crushed material by dry steam distillation.² Activated silica gel was used for column chromatography.²⁻⁴ The hydrocarbon fraction of the oil was resolved into individual constituents by GLC using flame ionization detector, nitrogen as the carrier gas and a 3 mm \times 3 m column packed with 7.5% carbowax on Celite (60-80 mesh) maintained at 100° for monoterpenes and 170° for sesquiterpenes. The oxygenated fractions of the oil containing more than one components were rechromatographed and the resultant single compounds identified by TLC, GLC, ir and by preparing their known derivatives. The other general methods

used in these studies have been described in our earlier communications.²

Results

The percentage yield, physico-chemical values and the chemical composition of the essential oil are recorded in Tables 1-2. Resolution of the hydrocarbon fraction by GLC is shown in Fig. 1.

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

Distillation time	8 hr
Yield	1.1%
Specific gravity	0.8703 ¹⁸
Refractive index	1.4210 ¹⁸
Optical rotation	+10° ¹⁸
Acid value	3.28
Ester value	41.76

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

Discussion

The essential oil of the *F. narthex* seed possesses fairly sweet smell but bitter tastes. The hydrocarbon fraction of the oil is mainly constituted of Δ^3 -carene, while the oxygenated fraction is chiefly composed of geranyl acetate and α -terpineol.

Identification of geranyl acetate was made by ir comparison with its standard sample and by hydrolysis of the ester with 0.5N KOH. Geraniol thus obtained was identified by TLC, GLC and ir comparison with an authentic sample. The acid regene-

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TABLE 2. PERCENTAGE COMPOSITION OF THE ESSENTIAL OIL OF *Ferula narthex* SEED.

Solvent used	Component	Percentage
<i>n</i> -Hexane	Hydrocarbons*	58.00
	α -Pinene	7.32
	Camphene	1.81
	Δ^3 -Carene	20.43
	Limonene	9.20
	γ -Terpinene	2.78
	<i>n</i> -Cymene	1.02
	Cadinene	6.36
	Unidentified sesquiterpene	9.08
	1% diethyl ether in <i>n</i> -hexane	Geranyl acetate
2.5% Diethyl ether in <i>n</i> -hexane	α -terpineol	16.24
5% diethyl ether in <i>n</i> -hexane	Geraniol	1.05
100% diethyl ether	Unidentified acid	1.60
	Mixture of coumarins and tarry matter	12.97
	Unrecovered material	2.94

*Resolved and estimated by GLC.

nerated from the potassium salt gave the characteristic smell of acetic acid.

α -Terpineol, as eluted from the column with 2% diethyl ether in *n*-hexane, was the major oxygenated component of the oil. It was identified by TLC, GLC and in comparison with an authentic sample of the alcohol.

Further elution of the column gave a mixture of three compounds by TLC. The fraction was acidic in reaction. It was treated with saturated aqueous solution of NaHCO_3 to extract the acidic component from the fraction. The acid is as yet to be identified. The unreacted portion of the fraction was mainly that of α -terpineol with a small amount of geraniol by TLC, GLC and in comparison.

The last fraction of the oil consisted of a mixture of coumarins. Their separation and identification has not been effected as yet.

From the present studies, it can be concluded that the essential oil of *F. narthex* is unique in *Ferula* genus in that it does not contain sesquiterpene alcohols which are the major oxygenated components of *Ferula costata* and *F. foetida*.⁵ On the contrary, the essential oil of *F. narthex* is rich in cyclic terpenic alcohols, namely, geraniol and α -terpineol. The ester value of the oil is also greater than that of the oils of the other species of *Ferula* thus indicating higher amount of esters in the oil of

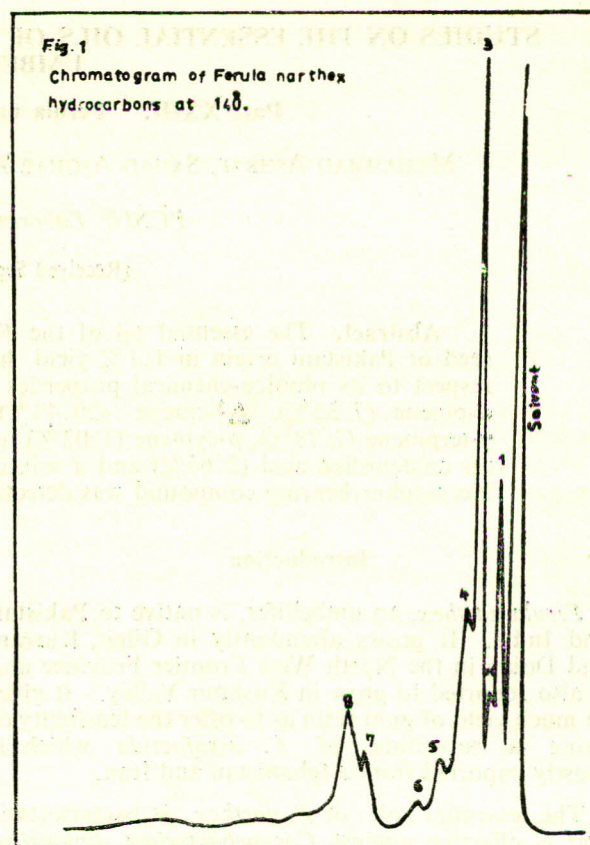


Fig. 1. Chromat-gram of *F. narthex* hydrocarbons at 140°.

F. narthex. The oil possesses acceptably pleasant smell on the basis of which it can find application in perfumery.

Acknowledgments. We are grateful to the United States Department of Agriculture for financing this research under a PL-480 Scheme and to Mr. Abdul Waheed Sabir, our Botanist, for the identification and procurement of authentic sample for this work.

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