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MONO- AND SESQUI-TERPENE HYDROCARBONS OF THE ESSENTIAL OIL OF *CANNABIS SATIVA*

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Key Word Index—*Cannabis sativa*; Cannabinaceae; essential oil; mono- and sesqui-terpene hydrocarbons; isocaryophyllene; β-selinene; selina-3,7(11)diene, selina-4(14), 7(11)diene.

The presence of cannabinoids in the essential oil of *Cannabis sativa* L. has been reported previously [1]. In this communication the results of the investigation into the mono- and sesqui-terpene hydrocarbon fraction are presented, together with previous work (Table 1).

The terpene hydrocarbon fraction obtained by means of column chromatography on Si gel eluting with light petrol (bp < 40°) was divided into a mono- and sesqui-terpene hydrocarbon fraction by vacuum distillation. All the monoterpene hydrocarbons previously mentioned [2–5], except

Table 1. Mono- and sesqui-terpene hydrocarbons of the essential oil of *Cannabis sativa* L., mentioned in previous and present work

Component	Nigam *et al.*[2] %*	Lousberg and Salemink[3]	Stahl and Kunde[4] %†	Hood *et al.*[5] %*	Present work %*
α-Pinene (+α-thujene)	1·3	+	—	3·9	1·50
Camphene	0·1	+	—	0·7	0·06
β-Pinene	0·8	+	—	2·2	1·49
Sabinene	—	+	—	—	n.d.
Δ^4-Carene	—	+	—	—	n.d.
Δ^3-Carene	—	+	—	0·1	trace
α-Phellandrene	—	+	—	—	0·87
Myrcene	1·3	+	—	1·0	0·97
α-Terpinene	0·1	+	—	trace	0·07
Limonene	2·8	+	—	1·0	0·45
β-Phellandrene	2·7	+	—		0·13
cis-Ocimene	—	+	—	0·2	0·14
γ-Terpinene	1·3	+	—	trace	trace
trans-Ocimene	—	+	—	0·7	0·34
p-Cymene	0·4	+	—	0·1	0·04
Terpinolene	—	+	—	0·6	0·10
Longifolene	—	—	33·0	—	n.d.
Isocaryophyllene	—	—	—	—	1·30
trans-α-Bergamotene	5·0	—	—	8·0	36·88
β-Caryophyllene	45·7	—	23·0	37·5	
β-Humulene	16·0	—	7·0	13·9	9·39
β-Farnesene	5·1	—	—	9·8	2·47
β-Selinene	—	—	—	—	3·30
α-Selinene	8·6	—	—	2·2	1·23
β-Bisabolene	—	—	—	3·2	n.d.
Curcumene	1·4	—	—	1·4	n.d.
Selina-3,7(11)diene	—	—	—	—	5·20
Selina-4(14),7(11)diene	—	—	—	—	3·18
Unidentified	—	—	—‡	—	±14·0‡
Total mono- and sesqui-terpene hydrocarbons	92·6			86·5	±83·5

— Not reported; + no quantitative data reported; n.d. not detected.
* Percentage of the essential oil.
† Percentage of the sesquiterpene hydrocarbon fraction.
‡ Several sesqui-terpene hydrocarbons unidentified.

sabinene and Δ^4-carene, were found to be present as shown by GLC co-chromatography with reference compounds. The sesqui-terpene hydrocarbon fraction was divided into several smaller fractions on a $AgNO_3$ column (Si gel containing 20% $AgNO_3$). From these fractions the sesquiterpene hydrocarbons were isolated by preparative GLC. Their identity was established by comparing the IR and NMR spectra with those of pure reference substances. As far as known the presence of isocaryophyllene, β-selinene, selina-3,7(11)diene and of selina-4(14), 7(11)diene has not been reported previously. Further information on the identity of the 20 unknown sesqui-terpene hydrocarbons and the fraction containing the oxygen components in which pulegone and α-bisabolol have been identified for the first time, will be given in a later communication.

From a chemotaxonomical point of view it is interesting to note that many of the components shown in Table 1 were present in the essential oil of *Humulus lupulus* L [6].

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TRITERPENE ACETATES AND D-(+)-PINITOL FROM *DRYMARIA DRUMMONDII*

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Drymaria drummondii (alfombrilla), Voucher specimen. No. 7306 deposited in the Herbarium of Dept de Biologia, ITESM Source: Chihuahua, Mex. *Uses* Unknown. *Previous work*—*Drymaria drummondii* and *D. arenarioides*., both known in northern Mexico as "alfombrilla", and *D. pachyphylla* from Arizona are annually responsible for serious loss of cattle, particularly in drought years when other forage is not available [1]. Their toxicity has been well established [2], but no chemical studies have been reported.

Present work—The dried whole plant (5·0 kg) was Soxhlet extracted successively with light petrol and EtOH. Each extract upon concentration yielded an oily residue on which preliminary tests for alkaloids, saponins and flavanoids were run [3]. Only saponins were detected in the EtOH extract.

The residue (62 g) obtained from the light petroleum extract, was chromatographed on Si gel. Elution with increasing gradients of C_6H_6–$CHCl_3$ gave first 0·6 g of oleanolic acid acetate, mp 266–268°, $C_{32}H_{50}O_4$ (M^+ at *m/e* 498). [α], UV, IR, NMR, mmp co-TLC; on hydrolysis oleanolic acid was obtained, mp, mmp co-TLC [α] IR. The second component proved to be α-amyrin acetate