

SHORT COMMUNICATION

CONSTITUENTS OF SOME MOSSES†

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THE LIGHT petroleum extracts from eight mosses, after concentration to isolate waxes and ursolic acid (when present), were saponified and carefully analyzed by combined column

TABLE 1. FRACTIONATION OF THE EXTRACTS

Moss	Waxes %	Wax-free extract %	Insaponifiable part %	Fatty acids %	Hydrocarbons %	Alcohols + sterols %	Ursolic* acid %
I	0.67	1.00	0.57	0.17	0.10	0.31	
II	0.03	0.48	0.14	0.18	0.02	0.11	
III	0.03	0.83	0.42	0.30	0.05	0.24	
IV	0.13	0.82	0.21	0.42	0.04	0.12	0.015
V	0.016	1.57	0.32	0.80	0.06	0.23	
VI	0.10	2.70	0.43	1.90	0.07	0.32	0.05
VII	0.20	1.10	0.21	0.72		0.21	
VIII	0.11	0.59	0.26	0.25	0.09	0.10	0.005

* Isolated and characterized by m.p. and IR spectrum.

chromatography and GLC. The content of alkanes, triterpenes and sterols was determined. The fatty acids were analyzed after conversion to methyl esters. Tables 1–4 give the percentages of the constituents with respect to the whole dry plant. The mosses examined were

TABLE 2. HYDROCARBONS (GLC ANALYSES)

Moss	Wt%	Alkanes %	Compositions of the alkane fractions											Hop-22 (29)-ene* %
			C ₂₄	C ₂₅	C ₂₆	C ₂₇	C ₂₈	C ₂₉	C ₃₀	C ₃₁	C ₃₂	C ₃₃		
I	0.10													0.10
II	0.02	0.009		2.0	1.1	18.0	3.5	34.0	4.0	37.4				0.01
III	0.05	0.01		1.0	0.5	5.5	0.6	12.0	0.7	67.5	2.0	10.2		0.03†
IV	0.04	0.04		1.0	0.5	11.2	0.5	19.9	1.4	58.1	1.5	5.9		
V	0.06	0.03	2.1	5.8	2.6	11.9	1.7	44.5	1.5	28.5		1.4		0.03
VI	0.07	0.03	0.9	3.8	1.0	14.0	1.3	38.0	1.0	40.0				0.04
VII	0.00													
VIII	0.09	0.09	0.6	2.1	1.6	25.3	2.8	21.4	1.8	31.0	1.2	12.2		

* Isolated and characterized by m.p., IR and NMR spectra.

† Huneck* has reported the isolation of hop-22(29)-ene from this moss.

‡ Part IV in the series "Triterpenes from Mosses." For Parts I–III see Refs. 1–3.

¹ A. MARSILI and I. MORELLI, *Phytochem.* **7**, 1705 (1968).

² A. MARSILI and I. MORELLI, *Phytochem.* **9**, 651 (1970).

³ A. MARSILI, I. MORELLI and A. M. IORI, *Phytochem.* **10**, 432 (1971).

⁴ S. HUNECK, *Phytochem.* **10**, 3282 (1971).

TABLE 3. TRITERPENOID ALCOHOLS AND STEROLS (GLC ANALYSES)

Moss	Campesterol	Stigmasterol	Sitosterol	Cyclolaudenol (or 24-Methylene- cycloarthanol)*	31-Norcyclolaudenol
I	35.6	20.2	44.2		
II	14.4	33.7	40.4	11.5	
III	16.4	40.2	43.4†		
IV	15.3	16.4	38.6		29.7
V	18.5	14.4	46.4	6.1	14.6
VI	16.6	23.8	47.7	11.9	
VII	24.4	24.4	48.7	2.5	
VIII	15.6	24.7	38.2	2.1	19.4

* These two triterpenes have the same retention time on different columns. Owing to the very small amount of material, it was impossible to unambiguously identify these products.

† Huneck* has found sitosterol in the same moss.

Eubrya: (I) *Climacium dendroides* (Dill.) Web. et Mohr; (II) *Neckera crispa* (L.) Hedw. var. *typica*; (III) *Abietinella abietina* (L.) Müll.; (IV) *Hypnum cupressiforme* (L.) ssp. *imponens* (Hedw.) Giac.; (V) *Rhytidiadelphus squarrosus* (L.) Warnst. ssp. *eu-squarrosus* Giac.; (VI) *Rhytidiadelphus triqueter* (Hedw.) var. *typica*; (VII) *Polytrichum formosum* Hedw. ssp. *eu-formosum* Giac., var. *typicum*. Spagnobrya: (VIII) *Spagnum teres* Schimp.

TABLE 4. FATTY ACIDS (GLC ANALYSES OF METHYL ESTERS)

Fatty acid	Moss							
	I	II	III	IV	V	VI	VII	VIII
Lauric	0.7	0.3	0.6	0.3	0.9			0.4
Myristic	4.5	1.4	2.1	0.4	1.2	1.7	1.7	1.7
Pentadecanoic	3.5	1.2	2.1	0.3	1.2	2.6	1.9	2.2
Palmitic	31.0	26.5	30.4	6.5	22.4	35.7	25.3	22.3
Palmitoleic	1.8	0.8	1.0	0.3	0.5		17.2	1.4
Eptadecanoic	1.5	3.3	0.6	0.5	0.7	1.3	0.8	1.0
Eptadecenoic		0.8				13.3 (?)	0.5	
Stearic	6.2	4.2	3.5	4.5	2.8	4.9	3.2	2.4
Oleic	0.6	12.5	18.1	14.5	8.8	11.9	31.9	13.5
Linoleic	5.9	9.4	11.9	23.0	21.8	15.7	3.2	18.1
Linolenic + arachidic	15.4	7.0	8.5	13.7	26.1	7.7	3.5	20.9
Gadoleic	1.2	1.9	2.5	0.5	0.4		2.9	1.4
Eicosadienoic	1.7	3.6	1.3	1.0	1.5		1.0	0.9
Behenic	5.7	9.9	2.6	14.7	2.1	5.0	4.5	4.2
Lignoceric	12.9	10.1	8.5	13.0	5.7			6.8
Cerotic	6.9	6.0	6.3	6.0	3.7			2.2
Other acids	0.5	1.1		0.8	0.2	0.2	2.4	0.6

EXPERIMENTAL

For experimental details on extraction, work-up of the extracts, column chromatographies, GC analyses and isolation of some constituents (see Tables 1–4), reference is made to our previous papers in this series.^{1–3}

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Key Word Index—Musci; chemotaxonomy; alkanes; sterols; fatty acids.