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Composition of the Essential Oil of *Blumea mollis* Merr.

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The essential oil of *Blumea mollis* (whole plant) was found to contain ten hydrocarbons, four alcohols, two oxides, one ester, two aromatic ethers and one phenol. Of these, seventeen compounds have been characterized.

THE genus *Blumea* belongs to the natural order compositae. It consists of some 80 species of annual or perennial herbs, sometimes shrubs, distributed in the tropics of Asia, Africa and Australia. The genus is eminently characteristic of India where about 35 species occur. A number of these are aromatic and medicinal[1,2]. *Blumea mollis* Merr.[3], an erect, annual biennial, medicinal aromatic species, possesses high content of essential oil. The oil has been found to possess antibacterial and antifungal activities[4]. Geda and Bokadia[5] reported the presence of 2,3-dimethoxy-*p*-cymene, γ-asarone, chrysanthenone, caryophyllene oxide and an ester from the extract of this plant. In the present study, the whole plant collected from Pithoragarh (U.P.) has been investigated for its mono- and sesquiterpenoid constituents. We now report the presence of 20 constituents out of which 17 have been identified.

Experimental

The essential oil from the whole plant of *B. mollis* was extracted by steam distillation using a copper still fitted with a copper spiral condenser and taken in petroleum ether (60-80°). It was dried (anhydrous Na_2SO_4), solvent distilled off and the oil was kept in dark place at low temperature. The physicochemical properties were determined by the common standard methods[6].

The light yellow oil was subjected to column (silica gel) and gas chromatography for separation of major constituents. The ir and pmr spectra were recorded for the main pure constituents.

The glc was performed on F and M-300 chromatograph using Carbowax 20 M (10%) packed column (12') and Varian-3700 chromotograph using

TABLE 1—CONSTITUENTS OF THE ESSENTIAL OIL OF *B. mollis*

	Compound	Content (% in oil)	M.W.	m/e 100%	Method of identification
Hydrocarbons					
	α-Pinene	1.8	136	93	rt, ms
	Camphene	1.4	136	93	rt, ms
	β-Pinene	0.9	136	93	rt, ms
	α-Terpinene	0.8	136	121	rt, ir, ms
	p-Cymene	2.1	134	119	rt, ir, ms
	Caryophyllene	39.5	204	41	ir, pmr, ms
	Humulene	7.7	204	93	ir, pmr, ms
	β-Bisabolene	6.1	204	69	ms
	δ-Cadinene	17.0	204	161	ir, ms
	$C_{15}H_{24}$	5.7	204	161	ms
Oxygenated					
	1:8-Cineole	0.9	154	43	rt, ms
	Linalool	1.3	154	71	rt, ms
	Linalyl acetate	0.7	196	93	rt, ms
	Eugenol	0.9	164	164	rt, ms
	Isoborneol	1.2	154	95	ms
	γ-Asarone	1.6	208	193	ms
	2,3-Dimethoxy-*p*-cymene	2.9	194	179	ms
	Sesquiterpene alcohol ($C_{15}H_{24}O$)	1.2	220	93	ms
	Caryophyllene oxide	5.2	220	41	ir, ms
	Unidentified alcohol ($C_{15}H_{26}O$)	1.1	222	180	ms

rt=gc retention time ; ms, ir and pmr represent the respective spectra.

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10′×1/8″ stainless steel column packed with 100-120 mesh Chromosorb-G (the solid support was coated with 5% OV-101 which was also used for gc/ms). All analysis were done under linear temperature programming conditions. In the gc/ms analysis of the oil, the mass spectra corresponding to the peaks in the chromatogram were recorded and the percentage area covered by each peak was also determined.

Results and Discussion

The essential oil was obtained in 0.3% yield. Physico-chemical properties as determined are specific gravity 0.9064/20°, ref. index 1.4980/20°, acid value 0.42, ester value 1.02, e.v. after acetylation 11.08 and carbonyl value as $C_{10}H_{16}O$ 1.12. These data indicate only low percentage of oxygenated compounds in the oil.

The mass spectra were identified by comparing with those available in literature[7-9] and some of the constituents were further confirmed by their ir and pmr spectra. The results are given in Table 1.

The oil is composed of 76% sesquiterpene hydrocarbons, 7% monoterpene hydrocarbons, 4.8% alcohols, 0.9% phenol, 10.6% ethers and 0.7% ester. Caryophyllene is the principal constituent (39.5%) followed by δ-cadinene, humulene and β-bisabolene.

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