Substance 5 — $C_{10}H_{10}O_4$, mp 167-169°C, R_f 0.83 (system 1), 0.32 (system 2), 0.32 (system 3). A mixture of substance 5 with an authentic sample of ferulic acid gave no depression of the melting point.

Substance 6 — $C_{16}H_{18}O_9$, mp 202-204°C, R_f 0.73 (system 1), 0.56 (system 2), 0.52 (system 3). On fusion with KOH protocatechuic acid was formed. The products of alkaline hydrolysis were investigated by paper chromatography with markers, which revealed the presence of caffeic and D-quinic acid [4]. A mixture with an authentic sample of chlorogenic acid gave no depression of the melting point.

Substance 7 — $C_{16}H_{18}O_9$ — could not be obtained in the crystalline state and was investigated in solution. R_f 0.67 (system 1), 0.63 (system 2), 0.62 (system 3). On alkaline degradation and alkaline hydrolysis, substance 7 also gave protocatechuic, caffeic, and D-quinic acids. The closeness of substance 7 to substance 6 indicated that they were isomers.

This is the first time that any of these phenolcarboxylic acids have been detected in the epigeal part of *Astragalus floccosifolius*.

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THE NATURE OF CHRYSANTHEMYL ACETATE

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An essential oil has been obtained by steam distillation from fresh whole flowering plants of the Arctic pansy *Tanacetum boreale* Fisch. growing in the eastern part of the Kungei-Alatau range (village of Ak-Tyuz). From fractions of this oil obtained by fractional distillation two substances have been isolated by preparative GLC the properties and spectral characteristics of which differ from those given in the literature. One substance, present in the essential oil in a concentration of 10.5%, was an ester (bands at 1741 and 1245 cm^{-1} in the IR spectrum) boiling at 81.5-82°C/5 mm and with n_D^{20} 1.457; d_{20}^{20} 0.9208; $[\alpha]_D^{20}$ +19.3°, M^+ 196.

Its PMR spectrum (Fig. 1a) showed in the 4.74 ppm region a doublet with J ∿ 7.5 Hz) belonging to an olefinic proton and indicating the presence in the molecule of a >CH—CH=$C(CH_3)_2$ group the methyl protons of which resonated at 1.59 ppm. The signal of the methine proton of this group consisted of a doublet (J ∿ 6 Hz) of doublets (J ∿ 7.5 Hz) with its center at 1.05 ppm. It was partially overlapped by the signals of the protons of quaternary groups at 1.05 and 0.96 ppm. The protons of a —CH_2O group resonated in the 3.50-4.25 ppm region and, being chemically nonequivalent, gave two doublets with centers at 4.11 and 3.77 ppm. These protons interact with one another with J ∿ 12 Hz and each, separately, interacts with a third proton with J ∿ 7 Hz and J ∿ 8 Hz. The signal of the latter was located in a very strong field and formed a doublet of quartets with its center at 0.72 ppm. Such a position of the signal of a methine proton can be explained by the assumption that it was located in a three-membered ring and interreacted not only with the nonequivalent protons of the —CH_2O group but also with another proton with J ∿ 6 Hz. In view of the close-

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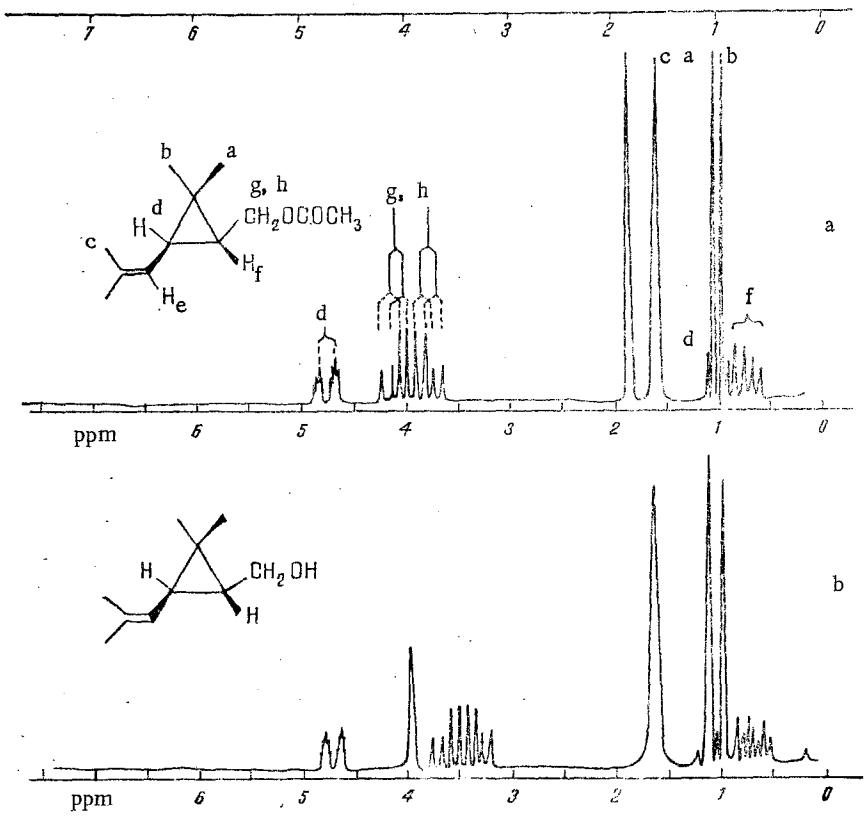

Fig. 1. PMR spectra of chrysanthemyl acetate (a) and chrysanthemol (b). BS 487C-80 mG spectrometer, internal standard HMDS, solvent CCl_4.

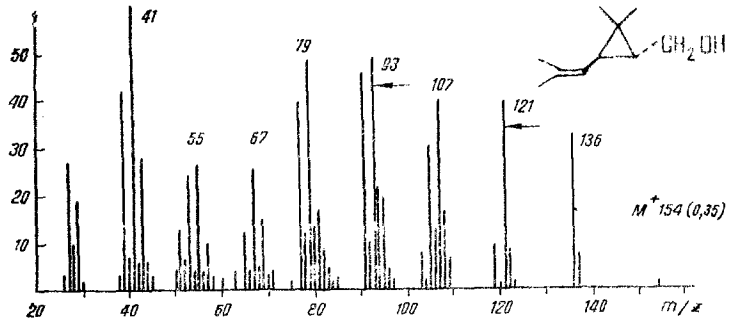

Fig. 2. Mass spectrum of chrysanthemol. MI 1201 spectrometer. Accelerating voltage 3 kV, energy of the ionizing electrons 70 eV. The intensities of marked ion peaks have been halved.

ness of the values of the chemical shifts and of the spin–spin coupling constants of the protons, their intensities revealed a considerable "roof effect."

Finally, a three-proton singlet at 1.87 ppm confirmed that we were dealing with an acetate of a terpene alcohol. When it was saponified, a primary alcohol was obtained (bands at 1030 and 3660 cm^{-1}, OH group) the IR spectra and constants of which were identical with those of a substance present in the essential oil: bp 83-84.5°C/5 mm, n_D^{20} 1.4748; d_{20}^{20} 0.8935; $[\alpha]_D^{19}$ +52.1°. This terpene alcohol had a faint pleasant odor similar to the odor of nerol. The mass spectrum of the substance, which is shown in Fig. 2, indicated that the substance had the composition $C_{10}H_{18}O$. According to its ^{13}C NMR spectrum (Bruker WP-80 instrument, CCl_4), obtained under conditions of partial decoupling and complete suppression of interaction with protons, the carbon atoms formed the following groups: 18.1 ppm, quartet, $-CH_3$; 21.2, quartet, $-CH_3$; 21.9, singlet, >C<; 22.6, quartet, $-CH_3$; 25.4,

quartet $-CH_3$; 28.4, doublet, >CH—; 34.86, doublet, >CH—; 62.3, triplet, $-CH_2O-$; 123.98, doublet, —CH=; 131.9, singlet, >C= [1].

The PMR spectrum of the alcohol (Fig. 1b) had the same signals as its acetate except that in place of the signal of the CH_3CO group in the 3.97 region the signal of the proton of a hydroxy group appeared.

According to their compositions and spectral characteristics, the substances isolated had the most probable structures of 1-hydroxymethylene-3-(isobuten-1-yl)-2,2-dimethylcyclopropane and its acetyl derivative.

The literature treatments of the results obtained showed that an alcohol with such a structure has been obtained by the reduction of the methyl ester of chrysanthemic acid with the aid of lithium tetrahydroaluminate and has been called chrysanthemol [2]. It was found that 25 mg of natural chrysanthemol has been isolated from the essential oil of the leaves of the wormwood *Artemesia ludoviciana* [3]. Since the constants of our alcohol differed from those given for chrysanthemol in [2] and [3] and, consequently, could not be used for identification, we oxidized the alcohol with chromium trioxide in pyridine in methylene chloride solution to the aldehyde [4] and the latter with silver oxide to the acid. After having been methylated with diazomethane, it gave a compound the PMR spectrum of which coincided with that of methyl trans-chrysanthemate [5].

Thus, we have isolated and described natural chrysanthemyl acetate for the first time.

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CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF *Ambrosia artemisifolia*

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The plant *Ambrosia artemisifolia* L. (common ragweed) — a weed of the family Asteraceae is widely distributed on the territory of our country and beyond its borders [1-3].

In the present paper we give the results of an investigation of the chemical composition of the essential oil of common ragweed growing in Georgia.

The essential oil was obtained by steam distillation from the epigeal part of plants collected in the environs of Tbilisi. The water—oil distillate was extracted exhaustively with pentane. The solvent was distilled off and the oil was dried over anhydrous sodium sulfate.

The essential oil of ragweed formed a mobile liquid with a light yellow color and the following physical and chemical indices: n_D^{20} 1.491-1.4998; d_{20}^{20} 0.872-0.885; $[\alpha]_D^{20}$ 37.5°; acid No. 1.5; ester No. 12-25; ester No. after acetylation 89.

The essential oil obtained was treated with 5% aqueous sodium carbonate solution and the free acids were isolated. After the separation of the acids, the oil was separated by fractional distillation into monoterpene and high-boiling fractions [4]. The high-boiling fraction was saponified and was separated by column chromatography (on alumina of activity grade II-III) into sesquiterpene and oxygen-containing compounds. These were eluted with petroleum ether and diethyl ether. The analytical and preparative GLC of the monoterpene,

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