

According to its UV, IR, and PMR spectra, the substance proved to be identical with that from the daphne willow. The yields of luteolin 7-glucoside from this species proved to be very low.

The high content of luteolin 7-glucoside in the leaves of the daphne willow gives grounds for considering this species as promising for introduction operations.

LITERATURE CITED

1. Z. P. Pakudina and A. S. Sadykov, The Distribution of Flavones, Flavonols, and their Glycoside in Plants, and their Physicochemical Properties [in Russian], Tashkent (1970), p. 10.
2. A. C. Vichkanova, L. D. Shipulina, A. I. Ban'kovskii, V. I. Glyzin, and V. L. Shelyuto, USSR Inventors' Certificate No. 491,387, Flavonoid Compounds Exhibiting Antiherpes Activity, Byull. Izobret., No. 42, 18 (1975).

ANTHOCYANINS OF THE FRUIT OF VARIOUS SPECIES OF THE GENUS *Amelanchier* Medic.

V. V. Vereskovskii, D. K. Shapiro, and
T. I. Narizhnaya

UDC 581.19+634./:634.741

We have investigated the anthocyanin pigments of the fruits of four species of the genus *Amelanchier* Medic. (serviceberry), family Rosaceae: *Amelanchier spicata* (Lam.) C. Koch., *A. alnifolia* Nutt., *A. oligocarpa* Roem., and *A. sanguinea* DC., which were collected in the Central Botanical Garden of the Academy of Sciences of the Belorussian SSR in the period of ripening. The fresh comminuted fruits (50 g of each species) were steeped in 95% ethanol containing 1% of hydrochloric acid (conc.) three times for three days each. The combined and filtered extract was evaporated in vacuum. The dry residue was dissolved in 30 ml of 95% ethanol containing 1% of hydrochloric acid.

The anthocyanins of the fruit were hydrolyzed (5 ml of extract + 5 ml of 2 N HCl) on the boiling water bath under reflux for 40 min. The aglycones were extracted with isoamyl alcohol [1, 2] for 20 h. To separate the anthocyanidins we used two-dimensional chromatography on Leningrad type S paper with two solvent systems: 1) acetic acid (glacial)-hydrochloric acid (conc.)-water (30:3:10), and 2) 15% acetic acid. It was established that the anthocyanins in the fruits are derivatives of three aglycones, which we have identified on the basis of combined chromatography with markers and spectral analysis as cyanidin, pelargonidin, and malvidin.

The anthocyanin glycosides were separated by preparative chromatography on Filtrak FN-7 paper in systems 3) butan-1-ol-hydrochloric acid (conc.)-water (7:2:5) and 4) 15% acetic acid* (in the second direction). It was found that the fruits of all the species contained seven anthocyanin glycosides, i.e., their qualitative compositions were identical. The glycosides were eluted from the chromatogram with methanol containing 0.01% of hydrochloric acid and were then hydrolyzed as described above. For neutralization, the hydrolysates were treated with Dowex 1×8 ion-exchange resin, 20/50 mesh, in the HCO_3^- form, after which they were subjected to spectral investigations [3].

The carbohydrate components were investigated by PC on Filtrak FN-3 paper [system 5: butan-1-ol-acetone-water (6:4:3)] with authentic samples of sugars.

*As in Russian original -

Central Botanical Garden, Academy of Sciences of the Belorussian SSR, Minsk. Translated from *Khimiya Prirodnykh Soedinenii*, No. 4, pp. 522-523, July-August, 1982. Original article submitted October 16, 1981.

It was established that glycosides 1, 4, and 5 contained the same aglycone — cyanidin; glycosides 2 and 3, pelargonidin; and glycosides 6 and 7, malvidin. Glucose was found in the hydrolysates of glycosides 1–4, and galactose in that of glycoside 5. On the basis of the results of a study of the chromatograms in the UV and visible regions, without and with the addition of aluminum chloride and of a study of the mobilities of the anthocyanin glycosides on paper chromatography in various solvent systems, and of the products of complete and step-wise hydrolysis, together with a chromatographic comparison with authentic samples, substance (1) was identified as cyanidin 3,5-diglucoside (cyanin); (2) as pelargonidin 3,5-diglucoside (pelargonin); (3) as pelargonidin 3-glucoside; (4) as cyanidin 3-glucoside (chrysanthemin); and (5) as cyanidin 3-galactoside. Because of their small amounts, compounds (6) and (7) could not be identified completely. It was established that they are malvidin derivatives.

Cyanin is quantitatively the predominating component of the anthocyanin complexes of the fruits of these species.

LITERATURE CITED

1. V. V. Vereskovskii and I. I. Chekalinskaya, Khim. Prir. Soedin., 525 (1978).
2. T. B. Samorodova-Bianki, Plant Physiology [in Russian], Moscow (1964), p. 544.
3. J. B. Harborne, Biochem. J., 70, 22 (1958).

THE ESSENTIAL OIL OF THE LEAVES OF *Citrus limonia*

N. A. Kekelidze and I. I. Dzhanikashvili

UDC 547.913

Among species similar to the lemon, the Meyer Chinese lemon (*Citrus limonia* Osbeck) has been widely introduced into the USSR [1]. The fruit of the Meyer lemon is considerably inferior in quality to the fruit of ordinary lemons *C. limon* Burm, but because of its comparatively high frost- and malsecco-resistance a great increase in the amount of it being planted is observed.

The essential oil obtained from the flowers and the ring of the fruit of the Meyer lemon growing in Georgia has been well studied [2, 3]. There is no information in the literature on the composition of the essential oil of the leaves.

We give the results of an investigation of the chemical composition of the essential oil isolated by steam distillation from the leaves of the Meyer lemon. The leaves were collected in the period of the forced dormancy of plants growing in Sukhumi. The amount of essential oil in the leaves was 0.32%. The components of the essential oil were identified by gas-liquid chromatography, through a comparison of the retention times of the components of the essential oils with the retention times of known terpenes on columns with stationary phases of different polarities. All the gas-liquid chromatographic operations were performed on a Varian Aerograph 1860 instrument using a flame-ionization detector. The best separation of the whole oil was achieved on 550×0.2 cm columns containing as stationary phases 5% of SE 30 and 10% of FFAP on Chromosorb W 80/100 mesh. The rate of flow of helium was 40 ml/min. The thermostat of the column was programmed from 100 to 220°C. The amounts of the components of the essential oil of the leaves of the Meyer lemon were as follows (% on the whole oil): α -pinene, 0.3; β -pinene, 0.7; sabinene, 1.0; myrcene, 1.0; δ -limonene, 66.7; γ -terpinene, 2.9; ρ -cymene, 2.0; linalool, 4.0; terpinen-4-ol, 3.1; nonanol, 1.4; neryl acetate, 0.9; citronellol, 1.4; geranal, 0.5; β -bergamotene, 0.8; β -bisabolene, 0.8; nerol, 0.8; geraniol, 1.3; thymol 1.1. Camphene, ocimene, terpinolene, linalyl acetate, and nerol were detected in the oil in trace amounts.

As compared with the essential oils of ordinary lemons [4–7], the process of terpene biosynthesis in the essential oil of the leaves of Meyer lemon is characterized by a marked

Institute of Plant Biochemistry, Academy of Sciences of the Georgian SSR, Tbilisi. Translated from Khimiya Prirodnnykh Soedinenii, No. 4, pp. 523–524, July–August, 1982. Original article submitted March 22, 1982.