the lactone under investigation of two exocyclic methylene groups (at C-4 and C-11, respectively). The paramagnetic shift (4.75 ppm) of the signal of one of the protons of an exocyclic methylene group and a signal at 3.85 ppm of a gem-hydroxylic proton indicated that they were present on neighboring carbon atoms (at C-4 and C-3, respectively) [3]. The nature of the multiplicity and the SSCC values of the gem-hydroxylic protons also showed the presence of OH groups on neighboring carbons (C-3 and C-2).

On comparing the details of the PMR spectra given above and others with those of pulchellin C (Table 1) [4], we identified the lactone under investigation as pulchellin C, and this is the first time that it has been isolated from Inula britannica L.

The IR spectrum was taken on a UR-20 spectrometer in paraffin oil, the mass spectrum on a MS-EI instrument at an ionizing energy of 70 eV, and the NMR spectra on a Bruker H-250 MHz instrument (δ scale, 0 — TMS).

LITERATURE CITED

1. P. V. Chugunov, V. I. Shiechenko, et al., Khim. Prir. Soedin., 276 (1971).
2. I. Kazuo and I. Toshyuki, Phytochemistry, 20, 271 (1981).
3. S. V. Serkerov, Khim. Prir. Soedin., 488 (1979).
4. H. Yoshioka, T. J. Mabry, N. Dennis, and W. Herz, J. Org. Chem., 35, No. 3, 627 (1970).

TRITERPENE GLYCOSIDES OF Astragalus AND THEIR GENINS.

XXVIII. CYCLOARTANES OF Astragalus babatagi

M. I. Isaev, M. B. Gorovits, and N. K. Abubakirov

UDC 547.918:547.926

Continuing investigations of cycloartane methylsteroids and their glycosides of plants of the genus Astragalus, we have analyzed Astragalus babatagi M. Pop. (Leguminosae). The epigeal part of this plant did not contain the substances being sought. The air-dry comminuted roots (170 g) of A. babatagi collected on July 1, 1986, in the environs of the village of Tavabulak (Babatag, Tadzhik SSR) were exhaustively extracted with methanol. This gave 23.6 g (13.9% on the weight of the air-dry raw material) of extractive substances. Their treatment by the method described in [1] gave 14 g of purified material which was chromatographed on a column of type L silica gel (Czechoslovakia). The column was eluted successively with chloroform and with the chloroform—methanol (15:1) and chloform—methanol—water (70:12:1) systems. Five fractions containing individual compounds of glycosidic nature were collected and these compounds were designated in order of increasing polarity as substances (1)-(5).

Substance (1) (10 mg — 0.006%), mp 276-279°C (from methanol), $[\alpha]_D^{24}$ −36 ± 2° (c 0.8; pyridine), was identified as β-sitosterol β-D-glucopyranoside [2].

Fraction 2 was rechromatographed on a column with elution by the ethyl acetate—methanol (15:1) system. This gave 1.177 g (0.7%) of substance (2), mp 229-230°C (from methanol), $[\alpha]_D^{24}$ −21.2 ± 2° (c 1.04; methanol), which was identified as cyclosieversioside A [3, 4].

Fractions 3 and 4 were rechromatographed on a column with elution by the chloroform—methanol—water (140:14:1) system. This led to the isolation of 270 mg (0.16%) of substance (3) and 170 mg [0.1% of substance (4)].

Substance (3), mp 185-188°C (from ethanol), $[\alpha]_D^{24}$ +16.6 ± 2° (c 0.84; methanol) was identical with cyclosieversioside B [4, 5].

Substance (4), mp 253-255°C (from methanol), $[\alpha]_D^{24}$ +20.7 ± 2° (c 1.16; methanol) was identified as cyclosieversioside C [3, 4].

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Uzbek SSR, Tashkent. Translated from Khimiya Prirodynkh Soedinenii, No. 6, pp. 880-882, November-December, 1988. Original article submitted March 25, 1988.

Fraction 5 was rechromatographed on a column with elution by the chloroform—methanol—water (70:12:1) system. This led to the isolation of 800 mg (0.47%) of substance (5), mp 180-182°C (from acetone), $[\alpha]_D^{24}$ −8 ± 2° (c 1.0; methanol). The IR spectrum of substance (5) contained bands characteristic for hydroxy groups (3550-3270 cm^{-1}) and for an ester grouping (1740, 1250 cm^{-1}). The PMR spectrum (C_5D_5N, HMDS) of substance (5), containing a three-proton singlet at 1.92 ppm, showed that the compound under consideration contained one acetyl group. The saponification of substance (V) led to a glycoside with mp 237-240°C (from methanol), $[\alpha]_D^{24}$ −7 ± 2° (c 0.8; methanol), which was identified as cyclosieversioside G [4, 6].

The Smith degradation [7] of compound (5) gave cyclosieversigenin 3-O-β-D-xylopyranoside, mp 263-264°C (from methanol), $[\alpha]_D^{24}$ +42 ± 2° (c 0.6; methanol) [4, 8]. The formation of the latter showed that the acetyl group was attached to a D-xylopyranoside residue located at C-3 of the genin. In the PMR spectrum of substance (5), the proton geminal to the acetyl group resonated at 5.46 ppm, in the form of a triplet with the SSCC ^3J = 8 Hz. This fact unambiguously determines the position of the acetyl group at C-3 of the D-xylopyranose residue. Consequently, substance (5) had the structure of 20R,24S-epoxycycloartane-3β,6α,16β,25-tetraol 6-O-β-D-xylopyranoside 3-O-[O-α-L-rhamnopyranosyl-(1 → 2)-(3-O-acetyl-β-D-xylopyranoside)]. Astrasieversianin IX isolated from Astragalus sieversianus Pall. [9] has an identical structure.

LITERATURE CITED

1. M. I. Isaev, M. B. Gorovits, N. D. Abdullaev, M. R. Yagudaev, and N. K. Abubakirov, Khim. Prir. Soedin., 572 (1981).
2. J. Swift, J. Am. Chem. Soc., 74, 1099 (1952).
3. A. N. Svechnikova, R. U. Umarova, N. D. Abdullaev, M. B. Gorovits, and N. K. Abubakirov, Khim. Prir. Soedin., 629 (1982).
4. V. Kh. Kravtsov, V. N. Biyushkin, O. N. Rebrova, M. I. Isaev, M. B. Gorovits, M. D. Alaniya, and N. K. Abubakirov, Khim. Prir. Soedin., 541 (1988).
5. R. U. Umarova, A. N. Svechnikova, N. D. Abdullaev, M. B. Gorovits, and N. K. Abubakirov, Khim. Prir. Soedin., 188 (1984).
6. A. N. Svechnikova, R. U. Umarova, M. B. Gorobits, N. D. Abdullaev, and N. K. Abubakirov, Khim. Prir. Soedin., 312 (1983).
7. M. Abdel-Akher, J. K. Hamilton, R. Montgomery, and F. Smith, J. Am. Chem. Soc., 74, 4970 (1952).
8. M. A. Agzumova, M. I. Isaev, M. B. Gorovits, and N. K. Abubakirov, Khim. Prir. Soedin., 117 (1986).
9. L. X. Gan, X. B. Han, and Y. Q. Chen, Phytochemistry, 25, 1437 (1986).