CHEMICAL STUDY OF Sida hermaphrodita

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Virginia sida, Sida hermaphrodita Rusby (Sida napaea Cav.), family Malvaceae, is widely cultivated as a fodder plant.

We have determined the composition of the free and bound amino acids, phenolic acids, and flavonoids in the raw material (epigeal part collected in the flowering phase in the Stavropol' and Pyatigorsk Botanical Gardens).

For the analysis of the free and bound amino acids the raw material was exhaustively defatted with chloroform. The chloroform was driven off, and 50 mg of the dry raw material was extracted three times with 70% ethanol at 45°C. After centrifugation, the free amino acids were determined in the supernatant liquid, for which purpose 15 ml of the liquid was evaporated in vacuum. The residue was dissolved in 2 ml of dosing buffer (pH 2.2) and the free amino acids were analyzed on an AAA-339 automatic amino acid analyzer (Microtechna, Czechoslovakia). The amount of sample injected was 0.1 ml, and the chart speed was 0.025 mm/s.

The deposit that had formed on centrifugation was hydrolyzed with 6 N HCl at 105°C for 24 h; the reaction mixture was filtered and, after decoloration, it was evaporated in vacuum, the residue was dissolved in 3 ml of dosing buffer (pH 2.2), and the bound amino acids were analyzed.

To determine the phenolic acids and flavonoids, the raw material was exhaustively extracted with 80% ethanol. The ethanolic solution was concentrated and was treated with water, the dark green precipitate was separated off and the filtrate was washed with chloroform and hexane and was extracted several times with ethyl acetate. The combined ethyl acetate extracts were dried with anhydrous sodium sulfate and were concentrated. The residue was poured into a tenfold volume of heptane, and the total flavonoids that deposited were then separated on a column filled with type L 40/100 silica gel. The chloroform extract was also concentrated and was separated on a column filled with silica gel of the same type, after which the fractions containing coumarins were purified by rechromatography on a column of alumina (act. grade II).

In this way, the following polyphenolic compounds were identified: substance (I) – $C_{21}H_{20}O_{12}$, mp 220°C (water). IR spectrum: 1655, 1620, 1570, 1550, and 1480 cm^{-1}. UV spectrum: $\lambda_{max}^{C_2H_5OH}$ 360, 265, 255 nm. Acid hydrolysis (2% H_2SO_4, 2 h) formed the aglycon quercetin and D-glucose. The substance was identified as isoquercitrin;

substance (II) – $C_{27}H_{30}O_{16}$, mp 190°C (70% ethanol). Acid hydrolysis formed quercetin, D-glucose, and L-rhamnose. On the basis of the results of UV, IR, and NMR spectroscopy and comparison with an authentic sample of a "marker," this corresponded to rutin;

substance (III) – $C_{21}H_{20}O_{16}$, mp 249°C (ethanol). Acid hydrolysis led to the aglycon quercetin and D-glucose. According to UV spectroscopy there were free hydroxy groups in the C-3, C-5, C-3', and C-4' positions. The D-glucose residue was present at C-7. Substance (III) was quercimeritrin;

substance (IV) – $C_{15}H_{10}O_7$, mp 284°C (ethanol). Its UV and IR spectra, on comparison with an authentic sample of a "marker," corresponded to herbacetin;

substance (V) – yellow crystals, mp 204-205°C. This was identical with the coumarin scopoletin; and

substance (VI) – white crystals with mp 217°C (ethanol). According to the results of UV and IR spectroscopy this was scopoletin 7-O-β-D-glucopyranoside, which is known under the name of scopolin.

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A phenolic acid was isolated from the ethyl acetate fraction by chromatography on polyamide (eluent: chloroform with increasing concentrations of methanol); UV spectrum: $\lambda_{max}^{C_2H_5OH}$ 325, 240 nm; $\lambda_{max}^{C_2H_5ONa}$ 380, 260 nm; $\lambda_{max}^{CH_3COONa}$ 330 nm, which permitted its identification as chlorogenic acid.

The amino acid composition of Sida hermaphrodita is given below (mg/100 g of air-dry raw material):

Amino acid	Free	Bound
Aspartic acid	0.73	5.70
Threonine	0.25	3.38
Serine	1.44	3.78
Glutamic acid	0.87	4.87
Proline	0.34	5.64
Glycine	0.11	6.42
Alanine	0.35	4.40
1/2 Cystine	–	–
Valine	0.40	3.78
Methionine	0.01	0.02
Isoleucine	0.02	1.19
Leucine	0.13	2.74
Tyrosine	0.01	0.09
Phenylalanine	0.47	0.04
Histidine	0.04	1.73
Tryptophan	–	–
Lysine	0.18	3.83
Arginine	0.06	1.17

Serine, glutamic acid, aspartic acid, phenylalanine, and alanine accumulated in the plant in the free form in the largest amount. Lysine, proline, alanine, aspartic and glutamic acids, serine, lysine, and valine predominated in the bound form, which shows the fairly high quality of the fodder plant.

LITERATURE CITED

1. V. A. Bandyukova and L. V. Ligai, Khim. Prir. Soedin., 665 (1987).