

## AMINO-ACID COMPOSITION OF SUBGENUS *Artemisia* HERBS

A. V. Ochkur, A. M. Kovaleva,\* and Ya. S. Kolesnik

UDC 577.112.3:582.998.2:543.544.45

The genus *Artemisia* L. (Asteraceae) is represented by 24 species in the flora of Ukraine. Of these, 11 belong to the subgenus *Artemisia* Less.; 8, to the subgenus *Dracunculus* Bess.; and 5, to the subgenus *Seriphidium* Rouy. Biologically active compounds include constituents of essential oils, flavonoids, coumarins, phenolic carboxylic acids, lignans, sesquiterpene lactones, diterpenes, and alkaloids. These have been studied in many species of *Artemisia* [1].

We established previously features of the constituent composition of essential oils of subgenus *Artemisia* herbs growing in Ukraine and identified the chemical varieties *A. absinthium* L., *A. vulgaris* L., and *A. austriaca* Jacq., which did not contain thujane derivatives [2, 3]. The goal of the present work was to study the quantitative amino-acid (AA) compositions of the herbs of *A. vulgaris* L., *A. abrotanum* L., *A. annua* L., *A. absinthium* L., and *A. austriaca* Jacq. collected during flowering in summer 2011 in Lugansk and Kharkov Districts. Herbarium specimens are preserved in the Pharmacognosy Department, NPhU (Nos. 42/11, 57/11, 58/11, 40/11, and 43/11, respectively).

The quantitative contents of crude protein in the studied raw material that were calculated as N content determined using EuroEA3000 Series CHNS-O elemental analyzer (EuroVector) were 15.6% in *A. vulgaris*; 26.9, *A. abrotanum*; 31.9, *A. annua*; 21.9, *A. absinthium*; and 16.2, *A. austriaca*.

The quantitative compositions of AA were determined on a Model 1100 chromatograph (Agilent Technologies) using a chromatographic column (4.6 × 50 mm) packed with octadecylsilyl Zorbax-XDB-C18 sorbent (1.8 μm). Samples for determination of free AAs were prepared in a vial by adding a weighed portion of raw material (10 mg) to HCl (0.1 N) containing β-mercaptoethanol (0.2%) and irradiating in an ultrasonic bath at 50°C for 2 h. The total content of AAs was determined by hydrolysis in HCl (6 N) containing β-mercaptoethanol (0.4%) at 110°C for 24 h [4]. AAs were identified by the retention times of standards (Tables 1 and 2).

A total of 22 AAs were identified in the studied species. This included 19 proteinogenic (9 essential and 10 non-essential) and 3 non-proteinogenic ones. The highest AA content was found in *A. annua* herb. The dominant AAs with respect to total content in the studied *Artemisia* species were proline, aspartic acid (with asparagine), glutamic acid (with glutamine), and arginine; with respect to free AAs, proline. The amount of bound AAs was calculated from the difference of the total AAs content and the content of free AAs taking into account destruction of individual AAs upon acid hydrolysis. The quantitative contents of protein calculated according to the RF State Pharmacopoeial method [5] that was recalculated for bound proteinogenic AAs were 7.5% in *A. vulgaris*; 10.5, *A. abrotanum*; 10.5, *A. annua*; 5.4, *A. absinthium*; and 6.3, *A. austriaca*. The differences in the quantitative contents of protein determined by the various methods could be explained by the presence in the plants of non-proteinogenic N contained in nucleic acids, enzymes, chlorophylls, vitamins, alkaloids, and biogenic amines [6].

The AA compositions of these species were studied for the first time.

---

National Pharmaceutical University, Ukraine, Kharkov, Ul. Pushkinskaya, 53, fax: (8 057) 714 25 40, e-mail: allamoon@rambler.ru. Translated from *Khimiya Prirodnykh Soedinenii*, No. 3, May–June, 2013, pp. 502–503. Original article submitted February 11, 2013.

TABLE 1. Contents of Free Amino Acids in *Artemisia* Herbs, mg/100 g

| Amino acid                      | <i>A. vulgaris</i> | <i>A. abrotanum</i> | <i>A. annua</i> | <i>A. absinthium</i> | <i>A. austriaca</i> |
|---------------------------------|--------------------|---------------------|-----------------|----------------------|---------------------|
| Essential proteinogenic AAs     |                    |                     |                 |                      |                     |
| Val                             | 66.9               | 36.9                | 50.2            | 67.4                 | 18.9                |
| Ile                             | 25.3               | 11.3                | 13.6            | 36.5                 | 7.9                 |
| Leu                             | 28.1               | 10.8                | 11.8            | 47.7                 | 21.2                |
| Lys                             | 24.2               | 19.9                | 16.4            | 38.8                 | 21.8                |
| Met                             | 23.0               | 21.8                | 101.4           | 60.5                 | 21.6                |
| Thr                             | 30.0               | 38.4                | 10.3            | 38.6                 | 18.3                |
| Phe                             | 37.3               | 32.9                | 97.1            | 38.6                 | 19.9                |
| Arg                             | 50.2               | 97.3                | 432.5           | 54.3                 | 179.6               |
| His                             | 20.3               | 36.0                | 46.9            | 29.9                 | 21.1                |
| Σess AAs                        | 305.3              | 305.3               | 780.2           | 412.3                | 330.3               |
| Non-essential proteinogenic AAs |                    |                     |                 |                      |                     |
| Gly                             | 14.0               | 7.8                 | —               | 14.7                 | —                   |
| Ala                             | 50.4               | 30.7                | —               | 77.4                 | 52.8                |
| Ser                             | 69.8               | 49.8                | 19.0            | 53.7                 | 18.5                |
| Asp                             | 74.9               | 47.7                | 25.2            | 22.9                 | 20.8                |
| Glu                             | 54.2               | 68.4                | 24.7            | 21.3                 | 18.6                |
| Asn                             | 279.0              | 279.4               | 174.8           | 111.2                | 72.4                |
| Gln                             | 5.4                | 9.2                 | 10.2            | 10.3                 | 8.5                 |
| Cys                             | 1.4                | 1.6                 | 1.4             | 3.0                  | 0.8                 |
| Tyr                             | 48.0               | 19.3                | 9.1             | 35.9                 | 16.6                |
| Pro                             | 504.6              | 385.5               | 1960.4          | 1036.8               | 773.9               |
| Σnon-ess AAs                    | 1101.7             | 899.4               | 2224.8          | 1387.2               | 982.9               |
| Non-proteinogenic AAs           |                    |                     |                 |                      |                     |
| GABA                            | 23.9               | 13.4                | —               | —                    | —                   |
| 4-Hydroxyproline                | 8.5                | 3.9                 | 6.7             | 10.7                 | 2.8                 |
| Cysteine                        | —                  | —                   | 18.1            | —                    | —                   |
| ΣAAs                            | 1439.4             | 1222.0              | 3029.8          | 1810.2               | 1316.0              |

TABLE 2. Total Content of Amino Acids in *Artemisia* Herbs, mg/100 g

| Amino acid                      | <i>A. vulgaris</i> | <i>A. abrotanum</i> | <i>A. annua</i> | <i>A. absinthium</i> | <i>A. austriaca</i> |
|---------------------------------|--------------------|---------------------|-----------------|----------------------|---------------------|
| Essential proteinogenic AAs     |                    |                     |                 |                      |                     |
| Val                             | 516.7              | 637.5               | 487.7           | 350.9                | 359.5               |
| Ile                             | 366.8              | 482.8               | 374.7           | 260.1                | 272.9               |
| Leu                             | 610.7              | 931.5               | 896.7           | 446.6                | 534.8               |
| Lys                             | 528.1              | 774.9               | 643.4           | 397.7                | 392.8               |
| Met                             | 67.6               | 95.4                | 548.2           | 126.1                | 72.0                |
| Thr                             | 455.4              | 710.1               | 626.1           | 386.3                | 427.5               |
| Phe                             | 459.1              | 655.0               | 716.4           | 327.0                | 356.7               |
| Arg                             | 757.0              | 1248.9              | 2165.0          | 597.0                | 892.8               |
| His                             | 248.1              | 367.8               | 399.7           | 202.7                | 252.7               |
| Σess AAs                        | 4009.5             | 5903.9              | 6857.9          | 3094.4               | 3561.7              |
| Non-essential proteinogenic AAs |                    |                     |                 |                      |                     |
| Gly                             | 441.6              | 714.3               | 751.1           | 375.3                | 439.6               |
| Ala                             | 547.6              | 920.6               | 835.9           | 509.7                | 598.9               |
| Ser                             | 525.6              | 655.3               | 599.8           | 420.3                | 417.8               |
| Asp                             | 1690.8             | 1579.9              | 1509.7          | 906.8                | 884.3               |
| Glu                             | 1076.5             | 1702.8              | 1454.9          | 830.2                | 923.4               |
| Asn                             | —                  | —                   | —               | —                    | —                   |
| Gln                             | —                  | —                   | —               | —                    | —                   |
| Cys                             | 12.5               | —                   | 25.3            | 11.4                 | —                   |
| Tyr                             | 331.5              | 478.8               | 479.7           | 295.0                | 322.8               |
| Pro                             | 1280.4             | 1233.8              | 2478.5          | 1480.4               | 1484.1              |
| Σnon-ess AAs                    | 5906.5             | 7285.5              | 8134.9          | 4829.1               | 5070.9              |
| Non-proteinogenic AAs           |                    |                     |                 |                      |                     |
| GABA                            | 49.8               | —                   | —               | 56.5                 | —                   |
| 4-Hydroxyproline                | 216.5              | 106.0               | 82.0            | 131.1                | 88.2                |
| Cysteine                        | —                  | —                   | —               | —                    | —                   |
| ΣAAs                            | 10182.3            | 13295.4             | 15074.8         | 8111.1               | 8720.8              |

## REFERENCES

1. *Plant Resources of the USSR: Flowering Plants, Their Chemical Composition and Use: Family Asteraceae* [in Russian], P. D. Sokolov, ed., Nauka, St. Petersburg, 1993, 352 pp.
2. A. M. Koval'ova, O. V. Ochkur, and A. O. Val'dovs'kii, in: *Collection of Scientific Works of Staff of P. L. Shupik National Medical Academy of Post-Graduate Education* [in Ukrainian], No. 18, Vol. 3, 2009, pp. 444–448.
3. T. I. Isakova, A. M. Koval'ova, O. V. Ochkur, N. V. Sidora, and O. M. Gritsenko, *Ukr. Biofarm. Zh.*, **1**, 62 (2010).
4. A. Jambor and I. Molnar-Perl, *J. Chromatogr. A*, **1216**, 6218 (2009).
5. *State Pharmacopoeia of the Russian Federation* [in Russian], 12<sup>th</sup> Ed., Vol. 1, Nauchnyi Tsentr Ekspertizy Sredstv Meditsinskogo Primeneniya, Moscow, 2008, p. 704.
6. J. L. Douglas, A. B. Heidi, and F. O. Sean, *J. Chem. Ecol.*, **26**, No. 7, 1749 (2000).