

## SUMMARY

### ***Stellaria media* (L.) Vill. and *Viola tricolor* L amino acids profile as environmental factors indicator**

Key words: free amino acids; weeds; LC-MS/MS; chromatography; soil properties

The presented doctoral thesis has a methodological and research character and consists of two stages. In the 1st stage, the method of determining free amino acids in fresh plant material was developed, using the technique of liquid chromatography and triple quadrupole mass analyser (LC-MS/MS). In the 2nd stage of the research, the developed method was used to assess the impact of habitat conditions on the content of free amino acids in the selected weeds often being valuable herbal material with beneficial properties for health.

The profile of free amino acids in *Stellaria media*, *Viola tricolor* and *Viola arvensis* was investigated. Despite the fact that the pool of free amino acids is on average 100 - 1000 times smaller than the amino acids built into proteins, their role in plant metabolism is very important. In addition to the protein building function, they are a material for the biosynthesis of other nitrogen compounds, such as nucleotides, phytohormones or secondary metabolites. There are over 300 amino acids in nature, 20 of which are considered proteinogenic. In the presented work, 19 of them were determined qualitatively and quantitatively, with the exception of cysteine.

The method for amino acids identification was optimized and validated. The optimization consisted of the sample preparation and selection of the chromatographic and mass spectrometer parameters. During the validation, the selection of ion transitions for each compound, calibration curve, precision, accuracy, LOD and LOQ was taken into account. The method was based on the guidelines contained in the documents: ICH Q2 (R1) (2005) and SANCO (2014). The developed method proved to be reproducible, reliable and sensitive, therefore it could have been successfully used in the second research stage for the determination of free amino acid profiles in the examined weeds.

In the second stage of research *Stellaria media*, *Viola tricolor* and *Viola arvensis*, originating from several natural habitats in the region of Lower Silesia, as well as grown under controlled conditions in the climatic chambers were investigated. Soils with different physicochemical properties, such as pH, granulometric composition, organic carbon, phosphorus and potassium content were the differentiating factor.

The studies showed that all three weed species always contained a full set of 19 amino acids. It was also found that a higher content of organic carbon and clay fraction, and hence a higher nitrogen content, resulted in the increase of the total amino acid content in the studied plants. Thanks to this, the content of free amino acids in weeds could serve as an indicator of the fertility of soils on which weeds are grown. In addition, it was found that soil conditions clearly differentiated the total level of total amino acids together, without affecting the percentage of individual amino acids in their total pool significantly, which remained relatively constant for each species. The dominant amino acids, with over 70% share in the pool of all 19 metabolites, were glutamine, glutamic and aspartic acid in the case of *Stellaria media*. In the case of the *Viola tricolor* and *Viola arvensis* - alanine and valine. In addition, it was found out that both *Violaceae* species were characterised by a greater proportion of essential amino acids than *Stellaria*, which exhibits their higher nutritional value.

The possibility of the future utility of the doctoral thesis results is mainly related to the use of the developed analytical method in various scientific research, mainly associated with monitoring oxidative stress in plants, which can be observed as changes in the amino acid profile. Another interesting issue may be the use of the method to monitor herbicidal stress.