WOLFFIA ARRHIZA — THE SMALLEST PLANT WITH THE HIGHEST ADAPTATION ABILITY AND APPLICATIONS

Summary

Wolffia arrhiza from the Lemnaceae genus is the smallest vascular plant, which is very expansive and reproduces intensively by gemmation under conditions of our climate. In Polish waters it is becoming more and more abundant, especially in small and shallow eutrophic reservoirs, rich in organic substances. The *W. arrhiza*'s morphological and anatomical structure underwent a high simplification process due to adaptation to the specific environment conditions. The atypical leaf-like body, called a frond, is a complex of tissues with only little differentiation, therefore the *W. arrhiza*'s organism resembles more the thallophytic algae than vascular plants. In unfavourable environmental conditions, especially in the winter and autumn, the frond changes to a resting form, which is called a turion. The plant is very resistant to the impact of various stress and toxic factors such as: temperature and pH fluctuations, xenobiotic pollution. In environment rich in organic substances, *W. arrhiza* changes a way of feeding from photoautotrophic into heterotrophic. Due to these properties, the plant is used more and more commonly in biotechnology of sewage treatment especially of municipal, agricultural and dairy origin, rich in aminoacids, proteins, sugars, organic nitrogen and phosphorus compounds. The wastes to which *W. arrhiza*'s culture become more easily clarified, the values of BOD_5, COD and organic compounds contents are reduced.

The *W. arrhiza*'s biomass is characterised by high accumulation of proteins (40–50%) in vegetative form (frond), the same amount of starch in turion and a variety of mineral compounds. Biochemical analysis revealed the occurrence of high level of cyanocobalamin (vitamin B_{12}) and hormones, steroid principally. Therefore it can be used as cattle fodder rich in proteins, starch, vitamins, hormones and mineral salts. *W. arrhiza* also may be taken advantage of in biotechnology to obtain biologically active compounds important for dietetics, phytotherapy and phytocosmetics.

The examination of the effect of some phytohormones on *W. arrhiza* metabolism shows that the plant reacts atypically to phytohormones, in comparison with other vascular plants and algae from Chlorophyceae which is probably due to its heterotrophic properties. Of auxins, the PAA (chemical analogue of IAA) was observed to have the most stimulating activity as compared with other IAA-treated plants. Salicylic acid also showed a strong effect on the plant growth, accumulation of organic components and net photosynthetic rate. The cytokinins, derivatives of adenine and urea, were found to have a stimulating effect on the growth and metabolism of *W. arrhiza* with varying intensity which can be explained by the large difference in their chemical structure. From among steroid hormones tested, β-estradiol and testosterone were shown to have the most stimulating effect on the growth, and content of nucleic acids and protein. On the other hand, the accumulation of monosaccharides was observed under the influence of corticosteroids: cortisone, 11-deoxycorticosterone and cortisole, this being analogical to the effect of these hormones on animal cells.