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The problem of the increased incidence of cancer, bacterial and viral diseases and antibiotic-resistant pathogenic bacteria, as well as the lack of effective cancer treatment methods entail serious consequences for human life and health. An important area of research focuses on seeking new therapies for diseases and therapeutic compounds that would be safe and easily available. Genetic engineering techniques offer an alternative and increasingly more common solution allowing for precise modification of organisms' traits, including those of plants.

In the present work, a carnivorous plant *Sarracenia purpurea* L., was introduced to *in vitro* cultures and then genetically modified using *Rhizobium rhizogenes* to obtain hairy roots. This transformation yielded seven composite plant lines, whose chemical composition was subsequently analyzed. The growth conditions of the obtained plants and the method of extracting compounds with pharmacological potential were optimized. The content of polyphenols, triterpenes, chlorophyll, and carotenoids, and antioxidant properties of extracts obtained from modified roots and green parts of composite plants were determined.

The next stage involved the selection of two lines with the best bioactive potential and testing them for antibacterial effect against human pathogenic bacterial strains (*Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus cereus*, *Escherichia coli*, *Salmonella typhi*). Next, cytotoxicity of the extracts towards healthy skin cells was assessed using a human keratinocyte cell line (HaCaT) and a human dermal fibroblast cell line (NHDF), as well as Chinese hamster ovary cell line. The anticancer effect of the plant extracts was determined for three cancer cell lines (pancreatic cancer, metastatic pancreatic cancer, cervical cancer).

The study showed that it is justified to introduce genetic modifications to *Sarracenia purpurea* L. to obtain hairy roots, since transformation resulted in plants displaying an increased accumulation of valuable compounds with health-promoting potential and significantly enhanced antioxidant properties. Furthermore, the extracts from modified plants did not show

cytotoxicity to healthy human cells, but they possessed an antiproliferative effect against pancreatic cancer cells and metastatic pancreatic cancer cells.

Keywords: *Sarracenia purpurea* L.; *Rhizobium rhizogenes*; biologically active compounds; *in vitro* cultures of plants; hairy roots; antibacterial properties; anticancer properties