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The Physiological Role of Secondary Metabolites in Cells of Higher Plants *in Vivo* and *in Vitro* (Formation, Protection from Pathogens, Viruses, and Other Stress Effects, Location, etc.)

Peculiarities of Secondary Metabolites Biosynthesis in Plant Cell Cultures

A.M. NOSOV*

Lomonosov Moscow State University, Russia, Moscow, Vorob'evi Gory, 1-12, Biology Department; Timiryazev Institute of Plant Physiology, Russia, Moscow, Botanicheskaya St., 35

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Plant cell culture is traditionally viewed as a unique artificially created biological system represented a heterogenous population of dedifferentiated cells. This system undergoes a continuous process of autoselection based on the intensity and stability of cell proliferation.

Obviously, secondary metabolism must be differ in cell culture compared to the plant *per ser*, because in cell culture metabolites are synthesized and compartmentalized within a single proliferating heterotrophic cell with sparse or underdeveloped vacuoles and plastids.

The specifics of formation and regulation of secondary metabolism biosynthesis in plant cells *in vitro* based on literature survey and our research results has been discussed.

We investigated secondary metabolites formation in plant cell cultures of *Panax spp.*, (ginsenosides); *Dioscorea deltoidea* (steroid glycosides); *Ajuga reptans*, *Serratula coronata*, *Rhaponticum carthamoides* (ecdisteroids*); Polyscias spp.*, (triterpene glycosides), *Taxus* spp. (taxoids), *Stevia rebaudiana* (diterpene steviol-glycosides), *Stephania glabra* (alkaloids). They are some regular trends of secondary metabolites synthesis in the plant cell culture:

It can be noted the stable synthesis of the compound promoting cell proliferation. Indeed, cell cultures of *Dioscorea deltoidea* were demonstrated to accumulate only furostanol glycosides, which promoted cell division. Furostanol glycoside content of *Dioscorea* strain DM-0.5 was up to 6 - 12% by dry biomass.

Panax ginseng and *P. japonicus* plant cell cultures synthesize as minimum seven triterpene glycosides (ginsenosides), the productivity of these compounds was up to 6.0 - 8.0% on dry biomass.

By contrast, the detectable synthesis of diterpene steviol-glycosides in cultivated cells of *Stevia rebaudiana* initiated in the mixotrophic cultures during chloroplast formation only.

Despite these differences, or mainly due to them, plant cell cultures have become an attractive source of phytochemicals in alternative to collecting wild plants. It provides a guideline to bioreactor-based production of isoprenoids using undifferentiated plant cell cultures.

*Corresponding Author Phone: (495) 939-21-18, E-mail: al_nosov@mail.ru

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