The Light Factor in Biotechnology Cultivation of Medicinal Mushrooms

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It has been proven that light is one of the main morphogenetic factors for growth and development of many cultivated mushrooms. However, the mechanism of photoreception in mycelium and fruiting bodies has not been sufficiently studied. Today the light of the visible part of the spectrum is used in technologies of submerged cultivation of filamentous fungi. It has been shown that light with wavelengths of 650 nm and 530 nm has essential influence on the growth regulators and activity on growth processes of these mushrooms and has modified the lipid and carbohydrate spore composition. The light-induced modifications had prolonged action and were transmitted to the following ontogenetic stages, from spores to mycelium. Infrared rays in definite doses cause the intensification of growth in culture of medicinal mushrooms *Coriolus vaporarius* (Pers.:Fr.) Bond. et Singer and *Serpula lacrimans* (Wulf. apud. Jacq.:Fr.) Schroet. The absence or existence of light influence during the period of vegetative mycelial growth affects the character of further bearing.

Laser techniques have also found practical application in biotechnology and are one of the most dynamically developing fields of investigation. The possible directed influence of laser radiation on intracellular processes and biosynthesis regulation is due to the selective influence of monochromatic light on the photosensitive structures, photoreceptors, and intracellular processes in microorganisms. One advantage of laser radiation is the chance to create high light brightness in a narrow range of wavelengths, not achievable with usual noncoherent light sources. Such properties allow us to investigate the possible realization of highly effective biotechnologies for obtaining microbial cultures with high biological activity. At the same time, the practical use of monochromatic light in biotechnological

processes is limited by the absence of information precisely determining mechanisms of light action, effective wavelengths, and irradiation modes.

Our preliminary investigations proved the stimulating effect of light in a visual part of the spectrum on the growth and development of some species of medicinal mushrooms (Poyedinok et al., 2002, 2003, 2004). We investigated the effect of helium-neon and argon laser irradiation on *Pleurotus ostreatus* (Jacq.:Fr.) P.Kumm., *Lentinus edodes* (Berk.) Singer, and *Hericium erinaceus* (Bull.:Fr.) Pers. production and determined that laser treatment accelerated mycelial growth, shortened the phases of mushroom development, produced more vigorous mycelium, and increased fruit body yields (36–51%). The activation of sowing mycelium by means of red light irradiation makes it possible to reduce the dose necessary for substrate inoculation by twofold. It was shown that laser irradiation also stimulated the mycelial growth in submerged culture and enlarged the accumulation of biomass twofold.

The influence of low-intensity laser light on antibiotic activity of *Pleurotus ostreatus* under submerged cultivation was investigated. The irradiation was carried out in two regimens: as continuous and intermittent light. Exposure doses were identical in both variants of experience. The irradiated mycelium was used as an inoculum in submerged cultivation. The antibiotic activity of cultural liquid was analyzed with the method of diffusion into agar medium. Eleven test organisms were used: *Staphyloccocus aureus, Bacillus mycoides, B. pumilis, Leuconostoc mesenteroides, Micrococcus luteus, Esherichia coli, Pseudomonas aeruginosa, Commamonas terrigena, Saccharomyces cerevisiae, Candida ablicans,* and *Aspergillus niger.* The antibiotic activity of mycelial and culture broth extracts against *Micrococcus luteus, Staphyloccocus aureus,* and *Bacillus mycoides* was increased by 10–20%.