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АКТУАЛЬНІ ПИТАННЯ БІОТЕХНОЛОГІЇ, ЕКОЛОГІЇ ТА ПРИРОДОКОРИСТУВАННЯ

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BIOLOGICAL ACTIVITY AGAINST PHYTOPATHOGENES OF *RHODOCOCCUS ERYTHROPOLIS* IMV Ac-5017 SURFACTANTS, SYNTHESISED IN THE PRESENCE OF YEAST INDUCER AND PHYTOHORMONE BIOSYNTHESIS PRECURSORS

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Introduction. One of the pressing issues of today is the use of toxic agrochemicals against phytopathogens in crop production, which poses risks of serious acute and chronic human poisoning, contamination of ecosystems, and the emergence of resistant strains. Phytopathogenes, most of which are capable of forming biofilms, represent a persistent threat to crop yield and the stability of food security [1, 2]. Bacterial diseases of agricultural crops have traditionally received less attention compared with fungal infections due to their lower prevalence; however, they can lead to up to 100 % yield losses and annual economic losses of up to USD 1 billion [3]. Microbial surfactants are considered a promising alternative to chemical pesticides due to their non-toxicity, biodegradability, and antimicrobial activity [4].

Previous studies have demonstrated that surfactants produced by *Nocardia vaccinii* IMV B-7405, synthesised in a medium supplemented with precursors of auxin (tryptophan) and gibberellin (erythritol) biosynthesis, exhibited antimicrobial activity against phytopathogenic bacteria [5, 6]. It has also been shown that the biological activity of *Rhodococcus erythropolis* IMV Ac-5017 surfactants can be significantly enhanced by the addition of *Saccharomyces cerevisiae* BTM-1 in different physiological states to the cultivation medium as a biological inducer [7].

The aim of this study was to evaluate the antimicrobial activity against phytopathogenic bacteria and the antibiofilm potential of surfactants produced by *R. erythropolis* IMV Ac-5017 in the presence of a yeast inducer and precursors of phytohormone biosynthesis.

Methodology. Cultivation of *R. erythropolis* IMV Ac-5017 was carried out in a liquid mineral medium containing 2 % (*v/v*) ethanol, tryptophan (300 mg/L) or erythritol (400 mg/L). Inactivated cells of *S. cerevisiae* BTM-1 were used as an inducer. The concentration of extracellular surfactants was determined gravimetrically after extraction using a modified Folch mixture. The antimicrobial activity of surfactants was assessed by the two-fold serial dilution method according to the minimum inhibitory concentration. The degree of biofilm disruption (%) was determined spectrophotometrically as the difference in cell adhesion of test cultures between untreated and surfactant-treated wells of an microplate. The following bacterial strains were used as test cultures for assessing the biological activity of surfactants: *Agrobacterium tumefaciens* UCM B-1000 and *Clavibacter michiganensis* subsp. *michiganensis* IMV B-10_2, obtained from the Ukrainian Collection of Microorganisms and the collection of living cultures of the Department of Phytopathogenic Bacteria of the D.K. Zabolotny Institute of Microbiology and Virology, NAS of Ukraine.

Results and their interpretation. It was established that the addition of inactivated cells of *S. cerevisiae* BTM-1 to a medium containing erythritol or tryptophan was accompanied by the synthesis of surfactants with higher biological activity against the studied phytopathogenic bacteria compared with that of preparations produced under similar conditions but without an inducer.

Thus, the minimum inhibitory concentration of surfactants produced by *R. erythropolis* IMV Ac-5017 in the presence of inactivated yeast cells and tryptophan was 0.78 µg/mL against *A. tumefaciens* UCM B-1000, which was 11.2-fold lower than that of surfactants obtained in a medium containing only the auxin biosynthesis precursor.

The antimicrobial activity against *C. michiganensis* subsp. *michiganensis* IMV B-10_2 of surfactants produced in a medium containing erythritol and inactivated cells of *S. cerevisiae* BTM-1 was 1.9-fold higher than that observed for preparations synthesised without the yeast inducer (minimum inhibitory concentrations were 1.17 and 2.81 µg/mL, respectively).

The degree of biofilm disruption of *A. tumefaciens* UCM B-1000 under the action of surfactants (3.75 µg/mL) produced in a medium containing tryptophan and inactivated yeast cells was 66.7 %, which was 23.2 % higher compared with the effect of surfactants obtained in the presence of tryptophan only.

Biofilm destruction of *C. michiganensis* subsp. *michiganensis* IMV B-102 reached 47–65.5 % upon treatment with surfactants (1.88–3.75 µg/mL) produced by *R. erythropolis* IMV Ac-5017 in the presence of an auxin biosynthesis precursor and inactivated *S. cerevisiae* BTM-1 cells, whereas under the action of surfactants obtained in the presence of erythritol only it did not exceed 18.1–27.1 %.

Conclusion. Therefore, the results of the study demonstrated the possibility of a significant increase in the antimicrobial and antibiofilm activity against phytopathogenic bacteria of *R. erythropolis* IMV Ac-5017 surfactants produced through the addition of inactivated cells of *S. cerevisiae* BTM-1 to a medium containing precursors of auxin- and gibberellin-type phytohormone biosynthesis.

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