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Mashkova A., Strashnova I.

ANTAGONISTIC EFFECT OF ACTINOBACTERIA ISOLATED FROM SPONGES *HALICLONA* SP. ON INDICATOR STRAINS OF PRO- AND EUKARYOTIC MICROORGANISMS

Odesa I. I. Mechnikov National University,
Dvorianska str., 2, Odesa, 65082, Ukraine
e-mail: nastyamashkova21082002@gmail.com

Abstract. *Studies of representatives of the Actinobacteria phylum remain relevant as the largest and most promising source of new antibiotic compounds. The aim of the study was to investigate the antagonistic activity of actinobacteria isolated from Haliclona sp. sponges against indicator strains of pro- and eukaryotic microorganisms. The antagonistic activity of 14 isolated strains of actinobacteria was determined by the block method after their preliminary cultivation on agarized medium Gauze 2. The antagonistic effect of actinobacteria was determined against 12 strains of indicator pro- and eukaryotic microorganisms. Almost all of the studied strains of isolated actinobacteria inhibited the growth of at least one strain of the indicator microorganism. The most sensitive to secondary metabolites of actinobacteria were indicator strains of all gram-positive bacteria, as well as Pseudomonas aeruginosa ATCC 27853 and Candida albicans ATCC 18804. Strains Actinobacteria Hal 2, Hal 4 and Hal 14 showed the best antagonistic activity against indicator microorganisms, which were selected for further studies.*

Keywords: *antagonistic activity, actinobacteria, Haliclona sp. sponges, indicator pro- and eukaryotic microorganisms.*

Introduction. Today, resistance to antibiotic substances and the emergence of multidrug-resistant microorganisms is a problem of global importance in both medicine and biology [4]. Various strategies are proposed to solve this problem, one of which is the isolation and screening of strains of microorganisms producing antimicrobial substances [3].

The main source of antibiotic substances with a diverse spectrum and mechanisms of action are representatives of the *Actinobacteria* phylum [1].

The aim of the study was to investigate the antagonistic activity of actinobacteria isolated from *Haliclona* sp. sponges against strains of indicator pro- and eukaryotic microorganisms.

Materials and methods. The object of the study was 14 strains of actinobacteria isolated from *Haliclona* sp. sponges collected in the waters of the Odesa Bay of the Black Sea in 2022.

The antagonistic activity of the isolated strains of actinobacteria was carried out by the block method after their preliminary cultivation on nutrient agarized medium Gause 2 at 30 °C for 12 days [2].

Activity was determined against indicator strains of gram-positive bacteria (*Staphylococcus aureus* ATCC 25923*, Micrococcus luteus* ATCC 4698*, Enterococcus faecalis* ATCC 29212*, Bacillus subtilis* ATCC 6633*, Kocuria rhizophila* DSM 348) and gram-negative bacteria (*Escherichia coli* ATCC 25922*, Proteus vulgaris* ATCC 6896*, Salmonella enterica* NCTC 6017*, Klebsiella pneumoniae* ATCC 10031*, Pseudomonas aeruginosa* ATCC 27853*, Pseudomonas putida* KT 2440), as well as the yeast-like fungus *Candida albicans* ATCC 18804. Daily cultures of indicator microorganisms were used, which were used to inoculate the semi-liquid LB medium. After that, blocks of actinobacteria were placed on inoculations of indicator microorganisms. Cultivated at the temperature optimal for each indicator strain. The results were recorded after 24 hours and 48 hours.

All studies were conducted in triplicate. The results were processed in Microsoft Office Exel-2010.

Results and discussion. The obtained data showed that all investigated strains, except *Actinobacteria* Hal 8, were active against at least one indicator microorganism. Sensitive to the tested strains of actinobacteria were the following indicator strains *B. subtilis, K. rhizophila, E. faecalis, M. luteus, S. aureus, P. aeruginosa* and *C. albicans*. The zones of growth inhibition of indicator microorganisms ranged from 13.2 ± 0.1 mm to 27.4 ± 0.2 mm and depended on the specific strain of both actinobacteria and the indicator strain.

In view of the obtained results, the indicator strains of gram-positive bacteria showed better sensitivity to the metabolites of the investigated strains of actinobacteria, which does not contradict the data of literary sources [2]. However, it is noteworthy that the sensitivity of strain *P. aeruginosa* ATCC 27853, which was inhibited by 10 studied strains of actinobacteria, was found. The greatest inhibitory effect was found in the *Actinobacteria* Hal 2 strain, under the influence of which the zone of no growth of *P. aeruginosa* ATCC 27853 was 27.4 ± 0.2 mm.

Actinobacteria Hal 2, Hal 4, Hal 5, Hal 6 showed antagonistic activity against the eukaryotic microorganism *C. albicans* ATCC 18804.

Among the tested strains of actinobacteria, there were those that inhibited the growth of more than 4 indicator strains. These are strains *Actinobacteria* Hal 2, Hal 4 and Hal 14, but the range of susceptibility of indicator strains to their metabolites was different.

Conclusions. Almost all of the studied strains of actinobacteria showed antagonistic activity to indicator strains of pro- and eukaryotic microorganisms. The most sensitive to secondary metabolites of actinobacteria were indicator strains of all gram-positive bacteria, as well as *Pseudomonas aeruginosa* ATCC 27853 and *Candida albicans* ATCC 18804. The best antagonistic activity against indicator microorganisms was shown by strains *Actinobacteria* Hal 2, Hal 4 and Hal 14, which inhibited the growth of a large number of indicator microorganisms with significant the zones of no growth. Strains *Actinobacteria* Hal 2, Hal 4 and Hal 14 were selected for further studies of the activity of their secondary metabolites.

Машкова А., Страшнова І.

АНТАГОНІСТИЧНИЙ ВПЛИВ АКТИНОБАКТЕРІЙ, ВИДІЛЕНИХ ІЗ ГУБОК *HALICLONA* SP. НА ІНДИКАТОРНІ ШТАМИ ПРО- ТА ЕУКАРІОТИЧНИХ МІКРООРГАНІЗМІВ

Одеський національний університет імені І. І.Мечникова,
вул. Дворянська, 2, Одеса, 65082, Україна,
e-mail: nastyamashkova21082002@gmail.com

Анотація. *Дослідження представників філуму Actinobacteria не втрачають своєї актуальності як найбільш велике і перспективне джерело нових антибіотичних сполук. Метою роботи було дослідити антагоністичну активність актинобактерій, виділених з губок Haliclona sp., до індикаторних штамів про- та еукаріотичних мікроорганізмів. Антагоністичну активність 14 виділених штамів актинобактерій визначали методом блоків після попереднього їх культивування на агаризованому середовищі Гаузе 2. Антагоністичний вплив актинобактерій визначали до 12 штамів індикаторних про- та еукаріотичних мікроорганізмів. Майже усі досліджені штами пригнічували ріст хоча б одного штаму індикаторного мікроорганізму. Найчутливішими до вторинних метаболітів актинобактерій були індикаторні штами всіх грампозитивних бактерій, а також Pseudomonas aeruginosa ATCC 27853 та Candida albicans ATCC 18804. Найкращу антагоністичну активність щодо індикаторних мікроорганізмів проявили штами Actinobacteria Hal 2, Hal 4 та Hal 14, які відібрані для подальших досліджень.*

Ключові словаs: *антагоністична активність, актинобактерії, губки Haliclona sp., індикаторні про- та еукаріотичні мікроорганізми.*

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