New strains of bacteria that degrade aromatic compounds act as antagonists of highly active phytopathogens

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Soil is

a special natural body that is formed on the surface of the Earth as a result of the interaction of living (organic) and dead (inorganic) nature.

The most important property of soil that distinguishes it from rocks is fertility.

Soils are formed very slowly: over 100 years, the thickness of the soil increases by 0.5-2 cm (https://geographyofrussia.com/pochva/).

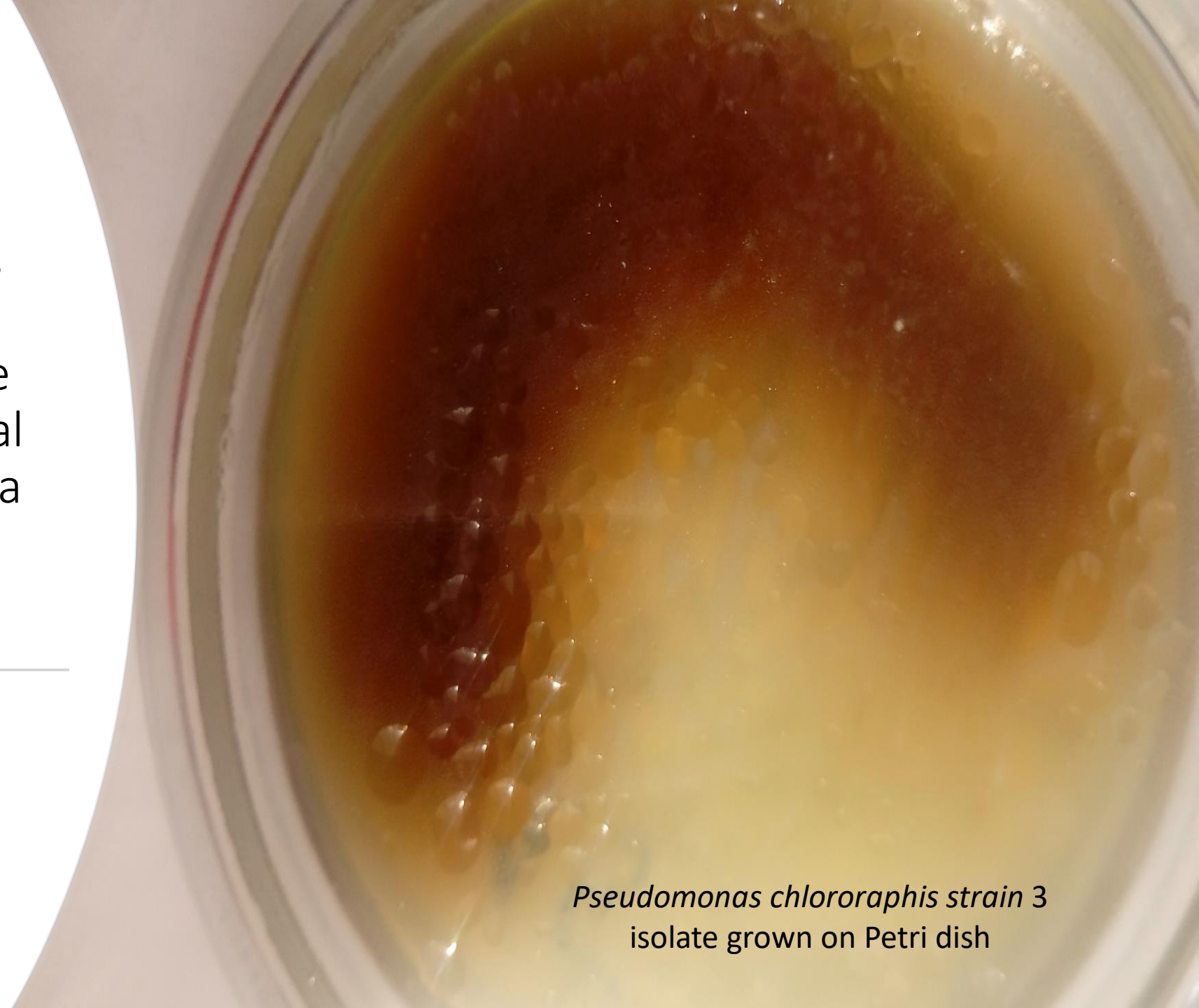
Where are you, organic farming?

A way to get the crop

Research fields of soil microbiology:

- the assessment of the general state of microbial systems;
- seasonal fluctuations in the biomass of microbiocenosis;
- the spread of microorganisms of various taxonomic groups in soils of different types;
- the study of the effect of anthropogenic load on the change in abundance and the diversity of soil microorganisms;
- the study of rhizosphere microorganisms, including bacteria that stimulate plant growth (plant growth promoting rhizosphere bacteria);
- the features of the interaction of microorganisms with the host plant are revealed;
- the mechanisms of the positive effect of bacteria on plants, etc.

The aim of this work was to search for new microbial strains that are applicable for agricultural production and possess a complex technologically significant potential.

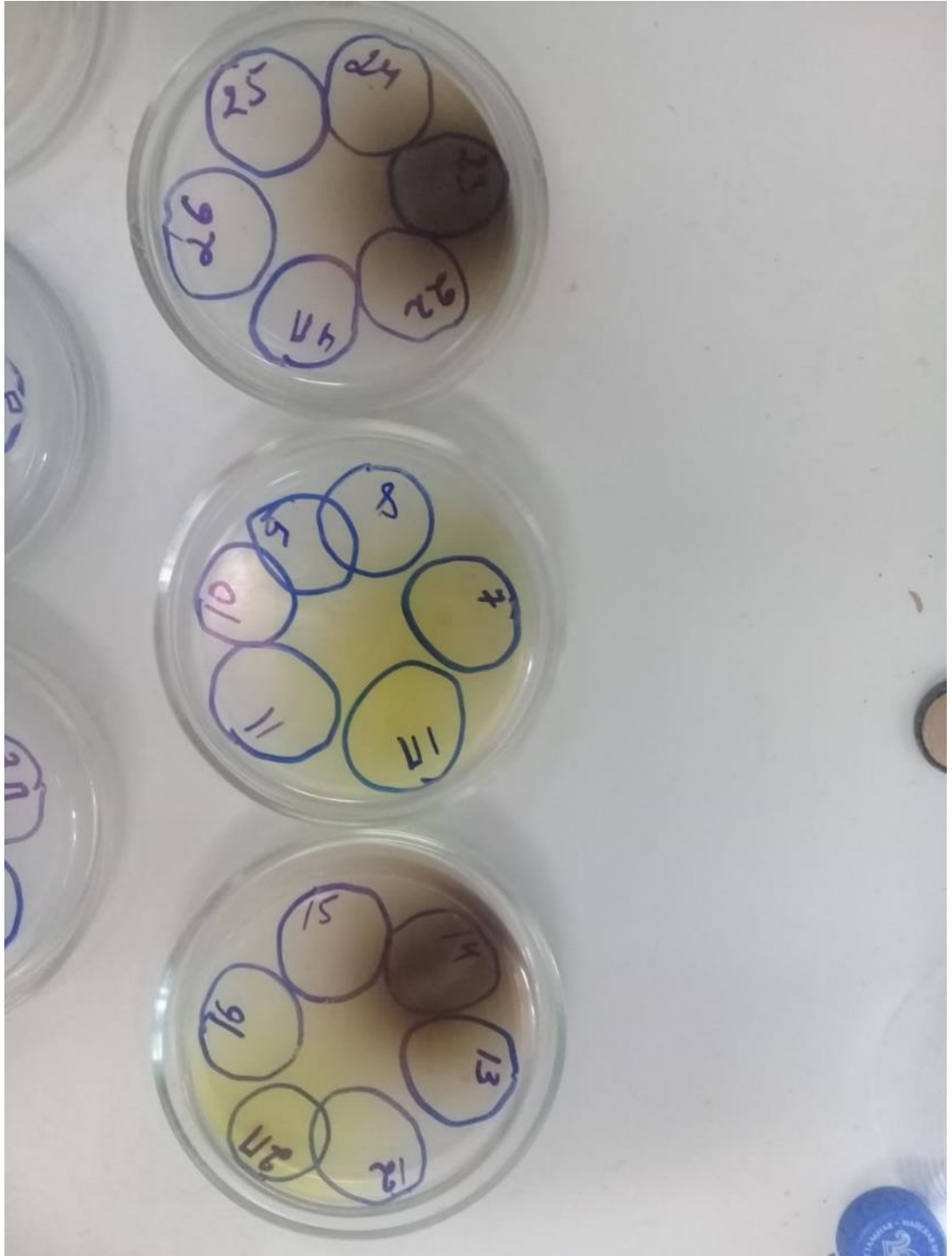


Pseudomonas chlororaphis strain 3 isolate grown on Petri dish

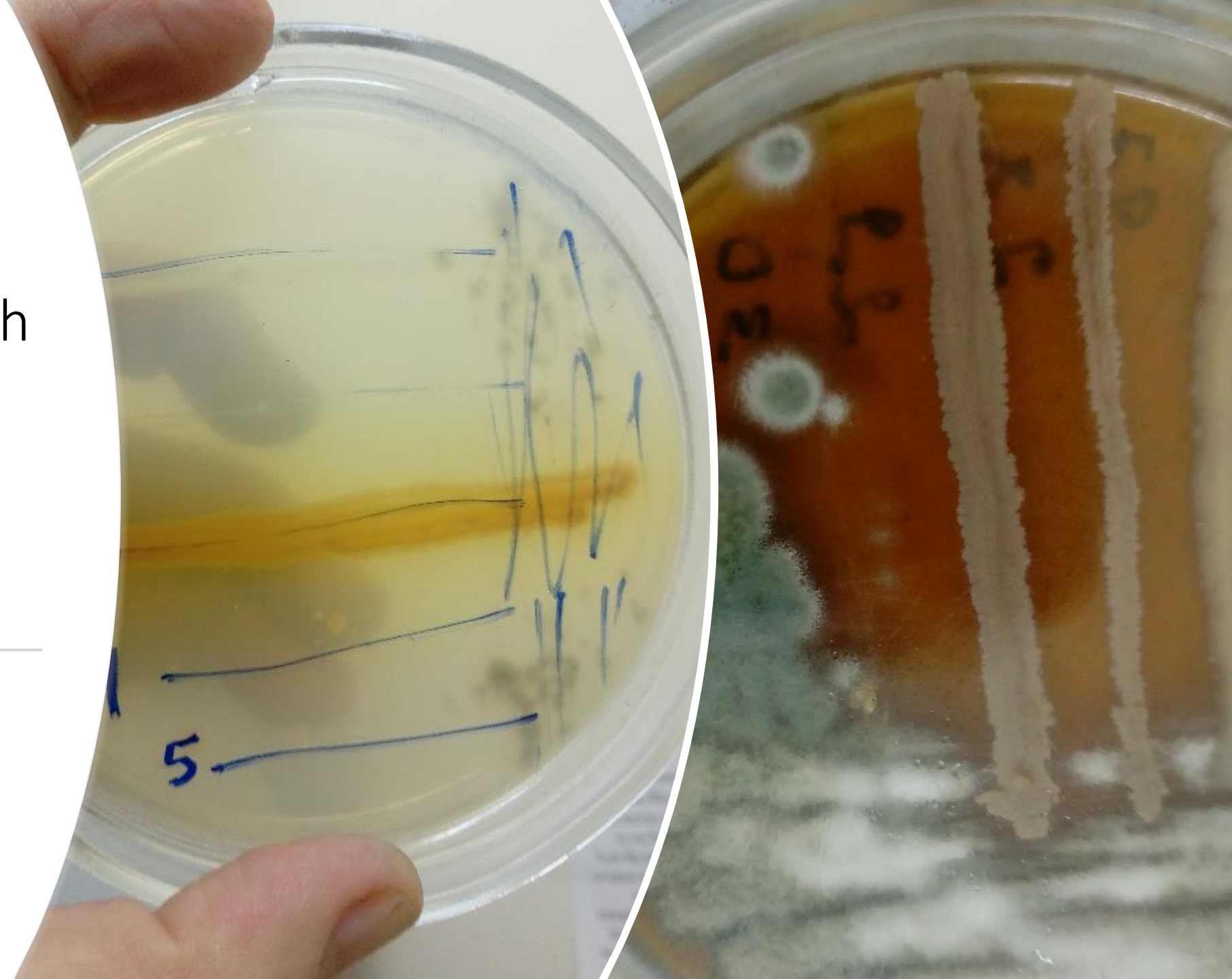
How was it done?

1. The ability to destroy organic compounds was checked

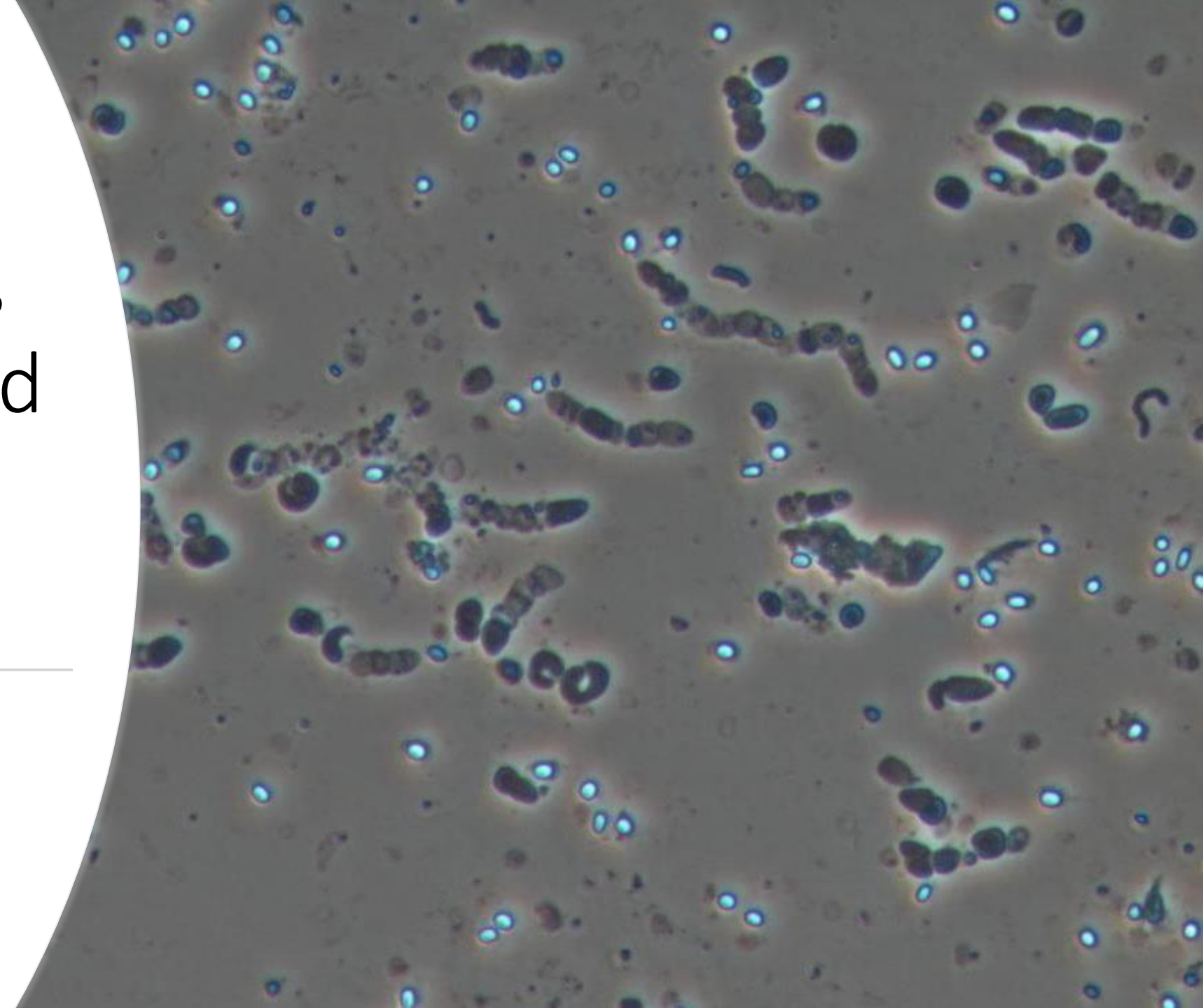
When bacteria are grown on medium with benzoate, the yellow color of the medium indicates a *meta*-cleavage of catechol,
black color means the formation of hydroquinone. The lack of color indicates the *ortho*-cleavage of catechol.
In the present study, none of the isolated bacteria degraded benzoate via *meta*-cleavage pathway.



2. The ability to control the growth of phytopathogenic fungi has been evaluated



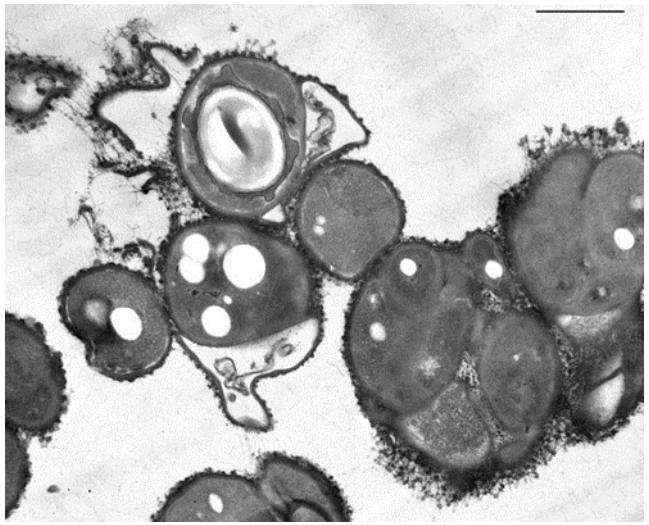
3. The isolates were examined using microscopy



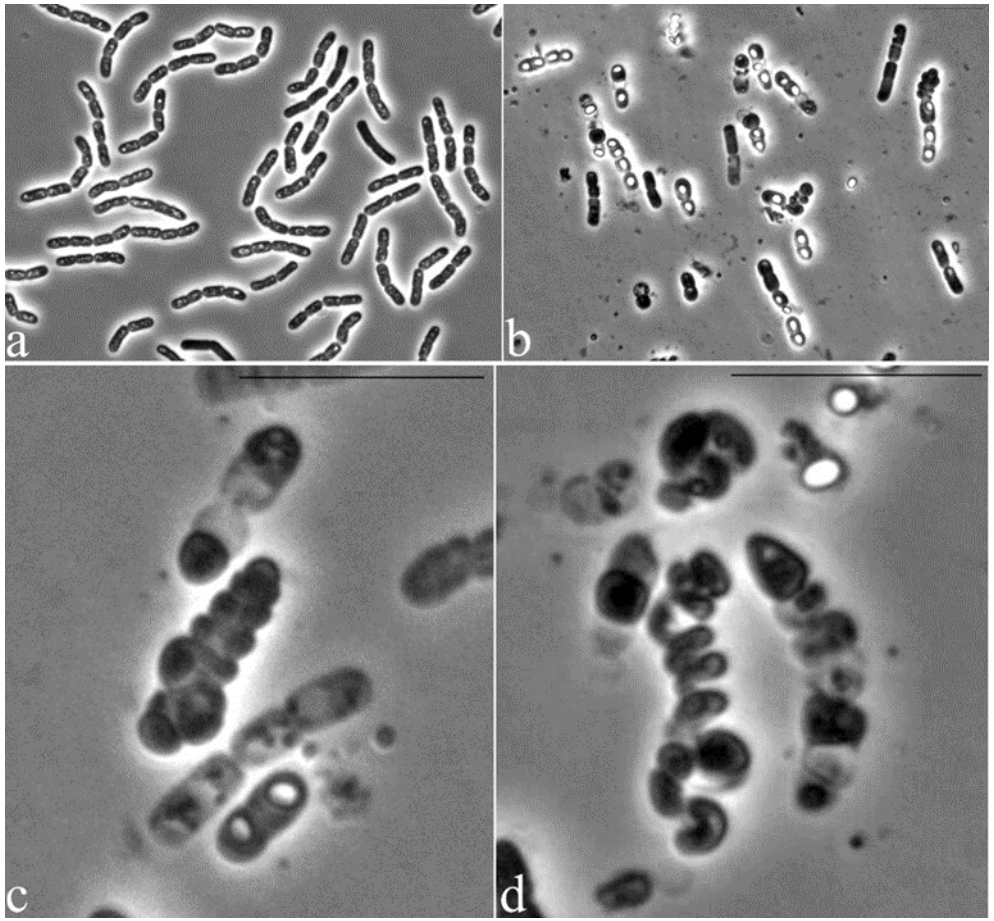
4. The most interesting and promising strains were identified based on the results of 16S rRNA gene sequencing

Strain	Identification according 16S rRNA gene sequencing	Phytopathogen suppression zone, mm		
		F. graminearum	*R. solani*	*G. g. tritici*
3	*P. chlororaphis*	3 ± 1	2 ± 1	2 ± 1
18	*B. subtilis*	≤1	– [1]	–
27	*B. subtilis*	≤2	–	–
28	*B. subtilis*	≤2	–	–
P. chlororaphis BS1393		2 ± 1	3 ± 1	2 ± 1
25	*Bacillus aryabhattai*	–	–	–

5. Bacterium *Bacillus aryabhattai* 25 with unique morphological features were studied by morphometric analysis of phase contrast images of the cells



Ultrathin section of cleaving cells of *Bacillus aryabhattai* str. 25 in a conglomerate (bunch). Some cells in the conglomerate are ultrasmall (less than 300 nm in diameter). Transmission Electron Microscopy. Bar – 1 µm



Bacillus aryabhattai str. 25 in the exponential growth phase (a - 1 day of growth; b - 2 days of growth). Light microscopy. Phase contrast. Bar – 10 µm

Conclusion:

- Number of bacterial strains were isolated from the soil according to their ability to decompose benzoate.
- Some of these strains have proven to be antagonists of fungal phytopathogens. Particularly noteworthy is the *P. chlororaphis* 3 strain, which was characterized by a pronounced ability to control the growth of fungal phytopathogens with comparable efficiency with the best bacterial strains used in biological products.
- The conducted microscopic studies made it possible to find the *Bacillus aryabhattai* strain 25, which significantly differs in its cytological and morphological characteristics from all known representatives of this genus.
- Thus, both biotechnologically significant strains and strains reflecting the microbial diversity of soil microflora were obtained. Further studies of their properties are ongoing.

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