CZU: 579.64+606(477) https://doi.org/10.53040/ppap2023.26

GENE RESOURCE OF INDUSTRIALLY IMPORTANT MICROBIAL CULTURE COLLECTION FOR AGRICULTURE BIOLOGIZATION

LOBAN Liudmyla*, PILYAK Nina **, YAROSHEVSKY Vladislav***
Engineering and Technological Institute "Biotekhnika" of the National Academy of Agrarian Sciences of Ukraine
**https://orcid.org/ 0009-0001-4437-4480,*
***https://orcid.org/ 0000-0002-5074-4011,*
****https://orcid.org/ 0000-0002-1905-2092,*
e-mail: biotechnica.od@gmail.com

Summary. The article is dedicated to describing the gene resource of Industrially Important Microbial Culture Collection for Agriculture Biologization of Engineering and Technological Institute "Biotekhnika" of the National Academy of Agrarian Sciences of Ukraine, which holds the status of the Ukrainian National Asset. The Collection includes known industrial microbial strains with antagonistic, entomocidal, rodenticidal, nematocidal, and cellulosolytic properties. There are natural isolates that can transform insoluble phosphorus and ones are phytohormones producers in the Collection. The Collection can serve as a ground of experience exchange for scientists and specialists working in the field of plant protection, as well as for educating students' biologists, biotechnologists, and agronomists.

Keywords: *strains, microorganisms, gene recourse, natural isolates, collection, national asset.*

Introduction. The primary objective of creating microbial collections is to preserve biological and functional diversity in specific fields [1]. Several large microbial collections specialized in agricultural microbiology exist in Ukraine [2]. However, the Collection Engineering and Technological Institute "Biotekhnika" of the National Academy of Agrarian Sciences of Ukraine (ETI "Biotekhnika" NAAS), is unique in that it specializes in microorganisms collecting used for developing biological plant protection agents [3].

The Institute Microbial Collection formation began in 1992 from 12 microbial strains. The Collection's main function at that time was to ensure Ukrainian regional biofactories and biolaboratories by commercial batches of stock microbial cultures. The present-day Collection includes 134 strains of

bacterial and fungal cultures with a variety of specific properties. The microbial cultures capable to produce bioactive substances suppressing plant pathogens or infectious agents responsible for diseases in harmful insects are the basis of the Collection [3]. Exactly these cultures are crucial for developing new as well as manufacturing known microbial pesticides.

Materials and Methods. The Microbial Collection maintenance's main goal is to search, accumulation, study, and preservation of microbial strains with agronomical important properties for effective use in scientific, educational, and practical purposes [1, 4].

The storage objects are bacterial and fungal strains with different action selectivity.

Commonly accepted techniques and methodological approaches employed in microbiology and biotechnology are used in the Collection maintenance [4, 5]. All microbial cultures maintain by periodic seeding method on an agar-based growth medium [5]. The work with the collection involves pure culture obtaining, microorganisms cultivating on different nutrient media and growth characteristics study, and also their cultural and biochemical properties research, etc. [3, 4].

Results and Discussion.

The Collection Structure

The gene resource of the Collection includes 134 microbial strains (Fig. 1). 71 strains are known industrial microbial strains with agronomical important properties (fungicidal, insecticidal, rodenticidal, nematocidal) [3, 4]. 12 strains belong to well-known phytopathogens of the genus *Sclerotinia*, *Fusarium*, *Botrytis*, *Alternaria*, etc. [3]. These microorganisms are used in studies as test objects. And 51 strains are the natural isolates of the different genus (Bacillus, Pseudomonas, Entorobacter). These strains represent a potential basis for new biopesticides creation.

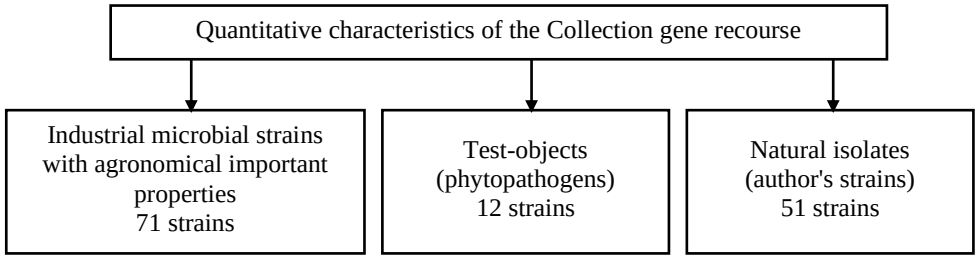


Figure 1. The structure of the ETI "Biotekhnika" NAAS Microbial Collection

Microbial Collection Maintenance

The requirement for modern biotechnological advancements effective using is the availability of stable genotype industrial strains. Therefore, a crucial aspect of working with the Collection lies in executing and improving methods for the preservation of microbial culture on various substrates and for different storage periods.

A significant portion of the research is dedicated to searching for new microorganisms capable of biomass accumulating with high titer of living microbial cells, which often correlated with bioactive substances producing.

Another important aspect of the work involves natural isolate searching that can be used in the development of novel plant protection agents. This process includes isolating microorganisms from natural sources, identifying them, and subsequently carrying them into the Collection, in the case their characteristics correspond to the Collection's profile (Fig. 2). Subsequently, biological preparations based on these natural isolates are developed, and their properties are studied.

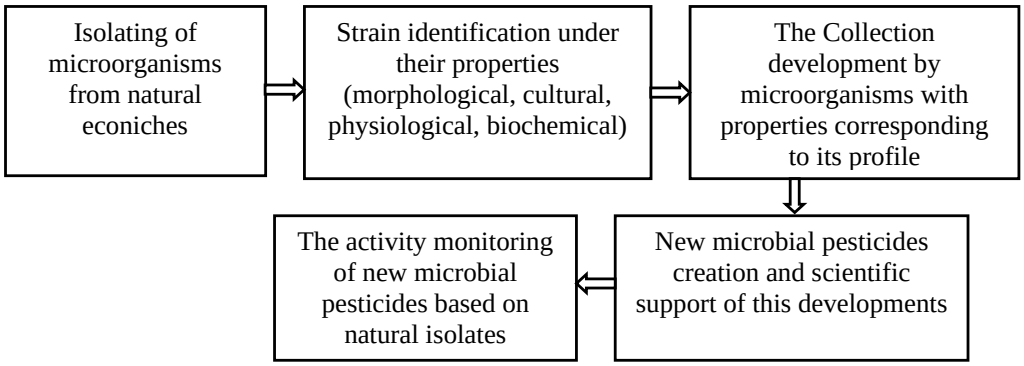


Figure 2. Algorithm for creating new microbiological plant protection products based on natural isolates

Preparations Based on Collection Cultures

Collection cultures are the foundation for effective microbial preparation development with a diverse range of actions. Their application improves agricultural products' quality, enhancing plant resistance to diseases, pests, and stressful factors, as well as increasing productivity. More than 20 microbial preparations based on monocultures have been developed in ETI "Biotekhnika" NAAS [4].

It is worth noting that 12 microbial strains from the Institute Collection were hygienically regulated at the Institute of Microbiology and Virology named after D.K. Zabolotny. It resulted in the conclusion of their toxicological properties. These microbial cultures have been deposited in the Ukrainian Collection of Microorganisms [6]. Now these strains formed the basis of effective microbial preparations, and some of them are without parallel (Table 1).

Table 1. Strains deposited in the Ukrainian Collection of Microorganisms and microbial preparations based on them

No.	Biological agent	Number in the Ukrainian Collection	The microbial preparations based on the deposited strains	Spectrum of action
1	*Arthrobotrys oligospora it. 12*	F-100047	Nematofagin BT	Nematocide
2	*Bacillus thuringiensis var. kurstaki it. Btr-4*	B-7173	Becimid BT	Insecticide
3	*Beauveria bassiana it. 71661*	B-100051	Boverin BT	Insecticide
4	*Beauveria bassiana it. 3300*	B-100044	Boverin BT	Insecticide
5	*Verticillium lecanii it. C-3*	F-100045	Verticillin BT	Insecticide
6	*Metarhizium anisopliae it. МАЛИ*	F-100090	Metarizin BT	Insecticide
7	*Microbacterium barkeri it. ЛІП-1*	B-7691	Organobiophos BT	Organic fertilizer
8	*Pseudomonas aureofaciens it. 5*	B-7690	Biospectrum BT	Insect fungicide
9	*Pseudomonas fluorescens it. AP33*	B-7206	Planriz BT	Fungicide and growth promoter
10	*Pseudomonas fluorescens it. 2*	B-7533	Fluorescin BT	Fungicide and growth promoter
11	*Salmonella enteritidis var. Issatschenko it. K-28*	B-7207	Bactorodencid BT	Rodenticide
12	*Trichoderma viridae it. T-4*	B-100046	Trichodermin BT	Fungicide and growth promoter

In recent years research efforts have been focused on the development of complex preparations including mutual tolerant collection strains [7]. These studies have resulted in the creation of five new microbial preparations: Biogipervit BT, Biodestructor BT, Bioget BT, Vitastim BT, and Trikhopsin BT. These preparations combine various beneficial properties of the original cultures, such as insecticidal, fungicidal, growth-promoting, etc., The crucial difference between these preparations from tank mixtures is the coculturing of microorganisms

Conclusions:

The unique microbial collection, intended for the development of efficient agents for biological control of pests, pathogens, and plant growth promotion, as well as for the creation of novel organic fertilizers, has been collected at ETI "Biotekhnika" NAAS. The gene resource of the Collection is continuously enriched with both natural isolates and industrial strains. Thus, the Institute Collection has the potential to serve as a ground for scientific and creative collaboration among researchers and specialists engaged in plant protection.

By Cabinet of Ministers of Ukraine Decree No. 1243 dated 04.11.2022, the ETI "Biotekhnika" NAAS Collection has been recognized as the national asset of Ukraine. This recognition raises hope for the sustained preservation of the collection's microorganisms in viable and genetically stable conditions, even amidst times of armed conflict.

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