CZU: 631.461:633.491 https://doi.org/10.53040/ppap2023.75

BACTERIUM COMPLEXES *PSEUDOMONAS FLUORESCENS* AND MATTERS OF STIMULATING NATURE IMPACT ON POTATO DEVELOPMENT

SOLOMIICHUK M.[1]* PIKOVSKYI M.[2]**
[1]*Ukrainian science-research plant quarantine station IPP*
[2]*National university of life and environmental sciences of Ukraine,*
**https://orcid.org/0000-0001-7394-0333,*
***https://orcid.org/0000-0003-0689-604X*
e-mail: ukrndskr.zam@gmail.com

Summary. The bacterium strain AP-33 Pseudomonas fluorenscens was the researches subject. The derivatives of ammonium salts of dihydropirymidine did not show toxic action on concentration decrease of viable cells of bacterium strain AP-33 Pseudomonas fluorescens. All biocomplexes combinations showed preparations efficiency against diseases in the scope 59,31-69,63 %. The best yield on potatoes was shown by the combination of AP-33 strain of Pseudomonas fluorescens bacteria, 3x109 CFU/cm3-5 l/ha+0.1% ximedon solution+0.2% succinic acid solution+2 ml of DMAE+2 ml of DMSO, which amounted to 3,4 t/ha. The combination 's efficiency against late blight consisted of 79,1 %.

Keywords: *biological agents; pests; biological preparation; stimulator; the effectiveness of the drug.*

Introduction. The main part of modern agricultural crops protection systems is based upon thechemical means usage. So the ecologiiation became the peculiarity for plant protection. So it is necessary to manage the number of pest population on the level of pest threshold with their natural antagonists and biolofical means usage [1, 2, 3].

The usage of biological methods, e.g. biological preparations increases together with chemical, agrotechnical and mechanical ways for pest management. The biological preparations usage allows to optimize the scope of chemical means usage. So they allowed to receive the best result. It opens the possibility for active competition. [1, 3, 4].

Potato is a valuable feed for manufacturing spirit, starch, glucose, dextrin and other important production for economy. [5, 6].

The serious lack of chemical means for plant protection are at first the pollution of environment. The dangerous for pesticide penetration in food, the weak selectivity of toxical action onnot only on pest,but useful biota, These actions come to developing resistance among the pests and diseases' causative agents. So it needs to look for alternative ways, characterized by more positive social and ecological indexes. So the biological method has a great perspective. It is based upon the viable organisms usage and their metabolism products usage for pests decrease with following creation favorable conditions for agrocenose favorable species, [3, 5, 7].

Purpose is to analyze the biocomplexes combinationson the bacterium base *Pseudomonas fluorescens* with preparations of stimulation matter and different derivatives of ammonium salts dihidropyrimidine and their efficiency study,

Materials and methods. Literary sources and previous years experiments showed that low concentrations of metoxicarbonyll dihidropyrimidine showed high antioxidant properties. 3,4-dyhidropyrimidine-2(1H) pay researcher's attention as stimulating effect on the plant. The present matters are low toxic. It allows to research the their usage together with biological preparations. 3,4-dyhidropyrimidine -2(1H) paid researchers attention, as systems with expressed complex of stimulating and antioxidant activity during two last decades [8, 9]. Bacterium *Pseudomonas fluorescens* researched in combinations with cathiogenic derivatives metoxycarbonyll dyhidroperimdine in low concentrations.

The investigations of metoxycarbonyll dyhidroperimidine cathiogenic derivatives were:

- Derived groups of dyhidropirimidine ammonia salts in sixth state of quarterly ammonium group and differed with nature of exchanger in quarter state (amine1, amine2, amine 3).
- Ximedon-hydroksyldimethylhydropyrimidin/

The succninic (amber) acid – ethane-1,2dicarboxylic acid $HOOC(CH_2)_2COOH$ – colorless crystal powder used in combinations preparations on the bacterium base *Pseudomonas fluorescens* and preparations group of dyhidropyrimidne ammonium salts. It impacts on soils microbiota. The acid consists of 99,72 % basic matter, 0,0001 %- phosphates, 0,00044 % – iron, 0,0076 % – sulfur acid and 0,00082 % chlore. The auxiliary substances researched too. *Dimethyl sulfoxide* (DMSO) is a chemical matter with formulae

-$(CH_3)_2SO$, bipolar solvent. It is used for trans tissue remove of active matters. *Dimethylethanolamine* (DMAE). It used as immunoprotector, It impacts on different transmembrane functions.

Preparations studied separately and in treating complexes during growing. The common approved techniques for diseases determining used during fungi infections determining and identification, The experiments put up, records providing and observation conducting provided as per generally approved techniques. [10].

Results and discussions. The concentration of viable cells in biocomplexes with input matters in ready preparation analyzed for determining possible toxic impact of stimulating matters order and dyhidropyrimidine ammonium salts on bacterium strain AP-33 *Pseudomonas fluorescens*.

It was noticed by the researches results that the concentration of bacterium *Pseudomonas fluorescens* viable matters in prepared biocomplexes were not less than recommended rate. We looked the possibility of dimethylsulfoxide and dimethylethanole usage for active matters transtissue remove. The study of combinations of bacterium strain AP-33 *Pseudomonas fluorescens* with auxiliary substances ДМАЕ and ДМСО usage conducted for biocomplex function increase. The ДМАЕ and ДМСО usage allowed to provide titer of viable cells concentrations of bacterium *Pseudomonas fluorescens* in scope 3,01 x 10^9 cells/cm^3. The researches results allowed them to recommend for the following biological complexes forming.

The concentration titer of viable cells of bacterium *Pseudomonas fluorescens* were in the scope of *3,0-2,7 10^9* cells/cm^3in all combinations, except Biginells combinations. The lowest deviation from the standard characterized combination *Pseudomonas fluorescens with* 0,1 % xymedon solution+0,2% succinic acid solution+2 ml DMAE+2ml DMSO. At this variant, the titer of viable cells consisted of 2,97 x 10^9 cells/cm^3 even on 15^{th} day of control. The following combination *Pseudomonas fluorescens* + 0,2 % succinic acid solution + 2 ml ДМАЕ + 2 ml ДМСО showed the highest titer of viable cells *Pseudomonas fluorescens*. Their concentration consisted of 2,95 x 10^9 cells/cm^3, and *Pseudomonas fluorescens* + 0,1 % ximedon solution + 2 ml ДМАЕ + 2 ml ДМСО – 2,92 x 10^9 cells/cm^3. It conforms that chosen combinations have no toxic synergy and negative effect on bacterium.

The preparation on the base of bacterium *Pseudomonas fluorescens* with titer in the scope 3 x 10^9 CFU/cm^3. They used in rate 5,0 l/ha. The examination

conducted on of preparation combination impact with stimulating and auxiliary substances on growing indexes and their efficiency against diseases.

The growing indexes of height and quantity of plants stems observed during the biocomplexes usage. They were higher in comparison with control. The usage of stimulating matters provided increase of seed fraction during potato gathering.

The forming of seed fraction highest quantity recorded during the following complex usage Pseudomonas fluorescens – 5 l/ha + 0,1 % ximedon solution + 2 ml DMAE + 2 ml DMSO. The best index showed the combination Pseudomonas fluorescens – 5 l/ha + 0,2 % succinic acid solution+ 2 ml DMAE + 2 ml DMSO. It allowed to increase the potato yield in 1,89 times. In compare with control (table 1).

1. Preparations efficiency study on the base of bacterium Pseudomonas fluorescens in combination with matters of ammonium salts group dihidropyrimidine and stimulating matters on potato growing indexes (field trial, variety Glazurna, 2019-2020).

Researches variants	Plants' height, cm	Ave-rage num-er of stems, pcs.	Tubers quantity in one bush (pcs/plant)			Tubers' weight, g/plant	Yield t/ha
			comm odity item	seeds fractio n	Non-conditi onal		
control 1 (without treating):	31,1	2,8	1,3	3,6	7,3	184	6,8
control 2 Pseudomonas fluorescens – 5 l/ha	30,8	2,9	2,8	4,5	5,9	201	8,7
Pseudomonas fluorescens – 5 l/ha + 2 ml DMAE + 2 ml DMSO	31,8	2,7	3,2	4,8	6,1	242	9,1
Pseudomonas fluorescens – 5 l/ha + 0,2 % succinic acid solution + 2 ml DMAE + 2 ml DMSO	36,4	2,9	6,9	7,8	7,5	286	11,6
Pseudomonas	31,4	3,1	3,5	5,6	6,4	256	9,8

fluorescens – 5 l/ha derivatives dihidropyrimidine (amin 1 – 0,5 % solution + 2 ml DMSO)							
Pseudomonas fluorescens – 5 l/ha +dihidropyrimidine derivatives (amin 3 – 0,25 % solution + 2 ml DMSO)	32,3	3,6	4,8	4,9	8,4	261	10,3
Pseudomonas fluorescens – 5 l/ha + 0,1 % ximedon solution + 2 ml DMAE + 2 ml DMSO	30,4	3,5	5,8	11,2	7,2	289	11,8
Pseudomonas fluorescens – 5 l/ha + 0,1 % xymedon solution + 0,2 % succinic acid solution + 2 ml DMAE + 2 ml DMSO	33,7	3,6	6,8	10,8	9,5	292	12,9
LSD_{05}	0,8	0,07	0,1	0,13	0,18	2,5	0,3

The DMAE and DMSO usage in combination with bacterium *Pseudomonas fluorescens* did not impact on plants growing indexes and their fluctuation towards control. The present indexes differed from control in scope of standard error. But their usage allowed to increase the preparations efficiency against fungi diseases on 8,7-15,4 % towards clean preparation on the bacterium base *Pseudomonas fluorescens*.

The preparation efficiency combinations fungicide analysis based upon bacterium *Pseudomonas fluorescens* with stimulating matters showed thereally true indexes for different combinations. It is caused the different effective interaction. The preparations efficiency was in the scope from 67% through

88%. The combination Pseudomonas fluorescens – 5 l/ha + 0,1 % xymedon solution + 0,2 % succinic acid solution + 2 ml DMAE + 2 ml DMSO. The preparations efficiency consisted of 88,1%.(table2).

2. The preparations efficiency based upon the bacterium Pseudomonas fluorescens in combination with ammonium salts groups dyhidropyrymidine and stimulating matters on potato's fungi diseases intensity appearing(field trial, variety Glazurna, 2019-2020)

Experiments' variant	Glazurna		
	Potato late blight		
	Plant defeating, %	Disease development, %	Efficiency, %
control 1(without treating);	68,4	32,7	-
Control 2 Pseudomonas fluorescens – 5l/ha	36,5	11,2	65,7
Pseudomonas fluorescens – 5 l/ha + 2 ml DMAE + 2 ml ДМSO	33,8	10,7	67,3
Pseudomonas fluorescens – 5 l/ha + 0,2 % succinic acid solution + 2 ml DMAE + 2 ml DMSO	28,1	6,2	81,0
Pseudomonas fluorescens – 5 l/ha dyhidropyrimidine derivatives (amin 1 – 0,5 % solution + 2 ml DMSO)	25,4	7,5	77,1
Pseudomonas fluorescens – 5 l/ha + dehidropyrimidine derivatives (amin 3 – 0,25 % solituion + 2 ml DMSO)	27,9	8,7	73,4
Pseudomonas fluorescens – 5 l/ha + 0,1 % ximedon solution + 2 ml DMAE + 2 ml DMSO	24,3	5,1	84,4
Pseudomonas fluorescens – 5 l/ha + 0,1 % ximedon solution + 0,2 % succinic acid solution + 2 ml DMAE + 2 ml DMSO	17,9	3,9	88,1

Conclusions. All biocomplexes usage showed preparations efficiency against diseases in scope 67,3-88,1 %. The usage of auxiliary substances ДМАЕ and ДМSO allowed to increase the preparations efficiency on 8-25 % in

compare with combinations without their usage, These substances have impact on transmembrane functions. The yield increased in 1,7 times in comparison with control by the resultsof biocomplexes usage. The preparation based upon Pseudomonas fluorescens at rate 5 l/ha + 0,1 % xymedon solution + 0,2 %bsuccinic acid solution + 2 ml ДМАЕ + 2 ml ДМSO showed the best result. It was consisted of 2,9 t/ha.

References

1. Babych A. O., Babych-Poberezhna A. A. (2011). Selektsiia, vyrobnytstvo, torhivlia i vykorystannia soi u sviti. [Selection, production, trade and use of soybeans in the world]. Kyiv: Ahrarna nauka. 548 p.
2. Kyryk M.M., Pikovskyi M.Y., Azaiki S. (2012). Diagnostic signs of diseases of vegetable crops and potato. Kyiv: Phenix 175 p.
3. Solomiichuk M. P., Kordulian Yu.V., Melnyk A. T., Pikovskyi M. Y. (2020). Vplyv biolohichnykh kompleksiv ta biostymuliuiuchykh rechovynna rist i rozvytok roslyn soi v Zakhidnomu Lisostepu Ukrainy. [Influence of biological complexes and biostimulating material growth and development of soybean plants in the Western Forest-Steppe of Ukraine.] Foothill and mountain agriculture and stockbreeding**.** Vyp. 67 (2). P. 182–197.
4. Petrychenko V. F. Tykhonovych, S. Ya. Kots, M. V. (2012). Silskohospodarska mikrobiolohiia i zbalansovanyi rozvytok ahroekosystem.[Agricultural microbiology and balanced development of agroecosystems]. Bulletin of Agricultural Science**.** №8. P 5–11.
5. Patyka V. H., Pasichnyk L. A. (2014). Phytopathogenic bacteria in the system of modern agriculture. Microbiol. J-l. V. 76. N 1. P.21–26.
6. Patyka V. P. (2016). Phytopathogenic Bacteria in Contemporary Agriculture. Microbiologichny zhurnal. V. 78. N 6. P.71–83.
7. Gorbunov O. P. (2011). Sovershenstvovanie preparatov na osnove Pseudomonas aureofaciens. [Improvement of drugs based on Pseudomonas aureofaciens.]. Plant protection and quarantine. № 5. P. 35–36.
8. Pat. 48943 Ukraina, MPK C07D 241/00, C07D 487/00, C07D 239/00. Sposib oderzhannia 1,6-diokso-8-aryl-1,3,4,6,6,7,8-heksahidro-2 N-pirazynoiu. O.N. Voloshchuk, O.V. Kushnir, M.M. Marchenko;

zaiavnyk i patentovlasnyk Chernivetskyi Natsionalnyi Universytet. № u200910851; zaiavl. 27.10.2009 vyd. 12.04.2010

9. Solomiichuk M. P., Pikovskyi M.Y. (2021) Vplyv bakterii Pseudomonas flurenscens i rechovyn stymuliuiuchoi pryrody na produktyvnist roslyn soi ta urazhennia nasinnia patohenamy. [The influence of Pseudomonas flurenscens bacteria and substances of a stimulating nature on the productivity of soybean plants and seed damage by pathogens.]. Plant and Soil Science. J. 12 № 4 C 29-36 doi.org10.31548/agr2021.04.028..
10. Trybel S. O., Siharova D. D., Sekun M. P., Ivashchenko O. O. ta in. (2001). Metodyka vyprobuvannia i zastosuvannia pestytsydiv; za red. S. O. Trybelia. Kyiv: Svit. 448 p.