The dynamics of biodiversity structure of soil microorganisms under the impact of biopreparations during potato growing season

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SUMMARY

The use of biological preparations such as Phytotsid and Planryz contributes the increase of the general number of soil bacteria population by 13.0–36.1% in the case of potato variety Scarbnytsya and by 4.5–24.6% for potato variety Oberig compared with control. It also increases the number of saprophyte microflora, which compete with plant pathogens, micromycetes, and causes 1.2–1.8 times reduction in the number of soil fungi – Fusarium and Alternaria. During the application of Rovral Akvaflo the Shannon ecological index of species biodiversity is lower than during the biopreparation use. The decrease of species biodiversity was observed as well as strengthening the dominance of some species (dark pigmentation in fungi).

Keywords: *soil microbiocenosis, phytopathogenic fungi, biopreparations, potato*

INTRODUCTION

The biological means of plants protection is relevant direction which has got the wide scientifically innovative development. These methods are alternative to chemical ones which have negative impact on the biological components of agrophytocenosis (Odum, 1983; Voznyakovskaya, 1988; Andreyuk et al., 2001; Zhuchenko, 2004; Patyka, 2005; Tikhonovich et al., 2005; Patyka et al., 2009).

Potato is one of the main and basic commercial crops cultivated in the world. Lately the distribution and increasing injuriousness of viral diseases, bacteriosis and mycosis of potato is observed. Emergence of new potato breeds and expansion of fungicide types testifies the need of seed-growing technologies improvement, application of essentially new systems of potato seed protection against pathogens.

Unlike chemicals for plant protection, the main part of biological preparations is presented microorganisms that take part in transformation of practically dissoluble compounds (e.g. phosphorus compounds), promote the formation of available nutrients in plant rhizosphere, produce the physiologically active substances (hormones, vitamins, amino acids etc.), contribute the induction of systemic plants resistance (Andreyuk et al., 2001; Kovalchuk et al., 2005; Patyka, 2005; Tikhonovich et al., 2005; Kulikov et al., 2006; Tektonydy and Myhalyn, 2006; Gvozdyak et al., 2007; Kurzawinska and Mazur, 2008; Sokolova et al., 2008; Degtyareva et al., 2009; Patyka et al., 2009). In addition, the substances with antibiotic and fungi toxic action are among metabolites of microorganisms and suppress the pathogens development. The active strains of microorganisms (biopreparations producers) do not cause the long-term genetic effects of human organism comparing to artificial chemically synthesized preparations.

In recent years, the investigations devoted to the studying of the effectiveness of biological preparations are carried out primarily for the potato treatment before planting and its protection against diseases in the vegetation period. For example, the treatment of potato by Hitozar P1 + Tekto in Karelia combined with biological system of plants protection induces the reduction of the scab development by 61%, 3 times decrease in *Rhizoctonia* stem canker cases and 8 times decrease in potato late blight cases; and insures the harvest increase by almost 23% (Hsieh and Huang, 2002; Tikhonovich et al., 2005; Kotova and Kuznetsova, 2006). In Russia the Baktofit and Planryz preparations use against the blackleg pathogen (tomato growing in greenhouses) and against late blight pathogen during the vegetation period was really biologically effective, and the calculation of the economical effectiveness showed the economic feasibility of this treatment (Gvozdyak et al., 2007).

The significant progress was made in the development of the potential biological preparations (application of the bacteria- and yeast antagonists) for the control of the post harvest damages and formation of the fungal toxins in fruits and vegetables (Grosch et al., 2005). Moreover, the effectiveness of preparation based on the *Gliocladium virens* bacteria-antagonists was examined against the scab pathogen *Rhizoctonia solani* (Grebenisan, 2006), and biofungicide *Lihnorin* (based on *Trichoderma harzianum*) – against scab and *Rhizoctonia* stem canker (Pryshchepa, 2007).

In Germany, the experiments with isolated potato leaves and plants in pots were made. It was found that application of the commercial preparation Serenade (on the basis of *Bacillus subtilis* metabolites) inhibited the late blight pathogen infection in potato leaves, but it was less effective than application of preparations based on copper (Stephan et al., 2005). According to German scientists investigations, the bacterisation of 2 bacteria strains – *Pseudomonas fluorescens* L 13-6-12 and *Serratia plymuthica* 3 Re 4-18 against *Rhizoctonia solani* limited the negative impact of scab disease on potato. The antagonist *Pseudomonas fluorescens* L 13-6-12 depressed the potato diseases development better than others, but only partially (Grosch et al., 2005).

According to investigations of Russian scientists, the treatment of potato by biological preparations induced the inhibition of *Rhizoctonia* stem canker and scab pathogens development in the storage period. In comparison with control variant, *Ryzoplan* caused 2–2.5 times reduction the spread of the late blight of potato, scab, *Rhizoctonia* stem canker and alternariosis in the tubers (Tikhonovich et al., 2005).

In Russia, the investigations devoted to the studying of the impact of potato treatment before growing with biopreparations (Phytosporyn, Planryz, Baktophosfin, Azovit, Integral) and liquid fertilizers (RUSP) on the harvest and tubers quality of the medium-early potato breed Nevsky showed that it ensured the plants resistance to diseases, which usually developed in the plants apex and tubers (*Rhizoctonia* stem canker development decreased by 8–35%) (Tikhonovich et al., 2005).

The effects of biological preparations and growth regulators (Ryzoplan, Cherkaz, Humate A, Agat 25K, Bioplant) on the potato resistance (breed Nevsky) to viroid infection and on harvest were studied in Russia (Pryshchepa, 2007).

The application of biological preparations – Ekstrasol-55 and Agat-25 – provided the potatoes harvest increase by 15–22%, which increased the harvest of seed tubers on 20–30% (standard fraction) and was important in the faster reproduction of the new and perspective potatoes breeds (Tektonydy and Myhalyn, 2006).

A significant effect on the potato harvest and its resistance to fungi pathogens was observed after bio-fertilizers application (Azotobacterin, Phosphobacteryn, Kremniyebacteryn): potato harvest increased in the range from 1.2 to 2.5 times depending on the breed, the soil enrichment by the main nutritional elements in the available for plants form was observed, the inhibition of pathogenic microflora development (scab pathogen) was determined, the nitrite and nitrate content in crops was examined, the maturing of potato tubers accelerated (Sokolova et al., 2008). The application of the bio-fertilizer Binoram in Russia (based on *Pseudomonas sp.*) decreased the *Rhizoctonia* stem canker lesions by 8–16 times (Tektonydy and Myhalyn, 2006) and bio-fertilizers Bioplan-Complex (which includes the nitrogen-fixing bacteria *Klebsiella planticola*) – accelerated the emergence of quality, development and ultimately – productivity of potato (Kovalchuk et al., 2005). The treatment of potato tubers by bio-fertilizers in the spring based on of *Klebsiella sp.* didn't affect the harvest, but had influence on its structure – improved the commodity potatoes quality, the starch content increased, and during the storage technical withdrawal decreased by 2.2–2.3%, natural weight loss and total losses also decreased (Tikhonovich et al., 2005).

The biopreparation Supresivit based on spores from the fungus *Trichoderma harzianum* was applied as a dressing mixed with mineral fertilizers: NPK, LAV (ammonium nitrate with limestone) and DASA (ammonium nitrate and ammonium sulphate) (Hŷsek et al., 2002). It was indicated that *Trichoderma harzianum* suppresses pathogenic fungi at the concentration 0.5 g of Supresivit per 1 kg of the fertilizer and higher. The plants from treated plots had lower infestation – decrease by about 5–15% superficial infestation (potato – blight fungus etc). Simultaneously the effect on higher yields was observed.

In the Institute of Molecular Biology and Genetics of Ukraine, the protective effects of the Pseudomonas sp. bacteria strains IMBG 163 and *Pseudomonas sp.* IMBG 287 were examined at the time of their introduction into higher plants, which is the basis for development of the biotechnological methods of potato protection (*Solanum tuberozum* L.), against the complex soil infection at different stages of seed and commercial production receiving. It was shown that *Pseudomonas sp.* strains IMBG 163 and *Pseudomonas sp.* IMBG 287 are perspective components of biopreparations for the protection of potato breeds sensitive to pathogenic microorganisms during the production of ecologically marketable tubers (Kovalchuk et al., 2005).

The investigation of biological preparations efficacy for the treatment of potato tubers before planting and protection it from diseases during the growing season is important in the recent decades. In Canada, for seed potatoes treatment against scab, the most effective were strains EF-76 Streptomyces melanosporofaciense + Khitosan (Perevast, 2006) and the strains of bacteria – antagonists, which were isolated from the soil under potato growing and showed the effectiveness against scab pathogen – *Streptomyces scabili* (after analysis of the 16S-RNA gene it was classified as *Bacillus sp. sunhua*) (Han, 2005). The current research in Tunisia showed that isolates of *Bacillus sp.* suppressed the development of dry tubers rot caused by various types of *Fusarium in vitro* and *in vivo* conditions (Daami-Remadi, 2006). In biological methods of the control of dry tubers rot development the application of the antagonist cells concentration and mixtures of two types were also studied (Schisler et al., 1997).

Chrysomal and globerin complexes containing antibiotics from polyether and heptaene aromatic macrolide groups have been isolated from the mycelium of *Streptomyces chrysomallus* R-21 and *Streptomyces globisporus* L-242 strains, respectively (Shenin et al., 2010). Physicochemical characteristics of these complexes have been investigated, including UV and NMR spectra, chromatographic parameters etc. The fungicidal and antiviral activity of the studied complexes has been demonstrated on tomato plants.

Soil antagonistic streptomycetes are particularly suitable for the biological control; they were proved to be highly efficient in reducing the incidence of fungal pathogens (Degtyareva et al., 2009). *Streptomycetes* isolated from the podzolic soils were evaluated for the bio-suppression of fungal populations. Seventeen strains of streptomycetes (out of the 279 isolates total) were found to be strongly antagonistic to fungal pathogens in vitro and were selected for further experiments in situ. The full protection of plants against *Fusarium spp.* was obtained with the *Streptomyces hygroscopicus* strain K49.

At the same time, the studies at the Institute of Microbiology and Virology NASU showed the high antagonistic activity and simulative activity of *Bacillus sp.* isolates against bacterial diseases of tomatoes, which resulted in resistance for two years (Gvozdyak et al., 2007). In the investigations of the Ukrainian scientists, the bacteria *Bacillus amyloliquefaciens* was

observed for the lupine treatment. The bacteria can move in the plant and produce the complex of the biologically active substances. The emergence of the first disease signs occurred later (in 2–2.5 weeks) compared with the control and reduction of plants lesions during the growing season was observed. It was also observed that biopreparation has the stimulating properties – the improvement of the growth indicators and development of plants (Kyprushkyna et al., 2003; Korniychuk et al., 2008; Kyprushkyna, 2009).

Plants were sprayed and watered alternately using Biosept 33 SL (Jamiołkowska, 2009). The mycological analysis showed that Biosept 33 SL influenced on the reduction of *Fusarium oxysporum* colony number and in part inhibited alternariosis on sweet pepper plants. Biosept 33 SL did not decrease the number of *Fusarium equiseti* and *Colletotrichum coccodes* on sweet pepper plants. The bio-preparation affected the *Trichoderma spp.* growth on roots and stem base at sweet pepper.

The aim of three-year field investigations in Poland was to evaluate the effect of bio-preparations Polyversum (B.A.S. *Pythium oligandrum*) and Biochikol 020 PC (chitosan) applied on infected tubers by *Rhizoctonia solani* sclerots during vegetation period. As a standard fungicide Vitavax 2000 FS (karboxin and thiuram) was used (Zvyahyntsev, 1991). During potato vegetation period all applied preparations affected both the lower tuber infestation level by *R. solani* sclerots and the lower tuber infestation percent by these pathogens. According to the results obtained from conducted in vitro examinations, it was found that Polyversum and Biochikol 020 PC bio-preparations significantly (in comparison with control) reduced level and percent of tuber infestation by *R. solani*. Application of chemical standard preparation karboxin and thiuram mixture as a dressing had the best influence on inhibition of tubers infestation by *R. solani*. Among all the tested preparations under in vitro conditions the most effective in reduction *R. solani* mycelium linear growth turned out to be Polyversum biopreparation. *In vitro* response of the tested pathogen depended on the type of preparation and its concentration. Also, based on the results it was found that the preparations under examination significantly inhibited top leaf and tuber infestation by *Phytophthora infestans*. Moreover, according to the results obtained from in vitro tests, a significant effect from the Vitavax 2000 FS and Polyversum preparations and from the highest concentration (2%) of Biochikol 020 PC preparation on the percentage of inhibition of *P. infestans* mycelium linear growth was observed (in comparison to the control) (Kurzawinska and Mazur, 2009).

Bacteria isolated from soil rhizosphere samples of healthy Malian indigenous trees were screened for their antagonistic effect against this pathogen (Babana et al., 2011). Three actinomycetes isolates (*Streptomyces spp*. RoN, G1P, and N1F) were the most effective microbioagents in suppressing the growth of the pathogen. The biological control essay showed the possibility of controlling potato soft rot by these three actinomycetes isolates under conservation conditions. These treatments significantly decreased soft rot compared with the untreated potato tuber slices. The microbiological control results of this study suggest that the actinomycetes isolates RoN, G1P and J1N are effective microbiological agents in controlling soft rot of potato and could be considered as promising alternative to chemical products.

In Russia the bio-preparation Planryz is widely used for potato treatment, but in Ukraine Planryz BT (based on the bacterial strain *Pseudomonas fluorescence* AR-33, with concentration 2.5×10^9 cells ml^{-1}, NV – 1.5–2.0 l ha^{-1}), despite of being recorded in the "List of pesticides and agrochemicals permitted for application in Ukraine (The list of pesticides and agrochemicals permitted for application in Ukraine: 2008), is recommended only for grain, corn and on vineyards. In Ukraine Planryz is applied for vegetables and potato on private plots, for example, in Lviv region where biological laboratory of Planryz production is situated.

In Ukraine the research of influence of biological preparations on soil microflora, the changes of qualitative and quantitative structure of microbes during potato cultivation have fragmentary character and are actual.

The purpose of research was studying of the impact of biological preparation on the level of population dynamics of a soil microbiocenosis at the time of potato cultivation.

MATERIAL AND METHODS

Research was carried out on experimental plots of UAAS Institute for Potato Research (soil – light or medium loamy for sod-podzolic soil) where potato (varieties Oberig and Skarbnitsa) was grown. The potato tubers were treated by biological preparations (Phytotsid and Planryz BT) and fungicide (Rovral Akvaflo) before landing, and later – plants in the end of the period of flowering (Tikhonovich et al., 2005). The experimental variants:

a) control (water treatment);
b) biological control – Phytotsid treatment (on the basis of bacteria *Bacillus subtilis*) titer $1\text{-}9\times10^9$ CFU sm^{-3}, 2 l/hectares;
c) biological control – Planryz treatment (*Pseudomonas fluorescence* strain AP-33, titer 2.5×10^9 cells ml^{-1}, consumption rate 1.5–2.0 l/hectares);
d) chemical control – Rovral Akvaflo treatment, suspension concentrate – 0,4 l/ton.

The object of research was biodiversity of soil microorganisms at the potato cultivation with application of different treatment methods. During the period of beginning of potato flowering the soil samples were selected according to standard techniques (Gerhard, 1983; Dospehov, 1985; Degtyareva et al., 2009). The microbiological investigations were carried out for studying the quantitative and qualitative structure of bacteria and fungi in soil microflora with the help of its cultivation on selective nutrient media of Zvyagintsev and Capeka. Calculation of colonies and studying of morphological, cultural properties of cultivated strains was made according to the methods, described in works (Voznyakovsky, 1982; Gerhard, 1983; Voznyakovskaya, 1988; Zvyahyntsev, 1991). The results were expressed as the number of colony forming units in 1 g of the soils (CFU/g). For estimation of the variety of microorganisms

in soil Shannon diversity index (H) and the Pielou's evenness index were counted (Voznyakovsky, 1982; Voznyakovskaya, 1988; Zvyahyntsev, 1991; Tikhonovich et al., 2005). Mathematical processing of experimental data was made according to Dospehov (1985).

RESULTS AND DISCUSSION

The studying of soil microbiocenosis structure during potato cultivation (before landing of the crop) resulted in determination of the total number of microorganisms which ranged within 153.4–259.2 thousands/g of soil in all variants of investigation. Among phytopathogenic micromycetes *Fusarium sp.* (pathogenic agent of dry rot of potato that causes considerable losses of the potato during the period of storage) and *Alternaria sp.* (agent of dry spottiness of potato) were the most widespread – 0.4–1.6 thousands/g of soil and 2.4–3.7 thousands/g of soil respectively. Among saprophytes such representatives as *Penicillium spp., Rhizopus spp., Trichoderma spp.* were found. The amount of bacteria exceeded the quantity of fungi and actinomycetes by 100–1000 times. Dominating prevalence of non-sporeforming bacteria (71%) was the general prominent feature observed in all variants of experiment.

The obtained results are in accordance with the data of other scientist concerning increase of the microorganisms quantity in the first half of potato vegetation because of the soil temperature rising, intensity of mineralization processes and, at the same time, mostly because of expense of root exudate (Andreyuk et al., 2001; Patyka, 2005; Tikhonovich et al., 2005; Patyka et al., 2009).

It was established that application of biological preparations promoted the total increase of saprophyte bacteria in soil in comparison with control by 13.0–36.1% at cultivation of a potato variety Skarbnitsa and by 4.5–24.6 % – of Oberig variety (*Table 1–2*).

As a result of potato treatment by biological preparations in comparison with control the qualitative structure of soil microflora was also changed with domination of *Pseudomonas, Bacillus, Micrococcus* bacteria. Among saprophyte fungi *Penicillium* and *Trichoderma* were the most numerous.

The reason of biological preparations impact on suppression of phytopathogens development could be explained by activation of saprophyte soil microflora and its antagonistic action against phytopathogenic fungi that are the pathogenic agents of rots (Odum, 1983; Voznyakovskaya, 1988; Andreyuk et al., 2001; Zhuchenko, 2004; Patyka, 2005; Tikhonovich et al., 2005; Patyka et al., 2009). By numerous studies it has been proved that the level of specific variety of soil microbiocenoses can be considered one of the most important criteria of stable soil fertility (Voznyakovskaya, 1988; Andreyuk et al., 2001; Patyka, 2005; Patyka et al., 2009).

During the investigation 62 morphotypes of bacteria and 15 morphotypes of fungi were isolated as the pure culture and described. According to the Shannon index

Table 1.

The quantitative and qualitative composition of bacterial microflora during the potato treatment by chemical and biological preparations in vegetation period

The variant of experiment	The total number of colonies ($x10^4$ CFU g^{-1} of soil)	Shannon diversity index	Pielou's evenness index
		Skarbnitsa variety	
Control (water treatment)	42.55±4.04	2.10	1.01
Biological control (Phytotsid)	48.08±5.41	2.22	1.07
Planryz	57.91±6.35	2.24	1.15
Chemical control (Rovral Akvaflo)	34.85±8.39	1.88	0.85
		Oberig variety	
Control (water treatment)	49.34±5.93	1.87	0.96
Biological control (Phytotsid)	51.56±2.39	1.89	0.97
Planryz	61.49±3.42	2.04	1.05
Chemical control (Rovral Akvaflo)	44.03±3.91	1.46	0.75

Table 2.

The quantitative and qualitative composition of fungi microflora during the potato treatment by chemical and biological preparations in vegetation period

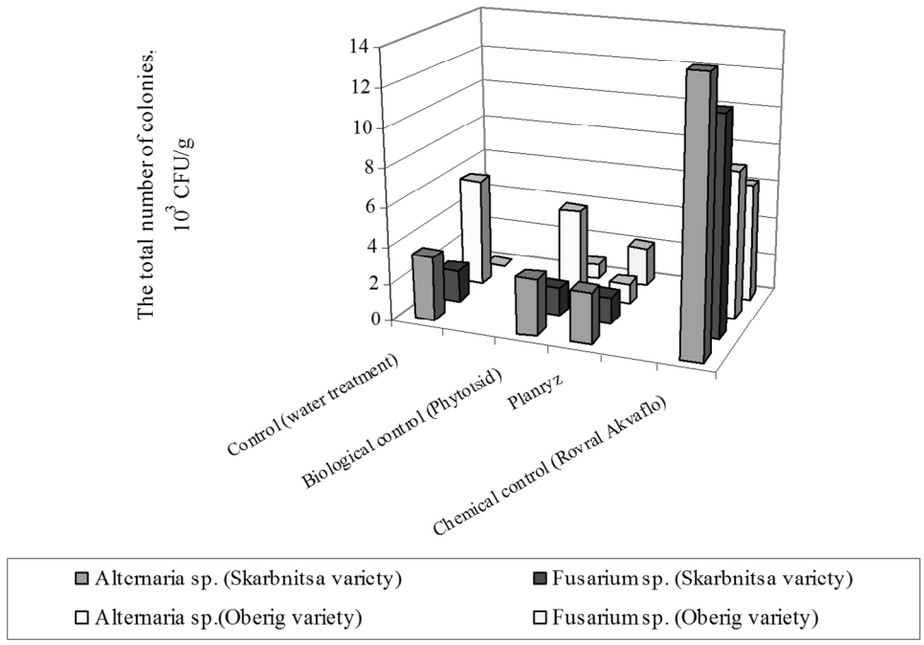
The variant of experiment	The total number of colonies ($x10^4$ CFU g^{-1} of soil)	Shannon diversity index	Pielou's evenness index
		Skarbnitsa variety	
Control (water treatment)	43.56±3.36	1.52	0.78
Biological control (Phytotsid)	59.33±3.05	1.82	0.88
Planryz	75.18±2.59	1.89	0.91
Chemical control (Rovral Akvaflo)	81.00±2.77	1.22	0.63
		Oberig variety	
Control (water treatment)	88.62±2.30	1.67	0.86
Biological control (Phytotsid)	130.42±5.70	1.82	0.83
Planryz	94.75±3.27	1.85	0.89
Chemical control (Rovral Akvaflo)	65.54±4.32	1.53	0.79

the variety of soil bacteria and fungi was the highest in soil where potato was treated by biological preparations – 1.89–2.22 and 1.82–1.89 in comparison with control – 1.87–2.10 and 1.52–1.67. At the application of chemical preparation Rovral Akvaflo reduction of the specific kinds of microorganisms was observed, in addition to the domination of dark-painted mycomycetes – *Alternaria sp., Cladosporium sp., Phoma sp., Doratomyces sp.* and chromogenic bacteria. In comparison with other variants of experiment the Shannon index in this case was 1.46–1.88 against 2.04–2.24, and the Pielou's index – 0.63–0.79 against 0.83–0.91.

The regularity of phytopathogenic fungi microflora changes in the soil at treatment of various varieties of potato by biological and chemical preparations was established. So, at the treatment by preparations Phytotsid and Planriz the number of pathogenic agents such as *Alternaria sp.* and *Fusarium sp.* decreased, but during application of Rovral Akvaflo – increased. At the same time the considerable decreasing of the total number of saprophyte microflora (*Figure 1*) was observed.

In the control variant the number of pathogenic agents – *Alternaria sp.* and *Fusarium sp.* was 1.7–5.7 thousand/g, in the variant of chemical control – 6.2–14.0 thousand/g, Phytotsid – 0.8–4.7 thousand/g, Planriz – 1.1–2.7 thousand/g.

Figure 1: **The impact of potato treatment by preparations during the cultivation on qualitative structure of phytopathogenic micromycetes**



It is known that the increase of pesticide loading leads to reduction of number of all ecologic-trophic groups of microorganisms, the ratio between them is considerably changed which is resulted in disturbance of functional links in agrosystem and decreasing of the biological activity of the soil (Voznyakovskaya, 1988; Andreyuk et al., 2001; Patyka, 2005; Tikhonovich et al., 2005; Patyka et al., 2009). The application of the organophosphoric insecticide chlorpyrifos has led to decreasing of total number of bacteria and actynomycetes in the soil (Shan et al., 2006). Essential changes in structure of saprotrophic microorganisms was also observed at the application of chemical means of protection against fungi phytopathogens of potato such as Ridomil gold MC and Kuprikol in comparison with biological preparations Trihodermin and Agrohit (Kulikov et al., 2006). That is, suppression of the autochthonic microflora could be accompanied with increasing of the number of phytopathogenic microorganisms, narrowing species variety and occurrence of new dominant ones.

Analysis of the fungi and bacteria species structure which were isolated from the soil in the various variants of experiment, showed the essential difference in microbic complex structure and changes of dominant morphotypes (*Figure 2–5*). At the treatment of the potato by biological preparations 18 various morphotypes of bacteria (treatment by fungicide – 10) have been isolated and identified. The application of fungicide has led to changes of soil microflora qualitative structure that further can lead to the soil toxicosis and decreasing of plant productivity.

The analysis of tubers lesion by phytopathogens after their storage has shown that the quantity of pathogenic agents after potato treatment by Planriz has decreased compared with control from 3.7–8.6 thousand/g soils to 0.6–2.2 thousand/g (*Figure 6*).

It is necessary to mention that at the treatment of potato tubers before landing and plants during the vegetation period by biological preparations such as Phytotsid and Planriz the crop increased in 1.2–1.3 times.

Figure 2: **The qualitative structure of bacterial microflora in soil at the beginning of potato flowering (%, Skarbnitsa variety)**

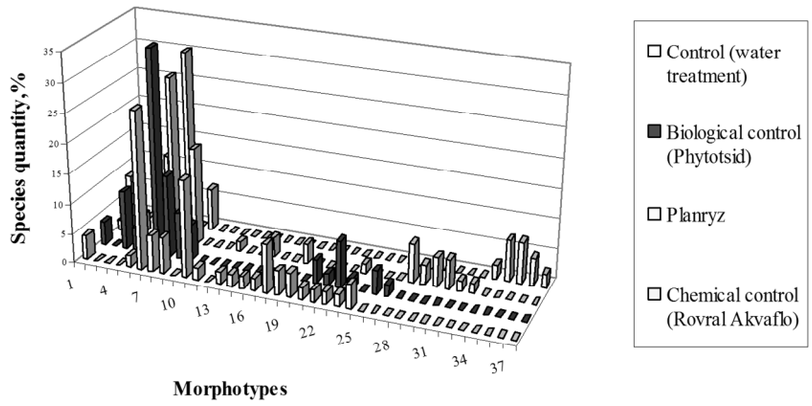


Figure 3: **The qualitative structure of bacterial microflora in soil at the beginning of potato flowering (%, Oberig variety)**

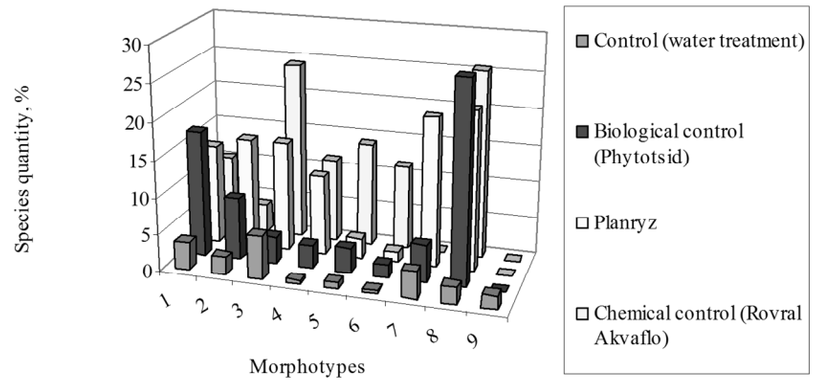


Figure 4: **The qualitative structure of mycomycetes microflora in soil at the beginning of potato flowering (%, Skarbnitsa variety)**

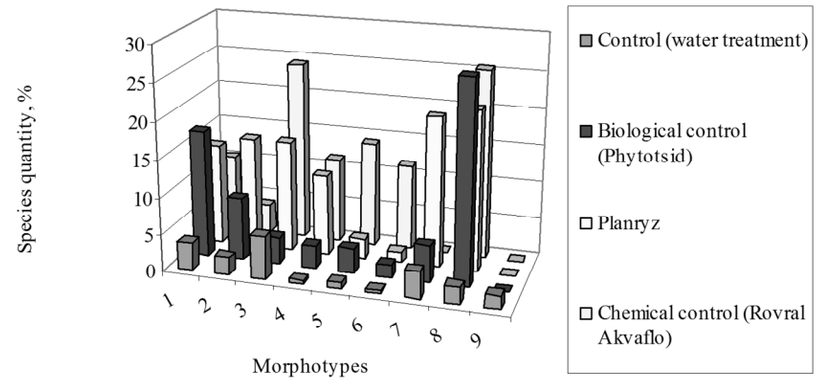


Figure 5: **The qualitative structure of mycomycetes microflora in soil at the beginning of potato flowering (%, Oberig variety)**

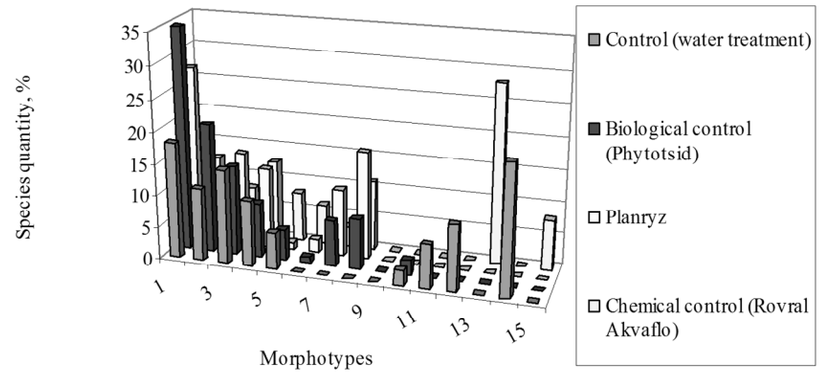
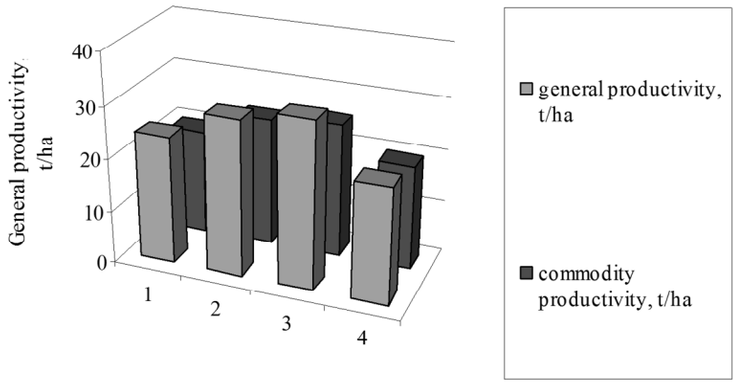


Figure 6: **The general and commodity productivity of potato at the application of biological preparations (1: control – water treatment); 2: biological control – Phytotsid; 3: treatment of Planriz; 4: chemical control – Rovral Akvaflo)**



Thus, the application of Phytotsid and Planriz promoted the total increase in saprophyte bacteria number in soil in comparison with control by 13.0–36.1% at cultivation of potato breed Skarbnitsa and by 4.5–24.6% of Oberig variety. In addition, the quantity of phytopathogenic fungi such as *Fusarium* and *Alternaria* has decreased in 1.2–1.8 times that is probably related to the increase of the number of saprophyte microorganisms which are capable to effective competition with phytopathogens. Reduction of quantitative and qualitative structure of soil microflora has led to changes in microbiocenoses composition of soil and occurrence of new dominant morphotypes.

The quantitative and species structure of soil bacteria and fungi was the highest in soil where potato was treated by biological preparations – the Shannon index was accordingly 1.89–2.22 and 1.82–1.89 compared with control 1.87–2.10 and 1.52–1.67. At the application of chemical preparation Rovral Akvaflo reduction of the specific variety of microorganisms was observed, besides the domination of dark-painted mycomyces – *Alternaria sp., Cladosporium sp., Phoma sp., Doratomyces sp.* and chromogenic bacteria was represented. In comparison with other variants of experiment the Shannon index in this case was 1.46–1.88 against 2.04–2.24, and an index of uniformity of Pielou 0.63–0.79 against 0.83–0.91.

Prelanding treatment of potato tubers and the subsequent one in vegetation period by biological preparations promoted the decreasing of pathogenic agent's population density in the soil and increasing of new crop tubers resistance to pathogenic agents.

Thus, application of biological preparations Phytotsid and Planriz for tubers treatment before landing, during vegetation and before putting on storage are effective methods of reduction of tubers lesions (caused by pathogenic agents) and improvement of potato quality. Work is executed with support of grant DFFD GP/F32/0016

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