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Phytonematodes Of Potato Agrocenosis

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Keywords

phytonematoda, fauna, potato - Solanum tuberosum L., agrocenosis, species, individual, root, soil, distribution, ecological groups, dominant, parasite.

Abstract

The article presents information about phytonematodes of potato agrocenoses of Samarkand region. As a result of research, 67 types of phytonematodes were identified in potato agrocenoses. According to the categories, representatives of Rhabditida, Dorylaimida and Tylenchida dominate, Aphelenchida is relatively rare, Mononchida, Chromadorida, Plectida and Enoplida are rare. In relation to the stems, leaves and roots of the potato crop, phytonematodes were found in the soil around the roots. Depending on the degree of occurrence of phytonematodes in plants and soil, they are divided into eudominants, subdominants, subdominants, residents, subresidents, and subresidents (70%) are the majority. According to the ecological groups, phytonematodes are dominated by pararhizobionts and devisaprobionts, non-pathogenic phytohelminths are in second place, eusaprobionts are in third place, and real parasites are in the last place. Species diversity in phytonematode fauna was observed in potato agrocenosis planted after cabbage crop in Okdarya district, and the maximum number of individuals was recorded in agrocenosis planted after potatoes in Tailoq district. The least number of phytonematodes was recorded in potato agrocenosis in dry soils planted after hot pepper in Jomboy district. Among the parasitic phytonematodes of potatoes - Bitylenchus dubius, Rotylenchus goodeyi, Helicotylenchus erythrinae, H. multicinctus, Pratylenchus pratensis, P. macrophallus and Ditylenchus dipsaci species were recorded.

1. Relevance of the Topic.

Expanding the production of agricultural products in the world, ensuring the safety of crops, especially protection from various pests and diseases, identifying organisms that cause significant damage to them are urgent issues. The number of pests and parasites in agricultural crops is increasing, the effect on productivity is increasing, and it is causing economic damage to farms that grow products. Accordingly, it is of great scientific and practical importance to determine the faunistic complex of phytonematodes, which cause a sharp decrease in productivity or the failure of the harvested crop to meet consumption requirements, and to develop measures to combat parasitic species based on the analysis of ecological characteristics.

Along with wheat, corn and rice crops, potatoes occupy the main place in the production of plant products in the world. In the world, potatoes cover 2 million hectares, the total yield is 280-290 million. tons, the average yield is 14-15 t/ha [20].

Today, based on the needs of the population and market requirements, potato and vegetable cultivation is growing year by year. In this regard, the areas of potato and vegetable crops have expanded in Uzbekistan, and hundreds of new farms specializing in this field have been established. In 2021, potatoes were planted on an area of 86.5 thousand hectares in our republic, and 3.2 million tons were harvested. Of this, 1.5 million were harvested from farms and agricultural enterprises, and 1.7 million tons were harvested from residential plots [21]. Special attention is paid to determining the species composition of pests found in various agrocoenoses, including phytonematodes, and developing countermeasures against harmful species. In particular, the demand for products with high food productivity is increasing day by day. Therefore, it is of great scientific and practical importance to determine the faunal complex of phytonematodes of potato agrocenoses in the potato and vegetable growing areas of the republic, including the Samarkand region, to reveal their ecological characteristics and to develop methods of combating parasitic phytonematodes found in potato crops.

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Analysis of literature on the topic. Information on phytonematodes of potato crop in Uzbekistan A.T. Tolaganov (1968) [11], S.M. Rizaeva (1986) [7], D.T. It is reflected in the research works of Sidikov (1993) [10]. In scientific works, it is stated that phytonematodes of potato agrocenoses were studied along with other crops. However, the analysis of the literature shows that in Uzbekistan, in particular, in the conditions of the Samarkand region, large-scale studies on the comprehensive study of the fauna, population, ecology and taxonomy of phytonematodes found in potato agrocenoses have not been carried out. Accordingly, determining the composition of the fauna of phytonematodes of potato agrocenoses and the application of parasite species is of great scientific and practical importance.

The purpose of the study Potato agrocenoses of Samarkand region consist of determining the composition of phytonematode fauna, revealing their ecological features and applying parasite species.

2. Research Methodology.

Research materials were collected from farms in Tayloq, Bulung'ur, Jomboy and Okdarya districts of Samarkand region. During the collection of research materials, the main potato growing areas of the region were selected. The soil of the area where the material was collected consists of gray soils. In the field, plant and soil samples were collected by route method [3] from stems and leaves, root and root peri-root soil of potato (Solanum tuberosum L.) cultivars "Arizona" and "Sante" at the end of the plant growing season. Samples were collected from 20 cm depth of plant leaves and stems, roots and soil around the roots at 5 points of the potato planting area (the points are the same distance apart). A total of 300 samples were collected from 75 potato agrocenoses in each district (25 stems and leaves, 25 roots, 25 soil).

Nematodes were isolated from soil and plant samples under laboratory conditions by the Berman funnel method [3] and fixed in TAF (triethanolamine: formalin: water in 2 ratio). A.A. Paramonov [6], E.S. Kiryanova and E.L. According to the methods of Krall [3], permanent (glycerol-gelatin) and temporary micropreparations of nematodes were prepared and species composition was analyzed using MBR-3 light microscope and spatial-contrast microscopes.

Dominance level of phytonematodes present in potato leaf and stem, root and soil around the root is K. Kasprzak, determined according to the method of W. Niedbala (1981) [18], in which the species that make up more than 10.0% of the number of individuals of the identified total species are eudominant, 5.1-10.0% - dominant, 2.1-5, 0% are subdominants, 1.1-2.0% are recessives, less than 1.0% are subrecedents [16].

3. Research Results and Discussion.

As a result of research, when the faunistic complex of phytonematodes of potato agrocenoses of Samarkand region was analyzed, two subclasses, 8 genera, 22 families, 42 genera, and 67 species of phytonematodes were recorded in the leaves and stems, roots, and the soil around the roots of potato plants. Both qualitative (number of species) and quantitative (number of individuals) indicators of the species found in potato stem and leaf, root, and soil around the root were analyzed: Chromadorida (2 species, 3.0% of identified species), Plectida (4 species, 6 ,0 %), Enoplida (1 species, 1.5 %), Mononchida (4 species, 6.0 %), Dorylaimida (14 species, 21.0 %), Rhabditida (22 species, 32.8 %), Aphelenchida (7 species, 10.4 %), Tylenchida (13 species, 19.4 %) formed the series.

It was found that phytonematodes found in the soil of potato leaves and stems, roots, and roots around the roots differ not only in the number of species, but also in the number of individuals. 27 individuals of 7 types of nematodes were recorded on plant leaves and stems, 21 species (229) on roots, and 67 species (595) on soil around roots. 14 species of phytonematodes found are common to the plant and the soil around its roots.

Using the method of scientific analysis based on the calculation of the dominance level of phytonematodes by Kasprzak, Niedbala (1981), 1 type of phytonematodes identified in our analysis was divided into eudominant, 6 dominant, 4 subdominant, 9 recessive and 47 species of phytonematodes belonging to subredentive species.

In 1962, the Russian phytohelminthologist, professor A.A. Paramonov created an ecological classification of phytonematodes, taking into account the diversity of phytonematodes feeding on plants, their relationship to plants, habitat and lifestyle. According to this classification, phytonematodes are divided into

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5 ecological groups: 1 - pararhizobionts - species adapted to living in the water environment, wet soils, having a spear in the mouth (stoma), feeding mainly on microscopic algae, sometimes bacteria, with high migration speed, living freely in the soil; 2 - eusaprobionts - are considered true saprobiont organisms and live mainly in wood residues, rotten roots, and dead green parts of plants. However, although these species do not parasitize healthy plants, they are considered carriers of various diseases, which causes their widespread distribution in agrocenoses; 3 - devisaprobionts are semi-saprobionts, which mainly use the saprobiotic environment as a place of residence, and are also found in healthy cells of plants, feed on bacteria, fungi and remains of plant tissues, and perform a sanitary function for the plant. However, in plants, it transmits fungal and bacterial diseases to healthy tissues; 4 - phytohelminths that do not cause special diseases - potential parasites; 5 - phytohelminths that cause specific diseases are true parasites [6]. According to the ecological classification of A.A. Paramonov (1962), the phytonematodes detected in the soil around the potato and its roots during our research were distributed as follows: pararhizobionts - 19 species (28.3%), eusaprobionts - 9 (13.4%), devisaprobionts - 19 (28.3%), non-disease-causing phytohelminths - 13 (19.4%), true parasites - 7 species (10.4%). Based on the above data, it can be said that according to the ratio of qualitative and quantitative indicators, the number of species of pararhizobionts, devisaprobionts and phytohelminths that do not cause specific diseases is different, and phytohelminths that cause specific diseases and eusaprobionts are found in small numbers. According to the ratio of individuals, devisaprobionts, non-pathogenic phytohelminths and eusaprobionts were diverse, while pararhizobionts and phytohelminths causing a specific disease were found in small numbers. 7 types of identified phytonematodes - *Bitylenchus dubius, Rotylenchus goodeyi, Helicotylenchus erythrinae, H. multicinctus, Pratylenchus pratensis, P. macrophallus* and *Ditylenchus dipsaci* are true parasites. In the course of the research, a difference was observed in the species composition and number of individuals of phytonematode fauna of potato agrocenoses in the studied areas. It was noted that each region has its own phytonematode fauna, as well as a characteristic group of species. As a result of the analysis of the fauna of phytonematodes of potato agrocenoses, 32 species (321 individuals) were found in Tailoq district, 50 species (303) in Okdarya district, 25 species (110) in Bulung'ur district, and 17 species (117) in Jomboy district. , below is an analysis of the prevalence of phytonematodes.

Taylaq district is the main potato-growing area of the region, two subclasses, 6 genera, 14 families, 21 genera, and 32 species of phytonematodes were recorded on leaves and stems, roots, and soil around the roots of potato plants in this region (table).

Both qualitative and quantitative indicators of the found species by categories were analyzed as follows: Plectida (2 species, 6.2 %), Enoplida (1 species, 3.1 %), Dorylaimida (4 species, 12.5 %), Rhabditida (16 species, 50.0 %), Aphelenchida (6 species, 18.7 %), Tylenchida (3 species, 9.4 %).

There are 8 species of nematodes characteristic of the region (*Proteroplectus longicaudatus, Alaimus primitivus, Eudorylaimus ettersbergensis, Heterocephalobus filiformis, Rhabditis longicaudata, Pelodera teres, Aphelenchoides subtenius, Pratylenchus pratensis*). Potatoes were the previous crop in the studied potato agrocenosis of the district. Nematodes were more common in Taylaq district compared to other districts. In this area, there were 5 species of pararhizobionts, 5 species of eusaprobionts, 13 species of devisaprobionts, 7 species of phytohelminths that do not cause special diseases, and 2 species of true parasites.

According to the ratio of qualitative and quantitative indicators, the number of species of devisaprobionts and phytohelminths that do not cause specific diseases is different, pararhizobionts and eusaprobionts are relatively few, true parasites are found in very few.

Two subclasses, 7 genera, 22 families, 37 genera and 50 species of phytonematodes were recorded in the leaves and stems, roots, and soil around the roots of potato plants in Akdarya district. Both qualitative and quantitative indicators of identified species were analyzed by categories as follows: Chromadorida (2 species, 4,0%), Plectida (3 species, 6,0%), Mononchida (4 species, 8,0%), Dorylaimida (10 species, 20,0 %), Rhabditida (17 species, 34,0 %), Aphelenchida (4 species, 8,0 %), Tylenchida (10 species, 20,0 %).

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24 species of phytonematodes characteristic for the area (*Monhystera filiformis, M. similis, Anaplectus granulosus, Proteroplectus parvus, Clarcus papillatus, Mononchus truncates, Anatonchus tridentatus, Prismatolaimus dolichurus, Paradorylaimus filiformis, Dorylaimoides elegans, Mesodorylaimus bastiani, Eudorylaimus acuticauda, E. centrocercus, Tylencholaimellus striatus , Eucephalobus oxyuorides, Acrobeles ciliates, Pelodera strogyloides, Filenchus leptosome, Bitylenchus dubius, Rotylenchus goodeyi, Helicotylenchus erythrinae, H. multicinctus, Hexatylus viviparous, Ditylenchus intermedius*). Cabbage was the previous crop in the studied potato agrocenosis in the district. Species diversity in the nematode fauna of this region was observed at a high level compared to other regions. The reason for the diversity of species was cabbage, a crop that preceded potatoes. Among the ecological groups, pararhizobionts - 14 species, eusaprobionts - 6 species, devisaprobionts - 15, non-pathogenic phytohelminths - 9, true parasites - 5 species.

According to the ratio of qualitative and quantitative indicators, the number of species of pararhizobionts, devisaprobionts and phytohelminths that do not cause special diseases in potatoes in this region is different, and true parasites and eusaprobionts are found in relatively small numbers.

Two subclasses, 4 genera, 8 families, 17 genera and 25 species of phytonematodes were recorded on leaves and stems, roots, and soil around the roots of potato plants in Bulungur district. Both qualitative and quantitative indicators of identified species were analyzed by categories as follows: Dorylaimida (5 species, 20,0%), Rhabditida (12 species, 48,0%), Aphelenchida (5 species, 20,0%), Tylenchida (3 species , 12,0%).

Nematodes characteristic for the region are 6 species (Labronema eudorylaimoides, Aporcelaimellus obscurus, Aphelenchus cylindricaudatus, Aphelenchoides tumulicaudatus, Tylenchus davainei and Filenchus filiformis). Before the potato crop in the district, onions were planted in the field. It was observed that nematodes are relatively rare in this area. There were 5 species of pararhizobionts, 3 species of eusaprobionts, 9 species of devisaprobionts, 9 species of non-disease-causing phytohelminths, and no true parasites.

According to the ratio of qualitative and quantitative indicators, the number of species of devisaprobionts and phytohelminths that do not cause specific diseases is different, pararhizobionts and eusaprobionts were identified in relatively small numbers, true parasites were not found.

Two subclasses, 3 genera, 9 families, 13 genera, and 17 species of phytonematodes were recorded on leaves and stems, roots, and soil around the roots of potato plants in Jomboy district (table).

Table Analysis of ecological groups of phytonematodes identified in potato agrocenoses in the cross-section of districts

Districts	Number of species	Ecological groups (in %)				
		P	E	D	SDCP	TP
Taylak	32	15,6	15,6	40,6	18,7	9,5
Akdarya	50	30,0	8,0	34,0	16,0	12,0
Bulungur	25	20,0	12,0	36,0	32,0	-
Jomboy	17	29,4	23,5	35,3	11,8	-

Note: P - pararhizobiont; E – eusaprobiont, D – devisaprobiont, SDCP– special disease-causing phytonematodes, TP – true parasites.

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Both qualitative and quantitative indicators of identified species were analyzed as follows: Dorylaimida (5 species, 29,0%), Rhabditis (10 species, 59,0%), Aphelenchida (2 species, 12,0%), nematode species from Tylenchida family did not meet.

The species *Diphtherophora communis* is characteristic for this area. At the time of sampling, the soil of the potato agrocenosis in the district was dry, and the previous crop in the field was hot pepper. In the course of research, the least phytonematode species were recorded in this area. Pararhizobionts - 5 species, eusaprobionts - 4 species, devisaprobionts - 6 species, phytohelminths that do not cause special diseases - 2 species, true parasites were not found.

According to the ratio of qualitative and quantitative indicators, the number of species of pararhizobionts, devisaprobionts is diverse, eusaprobionts and phytohelminths that do not cause special diseases were detected in relatively small numbers, true parasites were not found.

The quantitative and qualitative composition of phytonematodes depends on the nature of crop cultivation, the specificity of the species of phytonematodes, plant growth and development, and environmental changes [4, 8, 9, 12, 13, 14, 15, 17, 19]. According to the results of our research, it was found that the nematode fauna of potato agrocenosis in each region is distinguished by a certain group. The maximum number of species was recorded in potato agrocenosis planted after potato crop, while the least number of species was observed in potato agrocenosis of dry soils planted after hot pepper. We believe that this situation depends on the level of application of agrotechnical measures to crops and the condition of the soil.

The technology of crop rotation in fields primarily affects the density of nematode populations and, to some extent, the amount of their taxa. For example, as a result of growing carrot or turnip crops after potatoes, it was observed that the species diversity and population density in the nematode fauna decreased (3.7-4.3 times). It was noted that when cabbage was grown after carrots, the amount of nematodes in the soil increased sharply (10 times), and there was no change in the taxonomic composition. When cabbage is grown alternately with potato crops, the diversity of species has increased, and the amount of nematodes has decreased [5]. In our research, nematodes species were diverse in potato planted after cabbage and in the soil around its roots, population density (303 ind. per 100 g of soil) was lower than in the field planted after potato (321 ind.), respectively, in potato fields planted after onion. 110 ind., in the area planted after hot pepper - 117 ind. meeting was observed.

It is known that among phytonematodes, parasitic species are of great economic importance. Parasitic phytonematodes or phytohelminths infect all types of cultivated plants and can cause their complete death. Parasitic phytonematodes damage plant tissues and open the way for phytopathogenic microorganisms to enter the plant. Together with them, they form pathogenic complexes and cause great damage to agriculture. Plant damage and yield loss by parasitic nematodes ranges from 25% to 70% in different countries. Representatives of 20 genera of phytonematodes have been recorded as true parasites of plants, which cause problems in agriculture. It is estimated that the damage caused by parasitic nematodes to agricultural crops is about 100 billion per year [1]. Parasitic phytonematodes have not been fully studied as a complex of nematodes in the plant and its root and in the soil around the root. In the period of growing anthropogenic processes, parasitic phytonematodes cause great damage to plants, they parasitize all types of plants. Currently, more than four thousand species of phytonematodes are plant parasites [2]. 7 species of 67 species of phytonematodes identified in potato agrocenosis during the research - *Bitylenchus dubius, Rotylenchus goodeyi, Helicotylenchus erythrinae, H. multicinctus, Pratylenchus pratensis, P. macrophallus, Ditylenchus dipsaci* are real phytoparasitic nematodes, they belong to root ectoparasites and migratory endoparasite species. When the species composition of true parasitic phytonematodes was analyzed in the section of districts, 3 species (4.5% of all encountered nematodes) were found in Tailoq district, 6 species (9.0%) were found in Okdarya district. The species Pratylenchus pratensis and Ditylenchus dipsaci are migratory endoparasites and are common to both districts. The general structure of the species Ditylenchus dipsaci ((Kühn, 1857) Filipjev, 1936) is presented in the figure.

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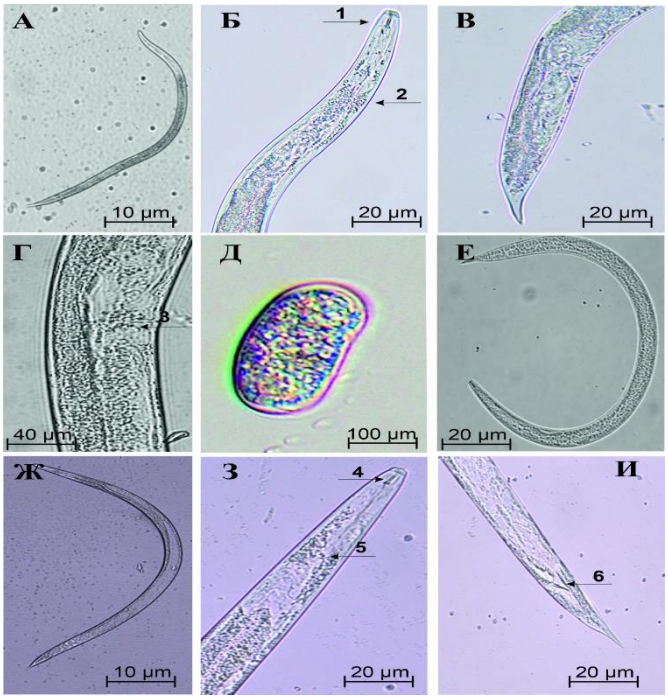

Picture. Ditylenchus dipsaci (Kühn, 1857) Filipjev, 1936). A – general view of female nematode; B - head part, 1st stele, 2nd bulb, 3rd anus; V - tail part; G - anus; D-egg; E- larva; J – General view of male nematode; Z - Head part; 4th stellate, 5th bulb, I-tail part; 6th spicule. View under a microscope (VX53, OLYMPUS, SC-180 Japan, 2018) (ok.10 x ob.20).

Bitylenchus dubius, Rotylenchus goodeyi, Helicotylenchus erythrinae, H. multicinctus species were found only in Okdarya district, Pratylenchus macrophallus species were found only in Taylok district. It was noted that true parasitic phytonematodes were not found in Bulungur and Jomboy districts.

4. Conclusions

1. As a result of studying the phytonematode fauna of potato agrocenoses of Samarkand region, 67 species of phytonematodes were identified. In terms of the composition of identified phytonematodes, representatives of Rhabditida (22 species), Dorylaimida (14) and Tylenchida (13) groups prevailed, Aphelenchida (7) was relatively rare, Mononchida (4), Chromadorida (2), Plectida (4) and Enoplida It was found that the species in categories (1) rarely met.
2. 7 types of phytonematodes found in potato agrocenoses were recorded in plant leaves and stems, 21 types in roots, and 67 types in the soil around the roots.
3. The potato plant was divided into the following groups according to the degree of occurrence of phytonematodes recorded in the leaves and stems, roots and the soil around the roots: eudominants - 1 species, subdominants - 6 species, subdominants - 4 species, residents - 9 species, subresidents - 47 species.
4. According to the ecological classification of nematodes, pararhizobionts (19 species) and devisaprobionts (19 species) prevailed in the number of species, non-pathogenic phytohelminths (14 species) took the second place, eusaprobionts (9 species) took the third place, true parasites (6 species) followed. It was noted that it was organized.
5. As a result of the analysis of the phytonematode fauna of potato agrocenoses, 32 species were found in Taylok district, 50 species in Okdarya, 25 species in Bulungur, and 17 species in Jomboy. The diversity of species in the fauna was recorded in the potato agrocenosis planted after the cabbage crop in Okdarya district, the maximum number of individuals in the agrocenosis planted after potatoes in Tayloq district, and the least number of species in the potato agrocenosis on dry soils planted after hot pepper in Jomboy district. We believe that this

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situation depends on the level of application of agrotechnical measures to potato agrocenoses, the type of crop planted before potatoes, and the condition of the soil.
6. *Bitylenchus dubius, Rotylenchus goodeyi, Helicotylenchus erythrinae, H. multicinctus, Pratylenchus pratensis, P. macrophallus and Ditylenchus dipsaci* species of true parasitic phytonematodes dangerous for crops were found in potato agrocenosis.

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