Journal of Critical Reviews

ISSN- 2394-5125 Vol 7, Issue 2, 2020

Review Article

COMPARATIVE ANALYSIS OF THE NEMATODIAN FAUNA AND ITS SEASONAL DYNAMICS OF AGRICULTURAL PLANTS OF FOOTHILL REGIONS OF THE TASHKENT OASIS

Jumaniyozova Dilnoza Komilovna[1], Eshova Holisa Saidovna[2],Sulaimonov Otabek Abdushukirovich[3]

[1]Independent researcher of the Department of Zoology, Faculty of Biology, National University of Uzbekistan, Uzbekistan.
[2]Professor of the Department of Zoology, Faculty of Biology, National University of Uzbekistan, Uzbekistan, Uzbekistan.
[3]Director of the Scientific Center of the State Inspection for Plant Quarantine under the Cabinet of Ministers of the Republic of Uzbekistan, Uzbekistan.
E-mail address: jumaniyozova1983@mail.ru

Received: 16.11.2019 ***Revised: 22.12.2019*** ***Accepted: 23.01.2020***

Abstract
The article presents data on the species and quantitative composition of nematode communities of soil layers of agrocenoses and natural ecosystems of the foothill regions of the Tashkent oasis of the Republic of Uzbekistan. As a result of studies, it was revealed that 54 species are widespread in the soil layers of wheat fields, 45 species in tomato fields and 65 species of nematodes in natural ecosystems. In the seasonal dynamics of the number of nematodes, spring and autumn peaks are observed, when the number of nematode individuals is several times higher compared to the summer and winter periods. Autumn temperature drop and a slight increase in soil moisture contribute to a new increase in species diversity and number of phytonematodes. A decrease in species diversity and number of phytonematodes in winter is associated with a decrease in temperature and the absence of a power source. The vertical distribution of soil nematodes and their accumulation in a particular soil layer, first of all, depends on the presence of the root system of plants, the optimum temperature and humidity of the soil and air. Various ecological groups of nematodes and their individual species do not react equally to changes in the conditions of existence, as the dynamics of para-isobionts were maximal in the spring, while in eusaprobionts, there was a small group that included only 4 species (4.1%) of nematodes. The species composition of devisaprbionts is more diverse in the spring and autumn. Phytohelminths are represented by 40 species (40.8%), in the dynamics of their species composition there are no sharp fluctuations that were observed in other ecological groups. The maximum number (27) of species is confined to the spring period. The difference in species diversity and the number of phytonematodes in different plants, soil layers and seasons was determined, which is associated with vegetation, changes in humidity and temperature in different soil layers.

Key words: Nematode, species composition, seasonal dynamics, agrocenosis, natural ecosystem, para-isobiont, eusaprobiont, devisaprobiont, phytohelminth, Tashkent oasis.

DOI: http://dx.doi.org/10.31838/jcr.07.02.57

INTRODUCTION

Nematodes are one of the richest species group and widespread in nature [10]. Most of the nematodes are free-living and live in water and land cenoses, while others have adapted to parasitization in plants, animals, and humans [6]. Fluctuations in the number of individuals in populations of nematodes can be very different. The dynamics depends on changes in the number of species that make up the population in time and in space, occurring under the influence of environmental factors. An integrated approach to studying the dynamics of the nematode fauna helps to more fully study their species composition, identify trophic relationships between species and ecological groups, decipher the issues of biology and ecology of populations, and reveal the specifics of participation in various ecological, biological and biochemical processes in soil and plants [8 ; 9].

The relevance of the work is determined by the fundamental and applied value of the data obtained on species diversity and the functioning of nematode communities in agrocenoses and natural ecosystems. The obtained data on the species diversity and functional characteristics of nematode communities in agrocenoses and natural ecosystems contribute to the further development of the theory of functioning of western and artificial ecosystems, which is one of the most relevant areas of modern phytohelminthology.

Agricultural techniques used on agrocenoses (plowing, irrigation, fertilizing, cultivating crops) lead to a change in the water-salt regime, agrochemical properties of the soil and through them act on the structure of the phytonematode community. The speed and direction of these changes in a certain way depends on the type of soil and cultivated crops [2]. In this regard, a comparative theoretical study of phytonemato-agrocenoses and their surrounding natural ecosystems may be of theoretical interest.

The aim of the study is to identify the species composition of the nematode of its seasonal dynamics in agrocenoses and natural ecosystems of foothill zones.

MATERIALS AND METHODS

The soil samples collected during 2014 in the agrocenosis of wheat, tomato (tomato of the first year of planting) and their surrounding ecosystems in the Karakalpak shirkat farm of the Parkent district of the Tashkent region of the Republic of Uzbekistan served as material for the work. The soil is light loamy. To identify the nematode fauna and its dynamics according to the seasons of the year, material was collected in February, April, June, and October. Samples were taken at five points of three soil horizons: 0-10, 10-20, and 20-30 cm. For each sampling, the layer soil was measured with a mathematical ruler. Soil temperature was measured by a soil thermometer. In laboratory conditions, soil moisture was measured. Five times replicates were taken from each soil sample. A total of 900 samples were obtained. Extraction, fixation and dehydration of nematodes, the manufacture of temporary and permanent preparations were carried out according to the methods generally accepted in phytohelminthological studies (1, 3). The degree of dominance of nematodes in the samples was

determined from the percentage of individuals of individual species to the number of all detected [11]. At the same time, species comprising more than 10% of individuals among all detected species belong to eudominants; to dominants - 5.1-10%; subdominants - 2.1-5% and subrecedents - less than 2.1% of individuals.

RESULTS AND DISCUSSION

As a result of studies of the nematode fauna in agrocenoses and natural ecosystems, 98 species of nematodes were identified, belonging to 42 genera, 22 families, 7 orders, and three subclasses. When taxonomic analysis of the detected nematodes adhered to the system of V.V. Malakhov [4], where the class Nematoda is considered as part of three subclasses. All detected nematodes belong to 7 orders (Plectida, Monhysterida, Enoplida, Dorilaimida, Rhabditida, Aphelenchida and Tylenchida). At the same time: order Plectida is represented by 1 family, 1 genus and 1 species; Monhysterida - 1 family 3 genera and 4 species; Enoplida - 3 families, 4 genera and 6 species; Dorilaimida - 5 families, 10 genera and 23 species; Rhabditida - 3 families, 14 genera and 27 species; Aphelenchida - 2 families, 3 genera and 10 species; Tylenchida– 7 families, 7 genera, and 27 species. The richest and most abundant species are Rhabditida and Tylenchida. Of the orders Dorilaimida and Tylenchida, the genera Aphelenchoides (12 species) and Eudorylaimus (7 species) are richest in species composition.

Studying the fauna of nematodes and its seasonal dynamics of agricultural plants of foothill regions, we saw the following picture: 54 species of nematodes in the amount of 1273 specimens were recorded in wheat vagrocenosis. When studying the dynamics of the soil nematode fauna in wheat agrocenoses by the seasons of the year, it was found that the largest number of nematode species and their individuals was observed in spring. During this period, 32 species were found (646 specimens), while species of Cephalobuspersegnis, Tylenchus agricola, Helicotylenchusmulticinctus dominated. The maximum number of individuals (23 species and 353 specimens) is concentrated in a layer of 10-20 cm. The highest rise of fauna nematodes in the soil during the spring period is explained by the development of vegetation and optimal conditions of temperature (+18.30 C) and humidity (8.8%).

In the summer, on a wheat agrocenosis, the number of species of nematodes and their individuals is minimal (26 species, 299 specimens). No prevailing species were observed here. This is due to an increase in soil temperature to an average of 310 ° C, a sharp decline in soil moisture to 2.4%. According to the literature [1], the soil nematode fauna and its dynamics depend on a number of factors: temperature, humidity, sufficient humus reserves and plant root system. These factors determine the specificity of the nematode fauna and dynamics. The influence of high temperature and low soil moisture is clearly demonstrated in samples taken in the summer season.

Autumn temperature of the soil at a depth of 0 to 30 cm on average + 16.30 ° C and humidity 11%. Due to lower temperatures and increased soil and air humidity, the number of species and individuals of nematodes increases. In addition, in October, some precipitation was observed, which leads to changes in soil temperature and humidity, as well as moisture in food debris (roots, stems, leaves). This season 32 species of nematodes were found (251 specimens). The dominant species were Tylnchus filiformis and Tylenchus agricola.

From the beginning of the winter season, the number of nematode individuals in the soil decreases markedly (14 species, 77 specimens). In winter, the temperature of the soil averages +1.5 - + 2.50 C and humidity of 14.7%. During this period, the species Paratylenchus macrophallus appears, which was not seen in previous seasons of the year. Nematode species found in winter mainly belong to the order Tylenchida, which is represented by 10 species.

The distribution and number of individual species of nematodes in the soil is the same in different seasons of the year. Each nematode species preferably lives in certain soil horizons, which is due to different requirements for temperature, humidity and other environmental factors. In heat-loving species, reproduction occurs in the warm season, when they are most numerous. Cold-loving nematodes are mainly found in autumn-winter or early spring. An analysis of the species composition of nematodes in the soil of wheat agrocenosis according to the seasons of the year showed that each season, like a certain season, has peculiar factors of existence and is characterized by a specific fauna of nematodes. For example, Cephalobuspersegnis, Eucephalobuselongates, Helicotylenchusmulticinctus and Tylenchorhynchusobtusicaudatus are typical for the spring season, and Aphelenchusavenae for the autumn season - Aphelenchoidesparietinus and Eudorylaimusmonchyste. Some species of Eudorylaimusmonchystera and Aphelenchusavenae are recorded in the winter, spring, summer and autumn seasons. Moreover, the number of their individuals increases significantly in the spring and autumn. The increase in numbers during this period is explained by the presence of the root system of plants, optimal temperature and favorable soil moisture.

A comparative analysis of the seasonal dynamics of the nematode fauna in wheat agrocenosis showed that the maximum number of species and individuals is observed in the spring, a sharp decrease in numbers is observed in the summer, and a new rise in autumn. This is expressed in the following ratio: 14 species (77 specimens) –winter, 32 and (646) - in the spring, 26i (299) - in the summer and 32 species (251 specimens) - in the autumn.

From the above material it can be seen that the qualitative and quantitative predominance of nematodes is observed in the two upper (0-10 and 10-20 cm) layers. Nematodes noted in wheat agrocenoses are representatives of all ecological groups. Eudominant species include Cephalobuspersegnis, Tylenchus agricola, and Helicotylenchus multicintus.

Natural ecosystems qualitatively and quantitatively look richer than nematodofauna of wheat agrocenosis. In natural ecosystems, 65 species have been recorded (1417ex). Species Eudorylaimuspratensis, Mylonchulissolus, Eucephalobuslaevis, Aphelenchusavenae, Aphelenchoidesparietinus and Merliniusdubius constitute the main quantitative core of the fauna. In natural communities, soil layers of 0–10 and 10–20 cm are also densely populated, and in deeper layers, nematodes are less common. In the winter season, in natural ecosystems, 19 species (94 specimens) of nematodes were recorded. Larvae of the species Eudorylaimuspratensis and Eucephalobuslaevis are mainly observed here.

In the spring, 53 species (1068 specimens) of nematodes were recorded. In spring, in the upper layer, a maximum of nematode fauna was recorded at a depth of 10–20 cm - 37 species (679 specimens). Characteristic representative of Merliniusdubius. It should be noted that all species found in summer are represented by an insignificant number of individuals (26 species, 127 specimens). The nematodofauna of the autumn season is represented by 31 species (128 specimens), most of which are concentrated in a 10–20 cm soil layer – 20 species (57 specimens). Dominant species are Merliniusdubius and Helicotylenchusmulticintus.

The structure of the fauna of nematodes of tomato agrocenosis has a different form than in wheat agrocenosis, it is closer to the natural ecosystem. This can be explained by the fact that in the agrocenozetomat (the first year of planting, there was an apple orchard) due to the lack of systematic agricultural measures, conditions are created close to natural communities, 45 species were recorded (1281 specimens).

In the winter season, 33 species of nematodes were recorded (145 specimens), despite the low temperatures of the upper soil layers, quantitative and qualitative predominance of

nematodes was observed at a depth of 10-20 cm. 22 species (65 specimens) were found here, 45% of which were individuals of larval age: Aphelenchusavenae, Eudorylaimusobtusicaudatus, Merliniusdubius, and Ditylenchusdipsaci. 39 species of nematodes (691 specimens) were recorded in spring, a maximum (34 species of 401 specimens) of nematode fauna was recorded in the middle layer of 10-20 cm. The most common species are Ditylenchusdipsaci, Merliniusdubius, Merliniusbogdanovi-katjkovi. It should be noted that all nematode species found in summer are represented by an insignificant number of individuals. In summer, 26 species of nematodes were recorded (281 ex.), In the autumn season, 27, 164 specimens. Most of which are concentrated in a layer of 10–20 cm (24 species, 89 specimens).

All nematodes are directly or indirectly connected with vegetative plants by their nutrition. For this reason, in the field, their main number is concentrated around the root system of plants. Studies have shown that changes in the quantitative and qualitative composition of nematodes does not remain constant both in time and in space [3]. Such changes are associated with various reasons, including the nature of the vegetation cover, species specificity of nematodes, growth and development of plants, and changes in the environment [7].

It can be seen from the above that in spring, qualitative and quantitative predominance of nematodes is observed in the two upper layers. The movement of the maximum of the fauna from a layer of 10–20 cm to a layer of 0–10 cm in spring is apparently explained not only by the presence of optimal conditions for development, but also by the appearance of vegetation.

The vertical distribution of soil nematodes and their accumulation in a particular soil layer, first of all, depends on the presence of the root system of plants, the optimum temperature and humidity of the soil and air. These factors are the main reasons for the differences in the composition and dynamics of the nematode fauna of certain habitats, which is confirmed by the content of the quantitative composition of nematodes. So, in the spring of nematodes at a depth of 0-10 cm, 1012 specimens were found. nematodes, and in the summer season in this same layer of 15 species 190 specimens, i.e., in comparison with the spring season (33 species, 647 individuals). This is the result of a maximum rise in soil temperature (up to 310 C) and a sharp decrease in humidity (2.4%).

The dynamics of the species composition and nematode individuals at a depth of 10–20 cm during the study approximately corresponded to the dynamics of nematodofauna at a depth of 0–10 cm (2217 specimens). Factors acting in a layer of 0-10 cm are also valid in this soil horizon. Aphelenchusavenae and Eudorylaimusmonchystera species prevailing in the soil at a depth of 10–20 cm are found throughout the entire study period.

Nematodofauna of the soil at a depth of 20-30 cm is more than 3-4 times poorer compared with the upper-lying layers and are characterized by the smallest fluctuation in numbers during the study period (742 specimens). In our opinion, this is explained by the lack of soil movements that the upper layers undergo during its mechanical treatment. In the lower horizon, the species Tylenchusagricjla and Aphelenchusavenae prevail throughout the study period.

According to the well-known ecological classification of phytohelminthology [5], all existing types of phytonematodes are divided into 4 ecological groups: paralyzobionts, eusaprobionts, devisaprobionts and phytohelminths. Different ecological groups of nematodes and individual species do not react equally to changes in living conditions. Pararyzobionts are the most diverse species group to the root soil of plants. Of the representatives of this group, 36 species were registered (36.7%). In the dynamics of para-isobionts, the maximum occurred in the spring, when the soil was well moistened and its temperature was relatively low. Eusaprobionts are a small group, including 4 species (4.1%) of nematodes (Rhabditisbrevispuna,Rh.filiformus,Mesorhabditusmonchystera and Diplogasterrivalis). Of the representatives of devisaprobionts, 18 species (18.4%) were found during the study, the species composition of which is more diverse in the spring and autumn. Phytohelminthes are represented by 40 species during the study (40.8%). In the dynamics of the species composition of this group, there are no such sharp fluctuations that were observed in other ecological groups. The maximum number (27 species) is confined to the spring period. The greatest decline in species composition was observed in the summer. In the dynamics of phytonematics, mycohelminths from the genera Aphelenchus and Aphelenchoides were of great importance.

Thus, a certain complex of nematodes is confined to each season; their spatial distribution depends on soil factors. Of the greatest importance are the vegetation cover, the physical properties of the soil, seasonal changes in temperature and soil moisture, as well as agricultural activities in the cultivation of crops.

CONCLUSIONS

1. In the fauna of nematodes, agrocenoses and natural ecosystems, 98 species of 42 genera, 22 families, 7 orders, and three subclasses were recorded.
2. The vertical distribution of soil nematodes and their accumulation in certain soil layers, primarily, depend on the presence of the root system of plants, the optimum temperature and humidity of the soil and air.
3. In the seasonal dynamics of the number of nematodes, spring and autumn peaks are observed, when the number of nematodes is several times higher compared to the summer and winter periods of research. Autumn temperature drop and a slight increase in soil moisture contribute to a new increase in species diversity and the number of phytonematodes. A decrease in these indicators in winter is associated with a decrease in temperature and the absence of a power source.

REFERENCES

1. Kiryanova E.S., Krall E.L. Parasitic nematodes of plants and measures to combat them. - Leningrad: Science, 1971. - T.II. - 522 s.
2. Mavlyanov O.M. Gall nematodes are dangerous plant parasites. - Tashkent: Mehnat, 1987 .-- 92 p.
3. Mavlyanov O.M. Phytonematodes of cotton agrocenoses (issues of taxonomy, ecology, zoogeography and control measures).: Author. Diss. ... Candidate of Biological Science. - Tashkent, 1993. - 28 p.
4. Malakhov V.V., Ryzhikov K.M., Sonin M.D. The taxonomy of large taxa of nematodes: subclasses, orders, suborders // Zoological Journal. Leningrad, 1982. -T. 61. - Vol. 8. - S. 1125-1134.
5. Paramonov A.A. Fundamentals of phytohelminthology. - Moscow: Nauka, 1964.V.2. - 446 p.
6. Suschuk A.A. Soil nematodes of transformed ecosystems of Karelia.: Author. Diss. ... Candidate of Biological Science. - Petrozavodsk, 2009 .-- 15 p.
7. Shesteperov A.A., Savotikov Yu.F. Quarantine phytohelminthoses. - Moscow: Kolos, 1985. Book. 1 .-- 453 s.
8. Bakker E., Dees R., Bakker J., Goverse A. Mechanisms Involved in Plant Resistance to Nematodes. // in: Multigenic and Induced Systemic Resistance in Plants. Eds. Tuzun S., Bent E. 2006. - P. 314-334.
9. Bird, D. Mc.K., A. F. Bird A.F. Plant parasitic nematodes. Chapter 8 // in: Parasitic Nematodes: Molecular Biology, Biochemistry and Immunology, M. W. Kennedy and W. Harnett (Eds). CABI Publishing, Wallingford, UK. 2001 .-- P. 139-166.
10. Hodda, Mike. Phylum Nematoda Cobb 1932 // Zootaxa. - 2011 .-- Vol. 3148. - P. 63-95.
11. Witkowsky T. Zmiany struktury zgrupowania nicieni glebowych w zwiazku z 'jego rozmieszczeniem W. rozmych wartwach glogy Studia // Soc. Scienttorun.,

1967. V. 9. - No. 1–2. - P. 24
12. Naeem Raza Khawaja, Aamir Mushtaq. "Diabetes Mellitus Type 2. Role of Pharmacist in Subcutaneous Therapy. A Challenge!." Systematic Reviews in Pharmacy 8.1 (2017), 1-4. Print. doi:10.5530/srp.2017.1.1