

Findings of the Wheat Nematode *Anguina Tritici* (Steinbuch, 1799) Chitwood, 1935 and their Significance in Growing Plants

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Abstract

The Purpose of the Research: To conduct phytohelminthological studies on wheat in order to detect the wheat nematode *Anguina tritici* (Steinbuch, 1799) Chitwood, 1935 and to find out their significance in plant cultivation.

Materials and Methods: We studied the fauna of wheat nematodes and its root soil collected from grain-growing farms of the republic in the spring-summer periods of 2019-2021. The collection of materials was carried out by the generally accepted route method. The survey was carried out 2 times, in the middle of the growing season (April) during harvesting (June). When isolating nematodes, the Berman funnel method was used. For the determination of phytonematodes, permanent preparations were prepared according to the Seinhorst method. When determining the species of plant nematodes, monographic works and an atlas of plant nematodes compiled at the Institute of Parasitology of the Russian Academy of Sciences were used. Morphometric parameters of nematodes were calculated according to the generally accepted de Mann formula.

Results and Discussion. As a result of the research, the wheat nematode *Anguina* and *tritici* (Steinbuch, 1799) Chitwood, 1935 was registered in wheat ears in the surveyed grain-sowing farms in 5 regions of Uzbekistan. In plant organs and root soil at different stages of development, larval stages of the nematode of two and three years of age were recorded. Population density, depending on habitat conditions, ranged from 8 to 60 larvae per 100 cm³ of soil and roots, and in stems and leaves from 12 to 25 larvae per 20 g. In heavily infested ears of wheat, the number of galls ranged from 9 to 50 ind. For the effectiveness of agrotechnical measures, such as crop rotation in the fight against wheat nematode, experiments were carried out to assess the viability of wheat nematode larvae. One-year-old, two-year-old and three-year-old galls were selected and the number of larvae was counted. It turned out that in annual galls, the number of viable larvae was more numerous compared to biennial and three-year-old galls. This is due to the fact that after a period of time, the accumulated food reserves in the body were used up for the viability of the larvae.

Keywords: Wheat Nematode-*Anguina Tritici*, Galls, Anabiosis, Population Density, Larvae, Uzbekistan.

INTRODUCTION

Agriculture occupies a leading place in Uzbekistan. Based on the introduction of scientific achievements in the republic, there are all opportunities for obtaining high yields of grain crops. However, the grain yield is often significantly reduced as a result of plant damage by various pathogens, among them phytohelminthiases are of no small importance, which partly lead to a sharp decrease in the yield of grain crops, in particular wheat, which contains a number of necessary components for the development of the human body.

Every year in various countries there is a decrease in wheat yields caused by phytohelminths. Often, plants experience a complex effect of harmful fauna and flora, while phytohelminths play an active role in the development of a number of fungal, bacterial, and viral plant diseases [1]. Therefore, the study of the fauna of wheat phytohelminths, the detection of the most dangerous parasitic nematodes, the study of their biology, ecology, distribution, the development of a system of anti-nematode measures and the rationale for control measures is relevant in grain growing [2, 3].

MATERIALS AND METHODS

Plant samples and soil samples collected in 2019-2021 served as material for the study of wheat phytohelminths. From 64 grain-sowing farms in districts and household plots in Ferghana, Andijan, Namangan, Tashkent, Syrdarya, Jizzakh, Samarkand, Navoi, Bukhara, Khorezm, Karakalpak, Kashkadarya and Surkhandarya regions of Uzbekistan.

Sampling was carried out by the route method generally accepted in modern faunistic studies [4]. In each district, wheat fields were subject to inspection twice. The first examination was carried out in the middle of the growing season (April); the second - at harvest (June).

In each surveyed field, plants were removed along with root soil at the same interval, every 100 meters. Each sample consisted of five plants, which were placed in a plastic bag, provided with an appropriate label and delivered to the laboratory for subsequent office processing and microscopic analysis. Under field conditions, the infestation of plants with nematodes was determined by a thorough visual inspection of the root system and aboveground organs.

In route faunistic studies, a total of 802 soil samples and 2406 plant samples were collected and analyzed.

To isolate nematodes from the soil and plant organs, a modified Berman funnel method [5] was used. Samples of soil (20 cm³) and cut roots, aerial organs (20 g) were placed in glass funnels 15 cm in diameter on metal meshes with milk filters, poured with tap water and left for 24 hours in summer, 48 hours in spring at room temperature (10-20°C). At 24-48 hour exposure, the best results were obtained.

Nematodes were fixed with 4% formalin and TAF solution. Permanent and temporary preparations for the detection of nematodes were prepared according to the Seinhorst method [6, 5].

In laboratory conditions, to determine the species affiliation from an ear of wheat, nematode galls were placed in a Petri dish with water and analyzed under the magnification of the MBS-6 and GDP-12AV binoculars. The galls were opened with a dissecting needle and an eye scalpel, and females, males, and nematode larvae were carefully removed from them.

Anatomical and morphological study of plant nematodes was carried out on freshly prepared temporary preparations in a water drop or on permanent preparations in glycerol-gelatin under an N-10E and Biolam-NSZ-405 microscope. 2150 permanent and 1545 temporary preparations were subjected to determination.

To determine the species of plant nematodes, monographic works were used, as well as an atlas of plant nematodes compiled at the Institute of Parasitology of the Russian Academy of Sciences, and morphometric indicators obtained by the generally accepted de Man formula in the modification of Micoletzky [7] were also used. Nematodes were determined under the microscope GDP-12AV and Biolam-NSZ-405 under immersion lenses.

RESULTS AND DISCUSSION

As a result of phytohelminthological studies, the wheat nematode *Anguina tritici* (Steinbuch, 1799) Chitwood, 1935 was registered in wheat ears in the surveyed grain-sowing farms of Tashkent, Fergana, Jizzakh, Syrdarya and Surkhandarya regions.

In plant organs (roots, stems, leaves), as well as in the root soil, larval stages of two-year and three-year-old nematodes were recorded at different stages of development. The population density, depending on the habitat conditions, ranged from 8 to 60 larvae per 100 cm³ of soil and roots. In the above-ground organs of wheat, both in stems and in leaves, the population density of larvae in the early initial periods was not found, then in the middle and at the end of the growing season of plants, their density was significantly average from 12 to 25 larvae per 20 g of stems and leaves.

Larvae in an anabiotic state enter the soil in galls along with seed material during harvesting or fallen spikelets of infected plants after harvesting. When the infected grain swells in moist soil, the second instar larvae actively enter the soil and penetrate into the roots of seedlings. The larvae move up the stem, reach the point of growth and accumulate in the axils of the leaves.

During the earing period, the larvae of the wheat nematode actively migrate into the interior of the stem, penetrate into the embryo of the flowers, causing the formation of galls. Inside the galls, the larvae develop into adult females or males (Fig. 1). After fertilization, females lay up to 2-2.5 thousand or more eggs inside the grain. In the same place, larvae of the second stage emerge from the egg.



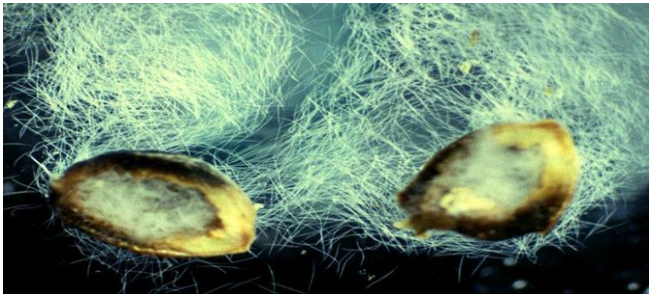
"Picture 1. Adult females and males inside the galls"

Wheat nematode galls are essentially wheat grains filled with larvae. They ripen at the same time as healthy grains. Mature galls are very different from healthy wheat grains in their darker color. They can be mistaken for weed seeds (Fig. 2).



"Picture 2.1: healthy grains of wheat; 2 - mature galls with more dark color (original)"

On a longitudinal section, one can see a white mealy mass surrounded by thick walls of the gall. When viewed under a microscope, numerous second-instar larvae can be seen in a drop of water. Larvae in galls in a state of anabiosis can remain viable for more than 10 years (Fig. 3).



Picture 3: Wheat nematode galls filled with larvae (micrograph)"

The nematode strongly infects all varieties of wheat. Infected plants are stunted, stems and leaves are short and twisted. Severely infected seedlings may not form spikes or form short spikes not exceeding 12 cm, in contrast to 15-22 cm in healthy ones. The number of galls in heavily infected ears varies from 9 to 50 ind.

To solve the issue of determining the effectiveness of agrotechnical measures, in particular, as a crop rotation used in the fight against wheat nematode, it is necessary to know not only the number, but also the viability of infested larvae in anguine galls. Assessing the viability of larvae in galls is rather difficult. We conducted experimental experiments in laboratory conditions to assess the viability of larvae of the wheat nematode - *Anguina tritici*. At the same time, one-year-old, two-year-old and three-year-old galls were selected, they were manually torn into a petri dish with dissecting needles into water, the contents of the gall shells were cleaned from larvae and they were sucked off with a pipette. Then the number of larvae in the suspension of galls was counted under a microscope. When counting, viable larvae straightened up, had normal body turgor, and their internal organs were clearly visible through the cuticles. The body of the dead larvae was curved with sharp bends; they were also characterized by a more granular esophagus and vacuolization of internal organs (Table).

Determination of the viability of wheat larvae nematodes - *Anguina tritici*

№	Age of the Galls	Quantity viable larvae (from the count of 2500 specimens)	in (%) nominal ratio	Quantity dead larvae (from the count of 2500 specimens)	in (%) nominal ratio
1	annual galls	2026	81,0	474	18,9
2	biennial galls	1308	52,3	1192	47,8
3	Triennial galls	459	18,4	2041	81,6

The data given in the table show that in one year old galls the number of viable larvae was more numerous compared to two year old and three year old galls. This can be explained by the fact that after a period of time, the accumulated food reserves in the body were used up for the viability of the larvae.

CONCLUSION

The wheat nematode is considered widespread in all countries of the world until the middle of the last century. It should be noted that due to the strict preventive measures taken, it has been destroyed in many countries or has no significant practical significance. But, unfortunately, it is still found in Uzbekistan. In most cases, the wheat nematode is not numerous. However, as the sown area expands and the infected seeds are not cleaned, as well as growing it in a monoculture, it leads to the identification of anguin with a fairly high density of their population.

Thus, based on the above data, it can be said that in case of detection of a wheat nematode in the fields where cereals are grown, in particular wheat, agrotechnical measures should be applied as a crop rotation for at least three growing seasons. This will undoubtedly lead to an improvement in the phytosanitary condition of wheat fields, an increase in productivity and the prevention of infection of fields with anguineosis by an average of 70-80%. We also believe that in the fight against the wheat nematode, a good result is given by preventive measures that prevent the sowing of infected seeds. Grains passed through a wheat trier, which is almost completely free of wheat nematode galls.

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