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PHYTONEMATODES OF PEANUT PLANTS IN THE SOUTH OF UZBEKISTAN

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Abstract.

The Surkhandarya oasis of the southern region of the Republic of Uzbekistan, the fauna of nematodes found in the peanut root and soil around the root was studied, as well as their population density and their effect on plants were scientifically analyzed. As a result of the carried out phytohelminthological studies in peanut plant in the southern region of Uzbekistan, we found 136 species of phytonematodes belonging to 55 genera, 38 subfamilies of 34 families, 22 superfamilies, 13 suborders, 9 orders and 2 subclasses. In total, the detected nematodes by orders are distributed as follows: Order Enoplida is represented by 2 species, Mononchida-4, Dorylaimida -18, Alaimida-3, Monhysterida -6, Teratocephalida-32, Rhabditida-12, Aphelenchida-21 and order Tylenchida-38 species. Also analyzed the frequency of stability of the number of individuals in the population of nematode species according to the Tichler scale. Accordingly, the Tichler scale was used to assess the frequency of species stability in the nematode population. The number of 16553 individuals belonging to 136 identified species was analyzed according to the frequency of stability, 4905 individuals belonging to 66 species were random species (belonging to Enoplida, Mononchida, Dorylaimida, Alaimida, Monhysterida, Rhabditida, Aphelenchida), 11648 individuals belonging to 70 species were recorded as unstable species (belonging to Teratocephalida, Tylenchida order).

Key words: pararizobionts, countermeasure, phytohelminthiasis, frequency of stability, permanent species, absolutely permanent species, random species, unstable species.

1.Introduction.

Peanut (*Arachis hypogaea*) is a common crop in tropical and subtropical regions of the world, the bulk of its cultivation, i.e. 90%, occurs in Asia and Africa, and a small part in North America (FAOSTAT statistics database, 2015). Currently, peanuts are planted on 3825 hectares of farms in Surkhandarya region (as of January 1, 2022). Peanut seeds contain 60% oil, 35% protein, vitamins such as A, E, K, D, and the grain is widely used in food and in the confectionery industry. The stems and leaves are valuable feed in livestock farming; peanut pods are used to make insulating materials and as fuel (firewood) (Variath, Janila, 2017; Oripov, Xalilov, 2007). In order to increase the productivity of the peanut plant, one of the important tasks is the creation and introduction of new high-yielding varieties that are resistant to unfavorable abiotic and biotic environmental factors, including the identification of microscopic plant-parasitic nematodes and the development of environmentally friendly, inexpensive and highly effective methods of fighting them theoretical, but also practical significance. Currently, a number of studies are being conducted around the world to study the parasitic nematodes found in the peanut plant and their negative impact on crop yields. In particular, in the United States, a single ectoparasitic nematode, *Belonolaimus longicaudatus*, was found to cause \$1.28 billion in annual damage to peanut crops, and research has found that the most effective way to control this parasite is to create a sustainable variety (Ravelombola et al., 2022). In 2021-2022, research was carried out on 6 peanut varieties in the Nyakach and Karachuonyo districts of Kenya. As a result, a total of 11 genera of nematodes were discovered (*Aphelenchoides*, *Meloidogyne*, *Pratylenchus*, *Helicotylenchus*, *Tylenchus*, *Scutellonema*, *Trichodorus*, *Hemicycliophora*, *Tylenchorynchus*, *Rotylenchulus* and *Criconema* spp.) (Nyandiala et al., 2023). A study conducted in northern China's Shandong Province found a significant impact of root-knot nematodes on peanut yield, with nematode counts in permanent peanut plots being 21.92% higher than in rotational peanut plots, the meeting noted (Wu et al., 2023). In Virginia, West Virginia and Georgia, *Anguina tritici* is considered a quarantine species and has been experimentally shown to damage major field crops such as cotton, wheat, potatoes and peanuts, as well as greenhouse vegetable crops (Eisenback, 2018). In Uzbekistan, in particular in Surkhandarya region, extensive research has been conducted on the fauna of plant phytohelminths, but there are very few sources of phytohelminths and their damage in peanut plants, which are not enough to solve phytohelminthological problems of our time and therefore require additional research. Lack of information on phytohelminths, which are the main parasites of peanut plants, and the pathological conditions they cause, leads to a sharp decline in the high yield that can be obtained from the plant. Based on this, our goal is to identify the fauna of parasitic phytohelminths and develop a system to countermeasure them (Chariyev et al., 2022; Choriyev S. H. et al. 2023).

The development of peanut plant crop in Uzbekistan is an urgent task in solving the problems of providing the population with high-quality and various food products. To increase the efficiency of peanut plant crop, it is directly related to the introduction into practice of new, more suitable grape varieties for certain environmental conditions, which are resistant to unfavorable abiotic and biotic environmental factors, as well as increased productivity in combination with a good harvest quality. In addition, the productivity of peanut plants and the quality of their seed from biotic factors can be limited by the wide spread of pests and diseases on them, in particular, the most dangerous of them are phytoparasitic nematodes that affect plants, caused as diseases of phytohelminthiasis. According to foreign researchers, the causative agents of phytohelminthiasis, lead to small-leaved and dwarf plants, a sharp decrease in productivity and cause significant damage to the quality of seed (Radhakrishnan et al., 2021; Elkelany et al., 2021). They cause numerous and varied damage to the root system of the plant; in addition, they play an even greater role in the spread of mycotic, viral, bacterial and other diseases. Therefore, phytohelminthological studies of this culture, the study of the faunistic complex of phytonematodes of peanut plants and the identification of parasitic species are relevant.

2. Materials and methods

Collection of samples

In order to determine the species composition of the faunistic complex of phytonematodes of peanut plants, as well as to analyze the population density and elucidate trophic relationships with the plant in the period from 2019-2022 (Хуррамов, Бобокелдиева, 2020; Кирьянова и Кралль, 1971). We collected phytonematodes from the root soil and root system of plants in 26 farms from 13 districts of the Surkhandarya region (**Figure 1**).

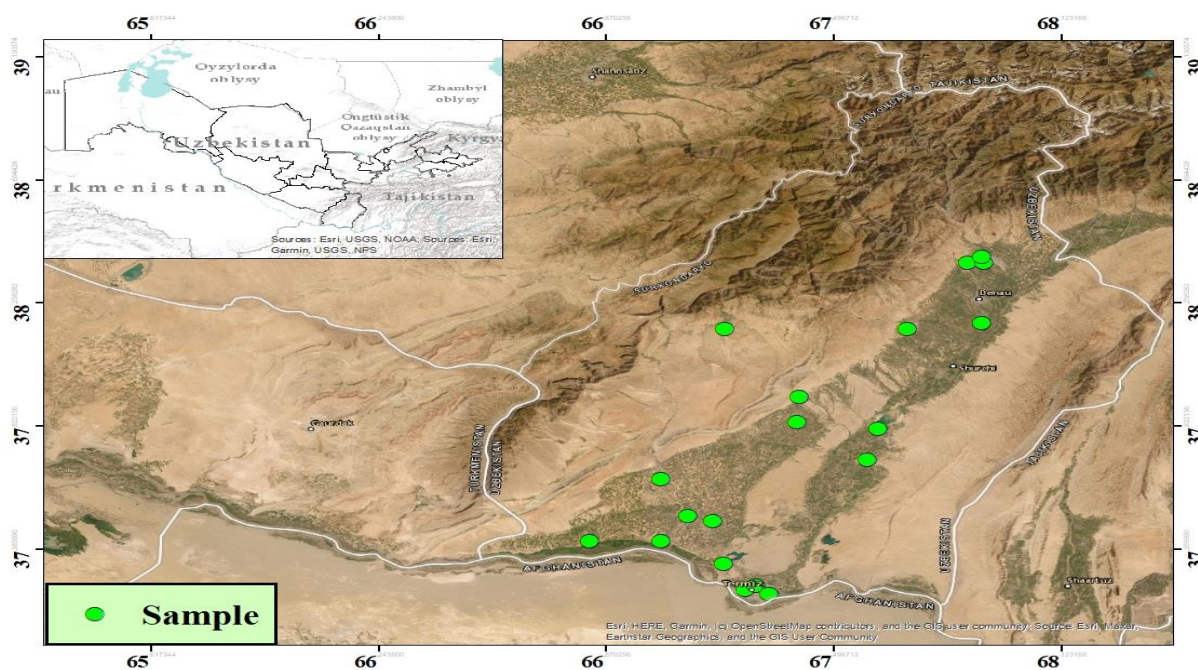


Figure 1: Areas where samples were collected

The studies were carried out by the generally accepted route method. During the phytohelminthological study, 442 samples of soil and root system of peanut plants were collected and analyzed. In the field, each soil sample, along with plant roots, was placed in a separate cellophane bag and labeled. The collected samples were analyzed in the phytohelminthological laboratory.

Isolation of nematodes from nanuna and preparation of drug.

First, the roots of the plant were carefully examined for nematode infestation. Then, the root soil and root system were examined separately. To isolate nematodes from the soil and root system of plants, a modified Berman funnel method was used (Khurramov, Bobokeldieva 2020). Exposure at room temperature + 25°C was 20-28 hours, at a temperature of +30° + 35°C - 10-12 hours. Soil samples for the presence of cyst nematodes were usually analyzed by the Decker method. A 4-5 % formalin solution was used to fix the nematodes. Enlightenment of nematodes was carried out in a mixture of glycerol with alcohol (1: 3), and permanent preparations on glycerol were prepared for in-office processing of the material according to the Seinhorst method (Seinhorst, 1959; Khurramov, Bobokeldieva 2020). The species composition of nematodes were studied under an N-300M Trinocular microscope. When determining the species belonging of plant nematodes, the works of domestic and foreign authors were used, as well as the atlas of plant nematodes compiled at the Institute of Problems of Ecology and Evolution named after A. N. Seversov of the Russian Academy of Sciences (Парамонов, 1962; Скарбилович, 1978; Кирьянова, Кралль, 1969; Кирьянова, Кралль, 1969; Кралль, 1978; Тулаганов, Усманова, 1975; Тулаганов, Усманова, 1978; Парамонов, Барановская, 1968; Скарбилович, 1980, Choriyev S. et al. 2024; Khurramov A. et al. 2024, Choriyev S.H. et al. 2024). To determine the species, we used morphometric parameters that are obtained according to the generally accepted de Mann formula modified according to Micoletzky (De Man, 1880).

3.Results and Discussion

As a result of the carried out phytohelminthological studies in peanut plant in the southern region of Uzbekistan, we found 136 species of phytonematodes belonging to 55 genera, 38 subfamilies of 34 families, 22 superfamilies, 13 suborders, 9 orders and 2 subclasses. In total, the detected nematodes by orders are distributed as follows: Order Enoplida is represented by 2 species, Mononchida-4, Dorylaimida -18, Alaimida-3, Monhysterida -6, Teratocephalida-32, Rhabditida-12, Aphelenchida-21 and order Tylenchida-38 species(**Table 1 and Figure 2**).

Table 1: Qualitative and quantitative ratio of nematode species of peanut plants by order

№	Orders name	Number of species	%	Number of individs	%
1	Enoplida	2	1,47	113	0,68
2	Mononchida	4	2,94	119	0,72
3	Dorylaimida	18	13,24	590	3,56
4	Alaimida	3	2,21	87	0,53
5	Monhysterida	6	4,41	147	0,89
6	Teratocephalida	32	23,53	6002	36,26
7	Rhabditida	12	8,82	820	4,95
8	Aphelenchida	21	15,44	3029	18,30
9	Tylenchida	38	27,94	5646	34,11
Total:		136	100	16553	100

The order Enoplida includes one family: Onchulidae; one genus: Prismatolaimus and 2 species which is 1,47 % of the total number of species) and a total of 113 specimens (0,68% of the total number of detected plant nematodes). The order Mononchida is represented by 2 families: Mononchidae, Mylonchulidae; 3 genera: Mononchus, Clarcus, Mylonchulus; 4 species (2,94 %) and a total of 119 specimens (0,72%).

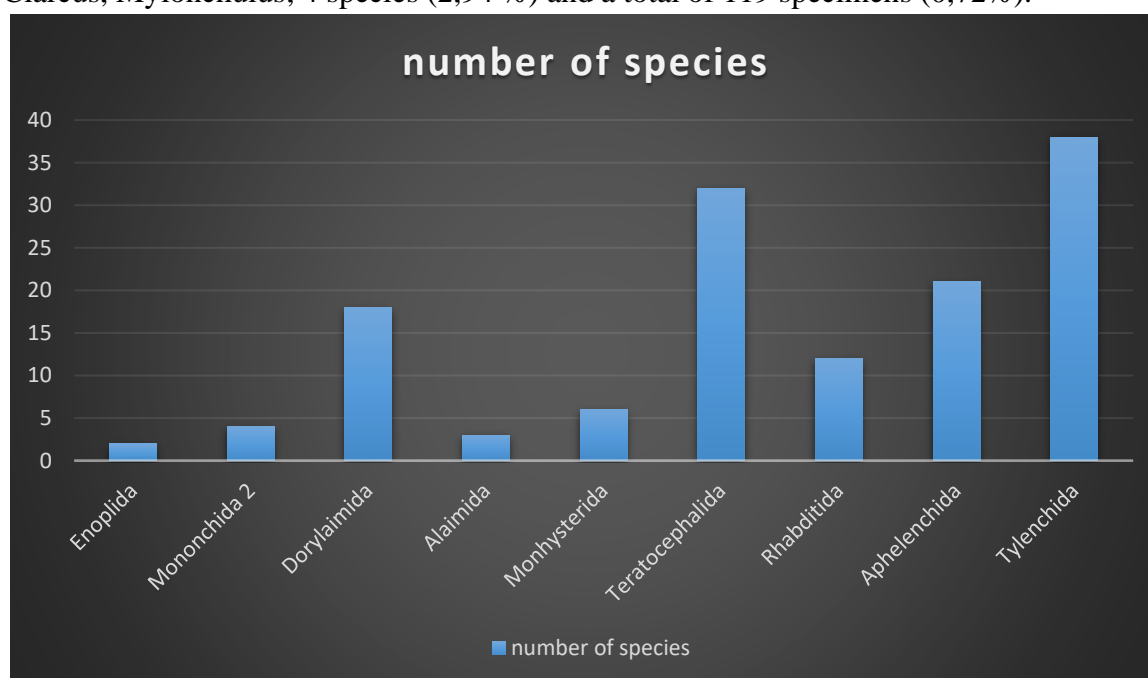


Figure 2: Distribution of the number of species in nematodes by order

The order Dorylaimida includes 8 families: Dorylaimidae, Qudsianematidae, Nordiidae, Aporcelaimidae, Xiphinemidae, Discolaimidae, Tylencholaimidae, Nygolaimidae; 10 genera: Dorylaimus, Paradorylaimus,

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Mesodorylaimus, Eudorylaimus, Longidorella, Aporcelaimellus, Xiphinema, Discolaimium, Tylencholaimus, Nysolaimus and 18 species (13,24), a total of 590 specimens (3,56 %) of phytonematodes.

The Alaimida order is represented by 2 families: Alaimidae, Diphtherophoridae; 2 genera: Alaimus, Diphtherophora; 3 species (2,21%), a total of 87 individuals (0,53%) of phytonematodes.

The order Monhysterida includes 3 families: Plectoidae, Axonolaimoidae, Monhysteridae; 4 genera Anaplectus, Proteroplectus, Gymnolaimus, Monhystra and 6 species (4,41%), a total of 147 specimens (0,89%) of phytonematodes.

The order Teratocephalida includes 2 families: Cephalobidae, Panagrolaimidae; 8 genera: Cephalobus, Heterocephalobus, Eucephalobus, Acrobeloides, Chiloplacus, Acrobeles, Ypsylonellus, Panagrolaimus; 32 species (23,53 %), a total of 6002 individuals (36,26%) of phytonematodes

The order Rhabditida is represented by 2 families: Rhabditidae, Diplogasteroididae; 7 genera: Mesorhabditis, Bursilla, Caenorhabditis, Pelodera, Rhabditis, Cuticularia, Mesodiplogaster; 12 species (8,82 %), a total of 820 individuals (4,95%) of phytonematodes.

The Aphelenchida order is represented by 3 families: Aphelenchidae, Paraphelenchidae, Aphelenchoididae; 3 genera: Aphelenchus, Paraphelenchus, Aphelenchoides; 21 species (15,44%), a total of 3029 individuals (18,30%) of phytonematodes.

The order Tylenchida includes 11 families: Tylenchidae, Dolichodoridae, Psilenchidae, Rotylenchulididae, Hoplolaimidae, Pratylenchidae, Meloidogynidae, Paratylenchidae, Anguinidae, Sychnotylenchidae, Neotylenchidae; 17 genera: Tylenchus, Filenchus, Lelenchus, Aglenchus, Tylenchorhynchus, Bitylenchus, Merlinius, Psilenchus, Rotylenchus, Helicotylenchus, Pratylenchus, Meloidogyne, Paratylenchus, Ditylenchus, Neoditylenchus, Nothotylenchus, Neotylenchus; 38 species (27,94%), a total of 5646 specimens (34,11%) of phytonematodes.

The above analysis shows that among the orders in terms of species composition, the order Tylenchida occupies the first place, which is 27,94% of all detected species of nematodes of peanut plants. Then the order Teratocephalida (23,53%), the order Aphelenchida (15,44%) and the order Dorylaimida (13,24%).

In terms of the number of individuals among the orders, the first place is occupied by the order Teratocephalida, which is 36,26 % of the total number of detected phytonematodes. Then the order Tylenchida (34,11 %), the order Aphelenchida (18,30 %) and the order Rhabditida (4,95%). Also, among the species recorded in the faunal complex of phytonematodes identified in the peanut plant, there are species that are widespread as species, but the population density is not very high, and vice versa, there are species whose range is narrow and short-lived. However, the population density turned out to be high. Accordingly, the Tichler scale was used to assess the frequency of species stability in the nematode population (Tichler, 1949, Trojan, 1980) The number of 16553 individuals belonging to 136 identified species was analyzed according to the frequency of stability, 4905 (29.63%) individuals belonging to 66 (48.53%) species were random species (belonging to Enoplida, Mononchida, Dorylaimida, Alaimida, Monhysterida, Rhabditida, Aphelenchida), 11648 (70.37%) individuals belonging to 70 (51.47%) species were recorded as unstable species (belonging to Teratocephalida, Tylenchida order). There were no permanent and absolutely permanent species.

4. Conclusion.

As a result of the carried out phytohelminthological studies in peanut plant in the southern region of Uzbekistan, we found 136 species of phytonematodes belonging to 55 genera, 38 subfamilies of 34 families, 22 superfamilies, 13 suborders, 9 orders and 2 subclasses.

The above analysis shows that among the orders in terms of species composition, the order Tylenchida occupies the first place, which is 27,94% of all detected species of nematodes of peanut plants.

Shows that among the orders in terms of species composition, the order Enoplida occupies the last place, which is 1.47% of all detected species of nematodes of peanut plants.

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In terms of the number of individuals among the orders, the first place is occupied by the order Teratocephalida, which is 36,26 % of the total number of detected phytonematodes.

In terms of the number of individuals among the orders, the last place is occupied by the order Alaimida, which is 0,53 % of the total number of detected phytonematodes.

When the number of 16553 individuals belonging to 136 identified species was analyzed according to the frequency of stability, random species and individual unstable species were recorded. There were no permanent and absolutely permanent species.

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