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Bio-Ecological Monitoring of Potatoes Stem Nematodes (*Ditylenchus destructor* Thorne, 1945) in Four Major Potato-Planter Municipalities of Kvemo Kartli (Eastern Georgia) Accompanying Fauna Biodiversity

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***Abstract*—**There has been studied the distribution character of potato stem nematode (*Ditylenchus destructor* Thorne, 1945) on the potato fields in four municipalities (Tsalka, Bolnisi, Marneuli, Gardabani) of Kvemo Kartli (Eastern Georgia).

As a result of scientific research there is stated the extensiveness of pathogens invasion, accompanying composition of fauna species, environmental groups of populations and quantity.

During the research process in the studied ecosystems there were registered 160 forms of free-living and Phyto-parasitic nematodes, from which 118 forms are determined as species and 42 as genus.

It was found that in almost the entire studied ecosystem there is dominated pathogenic nematodes *Ditylenchus destructor*. The large number of exemplars (almost uncountable) was found in tubers material of Bolnisi and Gardabani.

***Keywords*—**Nematoda, potato, steam, bioecological, monitoring.

I. Introduction

AMONG pests of cultivated plants the most important place is given to roundworms (nematodes). They attract more and more attention and become matter of special research. Nematodes are considered to be a very interesting group of organisms having evident biological progress, characterizing by high rate of population growth, wide spectrum of spreading and numerous intraspecific variable signs.

Nowadays there are known about 3000 species of phitohelminthes (plant parasitic nematodes), damaging practically all varieties of cultivated plants and annually destroying 10% of agricultural produced all over the world. 1000 kinds of them can cause various pathological reactions in the body and one hundred species can cause massive destruction of agricultural cultures on especially large territories. Phytohelmintosis of perennial cultural plants and woodland can take irreversible character and panphitoty can cause quarantine at the state level and even bring to termination of export and import between countries [1].

Plant parasitic nematode-phytohelminths cause colossal damage to crops and harvest. Great interest for them is connected with intensification of the modern crop farming, expansion of transport connections, export and import of crops, sapling and food stock and acute growth of private farms. 110 countries of the world have combined their joint efforts in struggle against nematode, constant global and regional monitoring is conducted on annual basis; millions of dollars are spent since losses connected with nematode can cause irreparable losses to the economy of any country [2].

Among cultivated plants particularly destroyed by nemathelminthes, potato is economically the most important one. Ground and root samples of dozens of cultures are annually taken in the USA - one of the largest potato producing countries of the world, in order not to miss any dangerous nematological epidemic. Among 16 species subject to permanent monitoring, the most important species is Globodera` s cysts. Monitoring of each missed year will cost to the state 25-30 million US dollars. Besides experts of Agricultural Department there are also scientists, collaborators of various state and private structures and forest service engaged in this program. This costs much cheaper to the state than quarantine of huge territories and losses running into millions [3].

Phitohelminthes noticeably reduce quality of any produce and cause poisoning of people and animals. Many species of phitohelminthes are registered in the quarantine list as very dangerous and epidemic pests. Specialists think that combating nematodes is the most difficult problem of protection of plants. At the present moment the most effective measure for combating nemathelminthes is prevention and quarantine."

Fighting against phytohelminths is one of the most difficult problems of the Plant Protection and Quarantine Service. It is very difficult to make complete diagnosis without phitohelminthology, since unique properties of phytho-helminth to overcome any possible hindrances, colonize huge territories, adopt in new ecological environment, are researched by phyto-helminthology [4]. It is adopted in the world practice that like in case of possible pandemia and

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epidemic, plant epiphytoty must be prevented at early stages and even once conducted bioecological monitoring will be the best means for prevention of possible results of epiphytoty.

II. Materials and Methods

Continuous ecological monitoring of researched areas is the most important condition in management of combating processes directed against invasion. In our case the matter of research is parasite nematodes or phitohelminthes of stem, root and tuber of potato (*Ditylenchus destructor*, *Pratylenchus pratensis*, and *Globodera rostochiensis* – the last one and its cysts have not been registered in Georgia), that can cause colossal losses to potato regions of Georgia. Invasion level of various parts of soil and plants is determined by numeral number of viable examples and their cysts in the certain quantity of soil and plants. Collection of materials (ground, green parts, root and tuber of plants) at the researched territory is reasonable both before planting and in the period of vegetation and harvest [5].

The three expeditions were held in Kvemo Kartli for execution of planned works according to the trophic. We received the material by route method in four municipalities of the region: Marneuli, Bolnisi, Gardabani, Tsalka (from January 2012 to November 2012). 5 samples (20 samples total) were accumulated from each region (during each expedition). Finally, 60 samples of soil and 30 samples of tubers and green parts were collected from 3 expeditions. One probe of soil and root is 50 gr. and the depth of sampling is 5-10cm. Extraction of nematodes from soil, fixation and identification was carried out by methods accepted in nematology in the Laboratory of Nematology of the Institute of Zoology.

III. Result and Discussion

It was found that in almost the entire studied ecosystem there is dominated pathogenic nematodes Ditylenchus destructor, representative of the Anguinidae family, which is known as potato stem nematodes. These nematodes going into the roots of potato, tubers and stem from the soil or from damaged seed and cause diseases that are known as Ditilenhosis. The presence of pathogenic nematodes is traced in the entire period of harvesting and reaches its peak at the end of vegetation. There were studied separately the nematode-fauna of potato roots, stem and tubers in all four ecosystems, and there was turned out that the number of pathogenic nematodes exceeded the permissible limit. The large number of exemplars (almost uncountable) was found in tubers material of Bolnisi and Gardabani. As reported, the tubers suffered from Ditilenhosis are rotting and become useless for human consumption, which reduces the amount of harvest and thus get damage to the farmers. Fluctuation of pathogenic nematode *Ditylenchus destructor* is resulted in the table (Fig. 1).

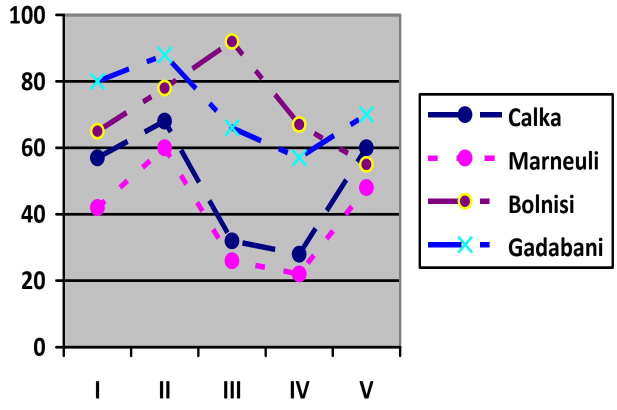

Fig. 1 Fluctuation of pathogenik nematode *Ditylenchus destructor* in percentage

During the research process in the studied ecosystems there were registered 160 forms of Free-living and Phyto-parasitic nematodes, from which 118 forms are determined as species and 48 as genus. The registered nematodes belong to 2 subclasses, 8 orders and 41 families. By quantity and diversity the order Dorylamida occupies the first place. The rest orders are characterized by nearly similar quantitative indices, what is well seen below.

Sicaguttur sp., the one form of nematodes identified by us, is probably new for scientists and requires further research. During the research there was registered a rare genus of nematodes, *Aprutides guidettii* Scognamiglio, 1974 (subfamily *Paraseinurinae*) [6]. The nematodes of this genus are registered in just a few places in the world. The constant preparation of nematode is kept at Ilia State University, in the Nematology laboratory of Institute of Zoology.

There is revealed a dominant species: *Anaplectus granulosus, Plectus parietinus, Eudorylaimus* sp, *Ecumenicus monohystera, Aporcelaimellus obtusicaudatus, Rhabditis* sp.

As nematodes inhabit any biotopes as a result of broad adaptive radiation, their ecological structure is extremely complicated. Trophic has the most important role from the ecological characteristics of nematodes [7]. Since the soil is one of the most densely populated parts of the terrestrial ecosystem, it consists of a large number of food resources, which has been successfully used by nematodes (bacteria, fungi, algae, small oligochaetes, vegetable detritus, etc.). Oligotrophy is characterized by abundant species from the 160 forms of material; bacteriotrophy is in the second place (45 form), parasites are presented with 28 species, they are as ectoparasites, as well as narrow stylet. Representativeness of ecological groups of nematodes in % is given in Fig. 2.

TABLE I
DISTRIBUTION OF NEMATODES SPECIES AND GENUS BY FAMILIES

Family	Genus	Number of Species
Alaimidae	Alaimus	6
	Amphidelus	2
Prismatolaimidae	Prismatolaimus	3
Tripylidae	Tripyla	3
	Tpripylina	1
Tobrilidae	Tobrilus	1
	Eutobrilus	1
Aulolaimidae	Aulolaimus	1
Monhysteridae	Monhistera	1
	Geomonhystera	1
Plectidae	Plectus	7
	Anaplectus	2
Cylindrolaimidae	Cylindrolaimus	2
Nygolaimidae	Nigolaimus	4
Dorylaimidae	Dorylaimus	1
	Laimodorus	1
	Prodorylaimus	1
	Mesodorylaimus	9
Thornenematidae	Thornenema	3
	Sicaguttur	2
Qudsianematiae	Eudorylaimus	12
	Allodorylaimus	3
	Ecumenicus	1
	Labronema	1
	Discolaimus	2
Aporcelaimidae	Aporcelaimellus	8
	Sectonema	1
Nordiidae	Dorydorella	1
	Longidorella	2
	Pungentus	4
	Enchodelus	2
Longidoridae	Xiphinema	3
Tylencholaimidae	Tylencholaimus	2
Leptonchidae	Leptonchus	1
Dipterophoridae	Dipterophora	2
Belondiridae	Belondira	1
Axonchiidae	Axonchium	1
Oxydiridae	Oxydirus	1
Actinolaimidae	Actinolaimus	1
Tylencholaimellidae	Tylencholaimellus	1
Mononchidae	Mononchus	1
	Clarcus	2
	Prionchulus	2
Mylonchulidae	Mylonchulus	4
Anatonchidae	Miconchus	1
Rhabditidae	Rhabditis	2
	Bursella	1
	Pelodera	1
	Diploscapter	1
Diplogasteridae	Mesodiplogaster	2
Panagrolaimidae	Panagrolaimus	1
Cephalobidae	Cephalobus	3
	Eucephalobus	4
	Heterocephalobus	1
	Acrobeles	1
	Acrobeloides	2
	Chiloplacus	1
Tylenchidae	Aglenchus	1
	Filenchus	2
	Tylenchus	3
	Psilenchus	1
	Malenchus	1
Anquinidae	Ditylenchus	2
Tylenchorhynchidae	Tylenchorhynchus	1
	Merlinius	1
Hoplolaimidae	Helicotylenchus	4
	Rotylenchus	1
Neotylenchidae	Neotylenchus	1
Pratylenchidae	Pratylenchus	2
Paratylenchidae	Paratylenchus	1
Aphelenchidae	Aphelenchus	1
Aphelenchoididae	Aphelenchoides	4
Seinuridae	Seinura	1
Paraseinuridae	Aprutides	1

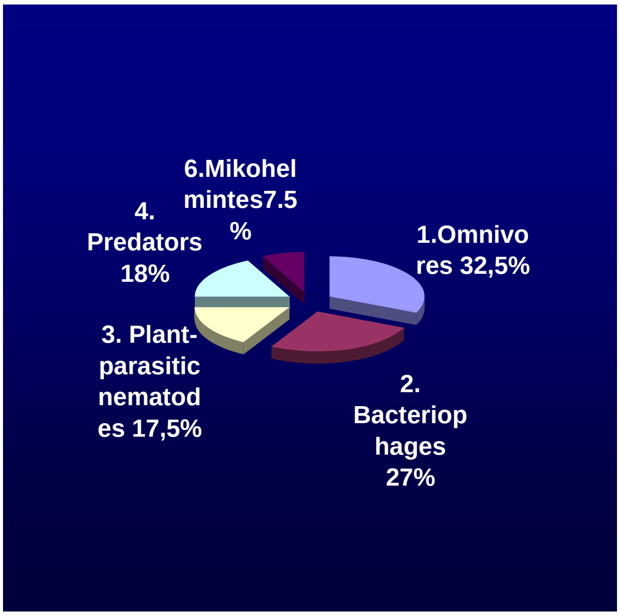

Fig. 2 Percentage parity of different ecological groups
1. Omnivores and nematodes of undetermined trophic specialization – 32.5%; 2. Bacteriophages and saprophages – 27%; 3. Plant-parasitic nematodes – 17.5%; 4. Predators – 18%; 5. Micophages – 7.5%.

Basing on such complex data we will have an opportunity to determine degree and economic borders of invasion; prepare recommendations and consultations by means of visual determination of the number of localization focuses and invasion degree of tuber. We think that the study of existing problems will make for the following development of potato growing, increases the number and quality of harvest, considerably reduces economical losses (in compliance with the existing data up to 10% to each ton) and contributes certain part into struggle against poverty.

And finally, complex studying of the most difficult interdependence existing between plants and nematodes will make it possible to find right approach to the problem. Complete destruction of nematodes is impossible. By means of constant ecological monitoring we can reduce the number of their population to the limit exceeding of which can cause economic losses. The most important thing is that we can prevent spreading of most pathogenic species at time of casual introduction.

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