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STUDY OF NEMATODES ASSOCIATED WITH THE VEGETABLE CROPS IN SOME LOCALITIES IN TIARET (WEST OF ALGERIA)

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Abstract

The present study aims to examine the nematode population at some stations of vegetable crops of the province of Tiaret.
The results of the study showed various species of nematodes associated with vegetable crops in the Algerian steppe especially the province of Tiaret and Djelfa. We counted eleven genres of phytophagous nematodes represented by Aphelenchus, Aphenchoides, Ditylenchus, Tylenchus, Psilenchus, Pratylenchus, Tylenchorhynchus, Paratylenchus, Cephalobus, Dorylaimus, Rabtidis and Helicotylenchus.
The densities of these nematodes vary by location and method of sampling and the nature of the soil.
The Cephalobus, Dorylaimus, Ditylenchus and Aphelenchus are the most common and abundant in the three stations of study. These taxa seem to adapt to different types of vegetable soils. Their existence may be subject to significant damage to installed cultures. Furthermore the use of ecological indicators of structure (Frequency and Abundance) class nematodes in 04 groups:

- *Nematodes abundant and frequent, dangerous for the vegetable crops.*
- *low abundance and frequent Nematodes, less harmful and adapts to different soil types*
- *abundant and infrequent nematodes, their presence in some soils, can be dangerous for the vegetable crops.*
- *Nematodes low abundance and infrequent occasionally meet their densities are low and have little or no damaging. Vegetable crops appear not to be their special host.*

Key words*: nematodes phytopages, not phyatophages nematodes, vegetable crops, Tiaret, Algeria.*

INTRODUCTION

Vegetable crops under greenhouses appear as one of the most promising sectors of the Algerian agriculture. The areas occupied by these crops in Algeria are constantly evolving, they increased from 345,558 ha in 2004 to 363,030 ha in 2005 for field crops for the greenhouse crops have increased from 0.02 ha in 1970 to 5500 ha 1990 (Benhamou, 1990), to 6862.87 ha in 2004 (Agricultural statistics, 2004) and 6736.67 ha in 2005 (Agricultural statistics, 2005). Vegetable crops are in second place after cereals in the daily consumption of Algerians (El- Kebiri, 1993).

In the Algerian steppe areas reserved to vegetable crops seem to be of considerable local importance. The District of Tiaret and that of Djelfa have large potential for vegetable production in large quantities due to climatic and soil conditions are very favorable in particular represented by abundant sunshine throughout the year and the diversity of conditions such environments spread to satisfy not only domestic needs but also the food industry (Agricultural statistics, 2007).

Apart from the best climatic conditions offered shelter greenhouses developments cultures, they also create an environment conducive to the spread of disease and pullulation many pests such as nematodes, the most abundant organisms in the world and almost common in soils (De Guiran, 1983). These nematodes cause considerable damage and decreases in yields on many crops. The damage depends on the density pullulations in the soil it varies depending on climate, soil conditions, cultural practices (Scotto La Massese, 1986).

This work aims to study the diversity of the communities of phytophagous nematodes of

vegetable crops in two regions of the steppe in western Algeria or market garden begins to take certain importance in recent years "case of onion plantations in the Rechaigua region "; since awareness phytophagous nematodes leads to better understand the risks associated with their introductions or their disseminations to guard by putting in place the methods of focused struggles.

MATERIALS AND METHODS

In order to inventory the phytophagous nematodes associated with vegetable crops the steppe of western Algerian in province of Tiaret and evaluate their densities, their diversity and their structures. The experimental method is made of functions of the following steps:

- outputs on field and collection of soil samples and when possible it is accompanied by whole plant at the selected sites.
- Extraction of soil nematodes by the method of flotation and sedimentation methods buckets (Dalmasso, 1966).
- Characterisation of phytophagous nematodes (counting and identification) under a binocular microscope based on the identification key (Jacob and Middepiaats, 1988).

The samples have been made in different vegetable crops with three stations in province of Tiaret "Rechaigua, Ksar El If Echellala and Houes".

Our methodology consists of a faunal comparison, for this we have adopted two sampling modes. A simple sample: one sample is taken per plot weighing more than one kilogram which will be placed in a sealed bag and labeled.

A composite sample consisting of soil samples of about 200 g to one sample every 10 meters on the diagonal of the plot are taken and combined into one in a sealed referenced bag. All samples of soil and roots are made in the rhizosphere of plants at a depth between 10 and 30 cm of soil.

The extraction method used is that of buckets (Dalmasso, 1966) method called flotation and sedimentation. The evaluation of the total density is after enumeration and morphological identification essentially based on the observation of some discriminative characters (the length and shape of the pen, the shape of the head, the tail, the body length, layout esophageal gland in relation to the intestine) under a binocular microscope.

Nematode populations in the soil are expressed in number of nematodes per dm^3 (N/dm^3) (Merny and Luc, 1973).

Statistical analysis of data

The analysis of nematode populations subservient to the various vegetable crops was the subject of a statistical treatment using factorial correspondence analysis (FCA) and hierarchical ascending classification (HAC) by software "PAST". The frequency and abundance was established on the principle of Fortuner and Merny (1973).

RESULTS

1. Inventory and structure of phytophagous nematodes of vegetable crops in some stations.

1.1. Inventory phytophagous nematodes vegetable crops.

1.1.1. Overall density of nematodes identified in composite and single samples.

Our study was performed in 03 stations of the province of Tiaret known to vocation by vegetable crops namely Ksar Chellala, and Rechaiga Si Haoues. The samples were focused on picked up ground (simple and composite) in the rhizosphere of vegetable crops.

The nematode analysis revealed the presence of 11 genera of nematodes in the simple soil sample. They are represented by Aphelenchus, Aphenchoides, Ditylenchus, Tylenchus, Psilenchus, Pratylenchus, Tylenchorhynchus, Paratylenchus, Cephalobus, Dorylaimus, Rabtidis and Helicotylenchus.

Table I covers different densities of taxa encountered in the 02 single and composite samples. It appears from these results that the densities of nematodes identified vary depending of the stations prospected. The most represented phytophagous in our study sites are Aphelenchus, Ditylenchus, Cephalobus, Dorylaimus, Tylenchorhynchus and Tylenchus. They have been detected in more than 50% of the stations. However, for the remaining taxa (Aphelenchoides, Psilenchus, Meloidogyne,

Psilenchus, Pratylenchus, Paratylenchus) They are limited to a few sites (- 50%).

The highest densities are recorded in the Tylenchorhynchus Ksar Chellala station (1940 N/dm^3) and for by way of example Pratylenchus in the same station; with a density not exceeding 440 N/dm^3.

Moreover, the results show that the diversity varies from one site to another and in the two sampling modes.

Also in Rechaigua station phytophagous nematodes are maintained at relatively low densities levels, the most represented taxa is the kind Ditylenchus with densities ranging from 260 to 60 N/dm^3 and those for all prospected crops in this station.

At the station Si Haoues, our investigations have carried on a single type of a large surface area leguminous crops lenses that appear to be free of all nematode infestations, only the kind Ditylenchus was collected in numbers ranging from 160 to 60 N/dm^3 respectively for the composite sample and simple.

3.1.1.2. Overall density of nematodes identified in Rechaigua station.

1. Cases of the composite sample.

The results of the composite samples revealed the presence of 10 kinds of nematodes, Ditylenchus, Aphelenchus, Tylenchus, Psilenchus, Pratylenchus, Tylenchorhynchus, Cephalobus, Dorylaimus Helicotylunchus, and gender Rabtidis (Figure1 and Table 1).

Large populations are observed for the kind Cephalobus, Dorylaimus, Ditylenchus, Tylenchus, with densities of 1780 N/dm^3, 440 N/dm^3, 180 and 184N/dm^3 respectively in the tomato, pepper crops, on tomato and pepper. To genres Rabtidis, Aphelenchus and Helicotylenchus, we recorded respective densities 120 N/dm^3 on tomato and 60 N/dm^3 on pepper and 20 N/dm^3 on tomato and pepper. For the genus of Pratylenchus densities are in the order of 80 N/dm^3 of pepper cultivation.

1. Inventory and overall densities of phytophagous nematodes in three locations in the province of Tiaret

Table 1. Density (N/dcm^3) of free nematodes in the soil sampled in the province of Tiaret

Stations	Culture	Type of sampling	Total number of nematodes	Différents genres de nématodes												
				Aphelenchus	*Aphelenchoides*	*Ditylenchus*	*Tylenchus*	*Psilenchus*	*Pratylenchus*	*Tylenchorhynchus*	*Paratylenchus*	*Cephalobus*	*Dorylaimus*	*Rabtidis*	*Heliicotylenchus*
Ksar Chellala	Oignon	Composite	3600	260	0	200	0	0	60	0	20	760	440	60	0
		Simple	3900	380	0	160	20	0	200	100	20	640	120	0	0
	Fève	Composite	8460	40	0	120	0	140	200	520	40	120	200	40	60
		Simple	16640	60	0	160	0	0	440	1940	0	0	140	460	40
	Ail	Composite	2100	480	0	120	80	0	180	140	0	400	180	20	0
		Simple	2700	300	0	20	60	0	120	60	0	920	200	120	0
	Tomate	Composite	2500	0	0	0	140	0	0	0	0	1788	440	120	20
		Simple	3280	120	0	260	80	0	0	0	0	2800	20	0	0
Rechaigua	Oignon (Parcelle 1)	Composite	260	0	0	40	20	0	0	0	0	160	40	0	0
		Simple	1120	40	0	140	40	0	0	0	0	560	340	0	0
	Oignon (Parcelle 2)	Composite	560	0	0	120	0	0	0	0	0	340	100	0	0
		Simple	640	20	0	120	60	0	0	20	0	320	120	0	0
	Poivron (Parcelle 3)	Composite	400	0	0	60	20	0	0	0	0	280	40	0	0
		Simple	540	40	0	60	120	0	0	0	0	180	120	20	0
	Poivron (Parcelle 4)	Composite	1080	60	0	180	20	0	40	140	0	360	280	0	0
		Simple	1360	180	0	180	140	0	80	60	0	560	140	0	20
Si IHaoues	Lentilles	Composite	1120	240	0	140	0	0	0	0	0	580	160	0	0
		Simple	800	0	0	60	0	0	0	0	0	660	60	20	0

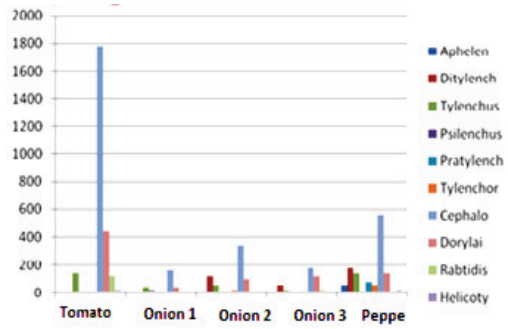

Figure 1. Density of nematode populations at the locality of Rechaigua

2. For simple sample

Examining the figure below shows a strong dominance of Cephalobus kind with a density of 2800 N/dcm^3 on tomato crop. The kind Dorylaimus comes in 2nd place with a density of 340 N/dcm^3 on onion crop (Parcel 1), the genus Ditylenchus with a density of 260 N/dcm^3 on tomato cropthe kind Aphelenchus is represented exclusively on culture tomato with a density on the order of 120 N/dcm^3. As for the other genres are represented by low densities as Tylenchus and Pratylenchus respectively with densities 80 and 20 N/dcm^3 on growing tomato and onion (Parcel 2).

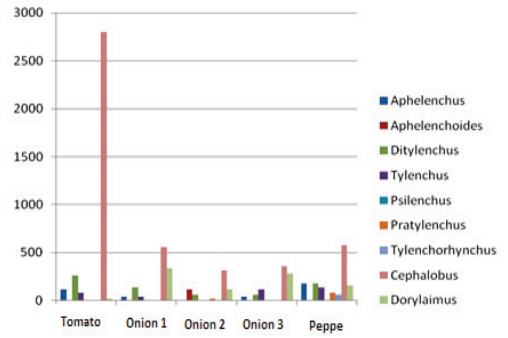

Figure 2. Density of nematode populations at the locality of Rechaigua

The analysis of dendrograms (Figure 3) identifies three groups for both sampling "the composite and simple", but these groups are not similar. For composite samples Group 1 (G1) essentially brings together two stations onion crops "Parcel 2 and 3" and the tomato field with the presence of 05 nematode taxa particular the following genres: Tylenchus, Dorylaimus Helicotylenchus , and Cephalobus Rabtidis.

Group 2 (G2) is formed only by Psilenchus kind associated with the onion crop land 1. As for Group 3 (G3), we note the presence of 04 genera represented by Tylenchus, Ditylenchus, Aphelenchus and Pratylenchus on one type of crop (pepper).

The analysis of Figure 4 distinguishes 03 groups that are similar to those obtained by hierarchical classification, and those for composite samples and simple.

AFC composite groups reveals the following groups: Group (1) G1 generates Tylenchus genres Dorylaimus, Cephalobus, Helicotylenchus and Rabtidis on following crops Onion (Parcel 2 and 3) and Tomato.

The Group (2) G2 is made exceptionally by the kind Psilenchus on onion crop only in that culture and those for the two sampling techniques adopted simple and composite.

As for the group (3) G3 is formed by 04 Tylenchorhynchus genres Aphelenchus, Ditylenchus and Pratylenchus only growing in peppers.

The generated groups are as follows: Group (1) represented by G1 and Ahenchoides Cephalobus only three onion plots (1, 2 and 3).

The Group (2) G2 formed by 05 Aphelenchus genres Tylenchus, Ditylenchus, Tylenchorhynchus and Dorylaimus tomato crop.

The Group (3) G3 is represented by Pratylenchus, Psilenchus on pepper culture.

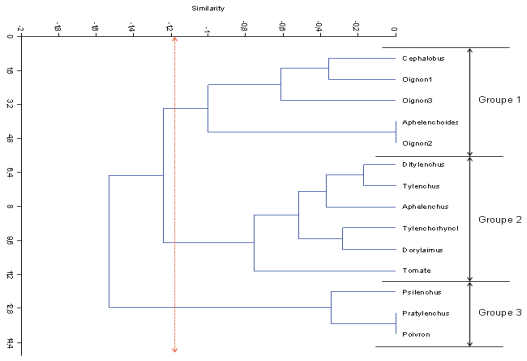

Figure 3. Dendrogram of the classification of types of nematodes inventoried by crop in Rechaigua station

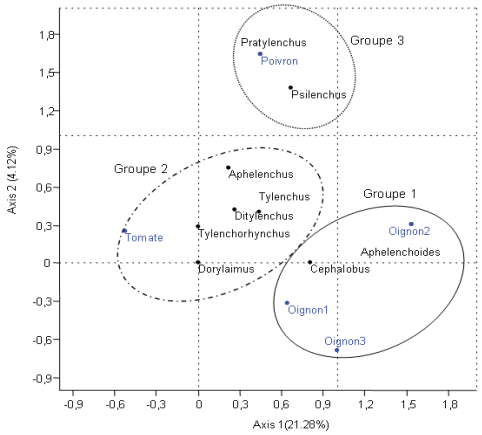

Figure 4. Arrangement of different kinds of nematodes inventoried along the axes 1 and 2 in different cultures in Rechaigua station

3.1.1.4. Overall density of nematodes identified in Ksar Chellala station.

1. Cases of the composite sample.

The results shown in the figure below show that the genre is predominant Cephalobus with a density of about 760 N/dcm^3 on onion crop, followed by genre, Tylenchorynchus 580 N/dcm^3 on bean culture. Garlic cultivation has two nematode genera namely Aphelenchus and Rabtidis 480 N/dcm^3 with respective average densities of 480 N/dcm^3 and 460 N/dcm^3.

The genre Dorylaimus often onion crop with a density of 440 N/dcm^3, as to Ditylenchus genera, Tylenchus on garlic cultures with respective densities 220 and 80 N/dcm^3; also on culture bean we note the presence of Helicotylenchus and Aphelenchus 60 and 40 N/dcm^3.

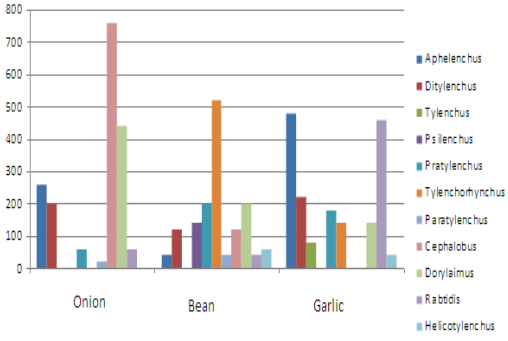

Figure 5. Density of nematode populations in the city of Ksar Chellala

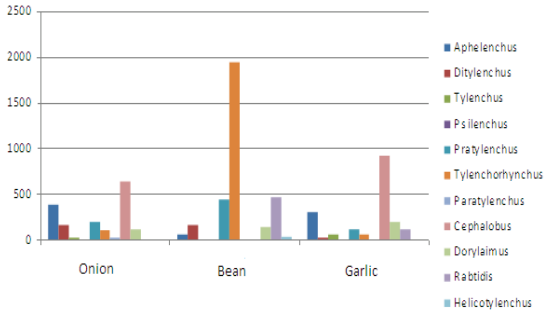

Figure 6. Density of nematode populations in the city of Ksar Chellala

On the basis of Euclidean distances and with respect to a similarity of 38.37% on the axis 1 and 2.13% along the axis 02. The classification gave 03 distinct groups and those for the two types of sampling composite and simple (Figures 7 and 8).

For composite samples, Group 1 (G1) essentially brings together the onion crops, with the presence of 04 nematode taxa particular the following genres: Aphelenchus, Ditylenchus, Cephalobus and Dorylaimus. Group 2 (G2) is formed only by the kind Tylenchus and Rabtidus associated with garlic culture. As for Group 3 (G3), we note the presence of 05 genera represented by Pratylenchus, Helicotylenchus Tylenchorenchus, Paratylenchus and Psilenchus on bean culture. For the single samples there are 03 distinct groups precedents. The Group (1) G1 formed by 03 genera Tylenchorynchus, Aphelenchus and Cephalobus on Onion culture.

The Group (2) G2 formed by Pratylenchus and Tylenchus on Garlic culture, while Group (3) G3 is represented by Ditylenchus, Psilenchus, Pratylenchus, Rabtidis, Dorylaimus and Helicothylenchus on bean culture.

Analysis of the AFC composite groups reveals the following groups: Group (1) G1 generates genres Aphelenchus, Ditylenchus, Cephalobus and Dorylaimus.

The Group (2) G2 is made exceptionally by 02 genres of naked garlic culture. As for the group (3) G3 is formed by 05 genres: Pratylenchus, Helicotylenchus, Tylenchorhynchus Paratylenchus and Psilenchus on Culture bean.

For the second type of single sampling there are 03 different groups:

- The groups are released as follows: Group (1) G1 represented by Tylenchorynchus, Aphelenchus and Cephalobus only on onion crops.
- The Group (2) G2 formed by 02 Paratylenchus and Tylenchus genres of garlic culture.
- The Group (3) G3 is represented by 06 genres Pratylenchus, Psilenchus, Ditylenchus, Rabtidis Dorylaimus and Helicotylenchus on culture bean culture.

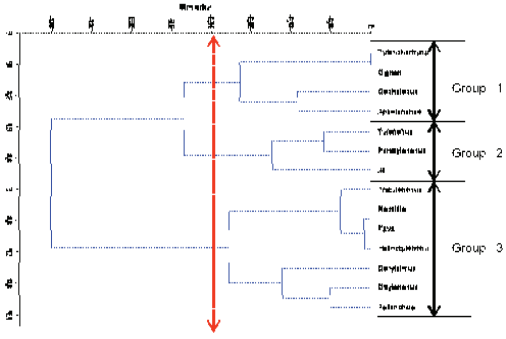

Figure 7. Dendrogram of the classification of types of nematodes inventoried by crop in Ksar Chellala station

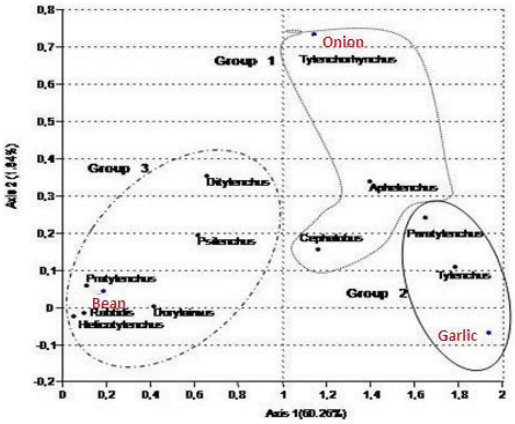

Figure 8. Arrangement of different kinds of nematodes inventoried along the axes 1 and 2 according to the crops in the Ksar Chellala station

3.1.1.5 Overall density of nematodes identified in Si Haoues station

1. Cases of the composite sample

On this station, one culture sample was taken due to the large area devoted to this crop. The review of the following histogram shows the presence of 04 genres significant at this type of composite sampling and are as follows (Figure 9): Cephalobus 580 N/dcm^3, Aphelenchus 240 N/dcm^3, Ditylenchus 140 N/dcm^3 and Dorylaimus 160 N/dcm^3

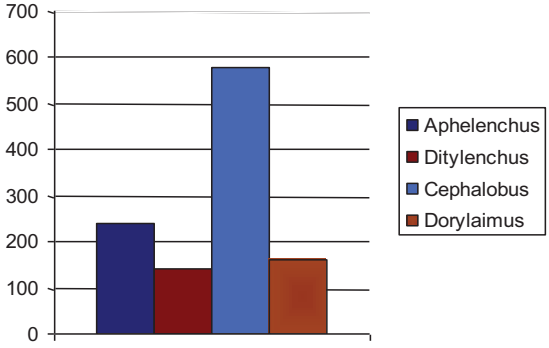

Figure 9. Density nematode populations at Si El Haoues station

2.2 For simple sample.

For simple sample is almost similar to the previous lack of Aphelenchus only one note to be replaced by the kind Rabtidus with a relatively low density is 20 N/dcm^3 only (Figure 10).

The most important kind consists Cephalobus 660 N / dcm3, Ditylenchus and Dorylaimus 60 N/dcm^3

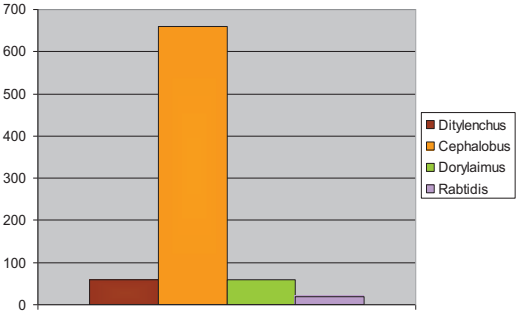

Figure 10. Density of nematode populations at the station Si El Haoues

DISCUSSIONS

The completion of this study allowed us to identify eleven types of nematode "phytophagous and not phytophagous" in distributed vegetable soils in both porbeagle different stations of the province of Tiaret They are represented by: Aphelenchus, Aphenchoides, Ditylenchus, Tylenchus, Psilenchus, Pratylenchus, Tylenchorhynchus, Paratylenchus, Cephalobus, Dorylaimus,

Rabtidis and Helicotylenchus The results obtained on the inventory of parasitic nematodes vegetable crops join a species found point of view those Netscher and Luke (1974).
The highest average total of the phytophagous nematodes recorded in this study is observed (16640 N/dm^3) distributed as follows;
Our observations have shown the presence of the more genres represented as Cephalobus with a density of 2800 N/dm^3, Dorylaimus, with a density of 440 N/dm^3 Ditylenchus with a density of 260 N/dm^3 and Aphelenchus with a density of 480 N/dm^3.
The Cephalobus and Dorylamus genre are the most representative genres in both regions studied. However, there is a total absence Meloidogyne and Heterodera although both regions are oriented cereals. The abundance and frequency of this type of vegetable crops in Niger (Diongue, 1986). Furthermore, the populations of Pratylenchus are shown to be important in both regions, however in Ksar Chellala station their densities reached 440 N/dm^3. Through, they reached 160 N/dm^3 in the Ain Ouassara station in the Djelfa region.
The frequency of this kind with a rate of 33.3% was reported in Garden Soils of Senegal (Sawadogo et al., 1993). In contrast, studies on banana in Burkina Faso [14] and in Ivory Cost (Fargette and Quenherve, 1988) were able to show that this kind grows poorly on this crop. *Pratylenchus thornei* was the dominant species in the soil and in the roots of wheat in arid areas of Israel. Which could explain its presence in the plain, cereal region (Orion et al., 1984).
The genre Ditylenchus presented high densities in Ksar Challala station in the province of Tiaret, these have reached 260N/dm^3 on onion plantations. In contraste in the Ain Ouassara station beans, they are estimated to 600N/dm^3.
About the genre of Aphelenchus it was reported in the two regions with densities of 480N/dm^3 in Ksar Chellala station, and 200 N/dm^3 in the Ain Ouassara station on bean crops.
For the genre of Tylenchorhynchus, it was recorded a density of bean culture 1940 N/dm^3 in Ksar Chellala station, the Ain Ouassara on pea culture is of the order of 120N/dm^3. On the other hand, the investigations into tomato respectively in Mauritania and Senegal have detected the presence of Tylenchorhynchus (Netstcher and Luc, 1974; Diongue, 1986). It is recognized that these phytophagous nematods are parasitic nematodes in agro ecosystems. They have a deleterious effect on plant growth and yields (Verschoor, 2001).
The use of ecological indices of structures such it has been previously described by the use of the frequency and abundance were classified phytophagous nematodes in two groups in the surveyed sites.
Scanty nematodes and frequent, they are active parasitic of vegetable crops. They met in the two locations, on different types of soil, but with low population levels. Scanty and infrequent nematodes considered minor pests. Their parasitism on vegetable crops seem less important than the first group. These species are rarely observed and too few to have any economic significance include, of Tylenchorhynchus in Ksar Chellala station with a density of 1940 N/dm^3. Calculating the diversity index Shannon Weaver helped confirm that the nematofauna is quite diverse in the two regions studied.
As for the equal distribution, it shows that there is a balance between the species studied habitats, except the kind Psilenchus present only on crop beans at the Ksar Chellala station and absent in the other stations of the region. Regarding the diversity at the stations. We record a nematofauna rather diverse. For equal distribution values tend to 1, it means that there is a balance between the species found in these habitats studied in the two regions studied.

CONCLUSIONS

The results of this study revealed various species of nematodes associated with vegetable crops in the Algerian steppe including in province of Tiaret. We counted eleven genres of phytophagous and frequent nematodes represented by Aphelenchus, Aphenchoides, Ditylenchus, Tylenchus, Psilenchus, Pratylenchus, of Tylenchorhynchus, Paratylenchus, Cephalobus, Dorylaimus, Rabtidis and Helicotylenchus.
The densities of these nematodes and frequent may vary by location and method of sampling and the nature of the soil.

The Cephalobus, Dorylaimus, Ditylenchus and Aphelenchus are the most frequent and abundant in the three stations of study. These taxa seem to adapt to different types of vegetable soils. Their existence may be subject to significant damage to installed cultures. Furthermore the use of ecological indicators of structure (Frequency and Abundance) class nematodes in 04 groups:

- Nematodes abundant, dangerous for market gardening.
- scarce Nematodes, less harmful and adapts to different soil type
- abundant and infrequent nematodes, their presence in some soils, can be dangerous for market gardening.
- Nematodes scanty and infrequent occasionally meet their densities are low and have little or no damaging. Vegetable crops appear not to be their special host.

At the end of this study, it seems important to advise gardeners, the application of proper rotation, or use of fallow or resistant varieties that may constitute a simple and effective alternative the species of phytophagous nematodes in these little infested areas to avoid the phenomena of adaptation and resistance.

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