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Contribution to the Knowledge of Nematodes Genera in Northern Vineyards of Algeria

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ABSTRACT

A study survey was conducted in the vineyards crop production areas in central and Western North of Algeria to identify the nematode communities structure and their abundance during 2008 season. Soil samples were taken from different vineyards at depth of 90cm for each plant. Results indicated that sixteen genus of nematode were inventoried. They include *Xiphinema* sp., *Longidorus* sp., *Ditylenchus* sp., *Aphelenchus* sp., *Pratylenchus* sp., *Aphelenchoides* sp., *Tylenchus* sp., *Helicotylenchus* sp., *Tylenchorhynchus* sp., *Psilenchus* sp., *Trophurus* sp., *Dorylaimus* sp., *Paratylenchus* sp., *Coslenchus* sp., *Heterodera* sp and *Pratylenchoides* sp. These nematodes are classified according to their dietary pattern in three trophic groups; phytophagous, fungivorous and omnivorous. Their densities vary according to the various prospected stations.

Keywords: Nematodes, diversity, vineyards, trophic groups, Algeria.

INTRODUCTION

The vineyards in Algeria occupy a total land area of 56.500 ha of which 23.110 ha (40%) for wine cultivars. 33.140 ha for represented commercial table cultivars (58%) and the rest constitutes grape vines to be dried. The national grape production, for the year 2007, is of 13 42.960 quintals of fruit grapes and 436.090 quintals of wines grapes [1]. The situation of the wine-groESwing sector in Algeria, is bad and encounter some difficulties which prevent it from following the economic evolution of the country. Among these difficulties, old age and poor health of the plantation which limits the strength and the potentiality of vine production and the main all kinds of devastations of this culture. Among these phytoparasitic, we find the nematodes

which are very dangerous animals, for most cultures [2]. Within the vine, the currently identified nematodes attack only the roots. They are indeed the most frightening nematodes on vines and which are the object of several research and publications carried out two groups [3].

It is compulsory to have information on the dynamics, the distribution and the composition of the nematodes populations to understand the role of the phytoparasite nematodes in the farming ecosystems [4-5]. The nematodes are both a national and world plague because of their rapid multiplication, which is accentuated in the systems of monocultures.

If it is now certain that the *Xiphinema index* (vector of the Grapevine Fanleaf Virus, Nepovirus (GFLV)), is spread in the main wine-producing areas of Algeria [6-7], and causes in some cases considerable damage on vine, it is not yet known whether if other nematodes of the kinds quoted previously, are also important and may be the cause of the weakening of the grounds of certain vineyards of the country. For this reason, it is useful to make a prospection in vines crops systems and to take samples of the grounds and roots in order to analyze, identify and determine the importance of their nematode fauna.

In Algeria, very few studies were carried out on vineyards nematodes [8-9]. However until recently these pests are almost unknown in this country.

In order to have a thorough knowledge of the vineyards nematode fauna, the present study was conducted in two important vineyards areas in North of Algeria, with the aim carrying out a better management and understanding of these populations of pests on this crop production.

MATERIELS AND METHODS

A survey on nematode genera has been carried out in 21 stations of various wine-growing areas of the West and central North of Algeria (Table 1). The samples were related to the sampling of ground in the vine rhizosphere. Our investigations concerned all wine cultivation growing in Algeria. For the West vineyards areas, 7 departments of which 11 stations were prospected namely, Ain Temouchent (Hammam Bouhdjar and Hassi El Ghella stations), Relizane (Sidi El Khatab, station), Mostaganem (Mostaganem1 and Stidia stations), Sidi Bel Abbès (Hassi Zahana, station), Oran (Boutlelis and Boufatis, stations), Mascara (Commar and Mamounia, stations) and Chlef (Ténès station). However in central area, the prospected vineyards concerned only 5 departments within 10 stations: Blida (Mouzaia and Meftah, stations), Algiers (Chebli and BirToutta, stations (ITAF)), Médéa (Benchikaou 1 and Benchikaou 2 and Oued Harbil, stations), Ain Defla (Oued Zeboudj, station) and Tipaza (Bourkika and Meurad, stations).

Soil samples of ground are taken from within the various vineyards prospected with a depth ranging from 70 to 90 cm for each plot. Basic samplings are collected randomly at the level of the stock vines at a rate of 10 samples of 200 to 300 g each to make only one sample of 3 to 4 kg per vineyard station [8]. Soil samples are taken in the rhizosphere of the plants. Samples were thoroughly mixed to one composite sample; a sub-sample of 500g was stored in a cold room at 4°C. Nematological analyses were conducted jointly at the Laboratoire de Nématologie of INES d'Agronomie (Université de Blida). Nematodes were separated from the soil by using a combination of sieving and modified flotation method [10].

Counting was done under a dissecting microscope (magnification: 40X). The vines nematodes were identified at genera level. The abundance of nematodes was expressed as numbers of nematodes by dm³ (N/dm³), [11].

Table 1: Geographical coordinate of prospected vineyards stations in North Algeria

Stations	Geographical coordinate	
1. Center Stations		
Mouzaia (Blida)	36°27'58''N	02°49'00''E
Meftah (Blida)	36°36'59''N	03°13'00''E
Chebli (Alger)	36°35'00''N	03°01'00''E
Birtouta (Alger)	36°39'00''N	03°00'00''E
Oued Zeboudj (Ain Defla)	36°18'33''N	02°20'26''E
Bourkika (Tipaza)	36°29'43''N	02°28'23''E
Meurad (Tipaza)	36°27'33''N	02°27'47''E
Benchicao (Médéa)	36°11'54''N	02°50'43''E
Oued Harbil,(Médéa)	36°13'06''N	02°37'36''E
2.West Stations		
Hammam Bouhadjar (Ain Temouchent)	35°22'44''N	00°58'04''W
Hassi El Ghella (Ain Temouchent)	35°26'16''N	01°03'05''W
Sidi El Khatab (Relizane)	35°54'41''N	00°30'50''E
Mostaganem	35°56'00''N	00°05'00''E
Stidia Mostaganem	35°49'50''N	00°00'25''W
Hassi Zahana(Sidi Bel Abbès),	35°01'39''N	00°53'00''E
Boutlelis (Oran)	35°49'06''N	00°15'25''W
Boufatis, (Oran),	35°40'00''N	00°25'00''W
Commar (Mascara)	35°24'00''N	00°08'26''E
Mamounia (Mascara)	35°25'24''N	00°08'09''E
Ténès (Chlef)	35°30'29''N	01°18'47''E

The data collected were analysed with software PAST vers.1.81 [12]. The correlation between abundance, distribution of vines nematodes in all vineyards prospected was analysed by a detrended correspondence analysis (DCA), followed by a hierarchical classification.

RESULTS

The survey of nematode in the prospected vineyards area of North Algeria, has revealed the presence of 16 genera of nematodes. Their densities vary according to the prospected stations. They are represented by *Xiphinema* sp., *Longidorus* sp., *Ditylenchus* sp., *Aphelenchus* sp., *Pratylenchus* sp., *Aphelenchoides* sp., *Tylenchus* sp., *Helicotylenchus* sp., *Tylenchorhynchus* sp., *Psilenchus* sp., *Trophurus* sp., *Dorylaimus* sp., *Paratylenchus* sp., *Coslenchus* sp., *Heterodera* sp and *Pratylenchoides* sp.

The identified nematodes are classified according to their diet in three trophic groups. The phytophagous nematodes are represented primarily by *Paratylenchus* sp., *Tylenchorhynchus* sp., *Xiphinema* sp., *Helicotylenchus* sp., *Longidorus* sp., *Pratylenchus* sp., *Heterodera* sp., *Pratylenchoides* sp., and *Trophurus* sp. Whereas the fungivorous nematodes are presented by the *Aphelenchus* sp., *Tylenchus* sp., *Ditylenchus* sp., *Aphelenchoides* sp., *Coslenchus* sp. and *Psilenchus* genera. On the other hand, for the omnivorous nematodes only the *Dorylaimus* sp. genus was inventoried.

The results in figure 1 show that the group of the phytophagous nematodes is the most frequent. It covers 41% of the prospected sites, followed by the fungivorous group which accounts for 37% of the total density of the nematodes and in the last position the omnivorous nematodes with a value of 22%.

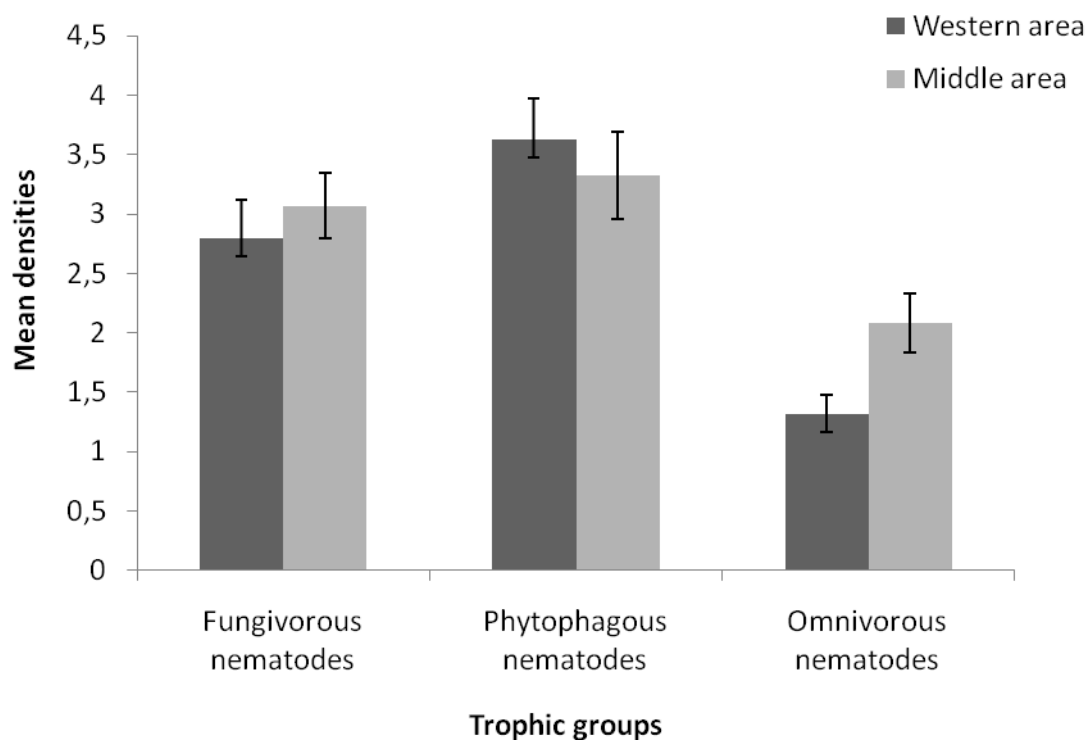


Figure 1: Global average densities of different trophic groups of nematodes in the vineyards prospected

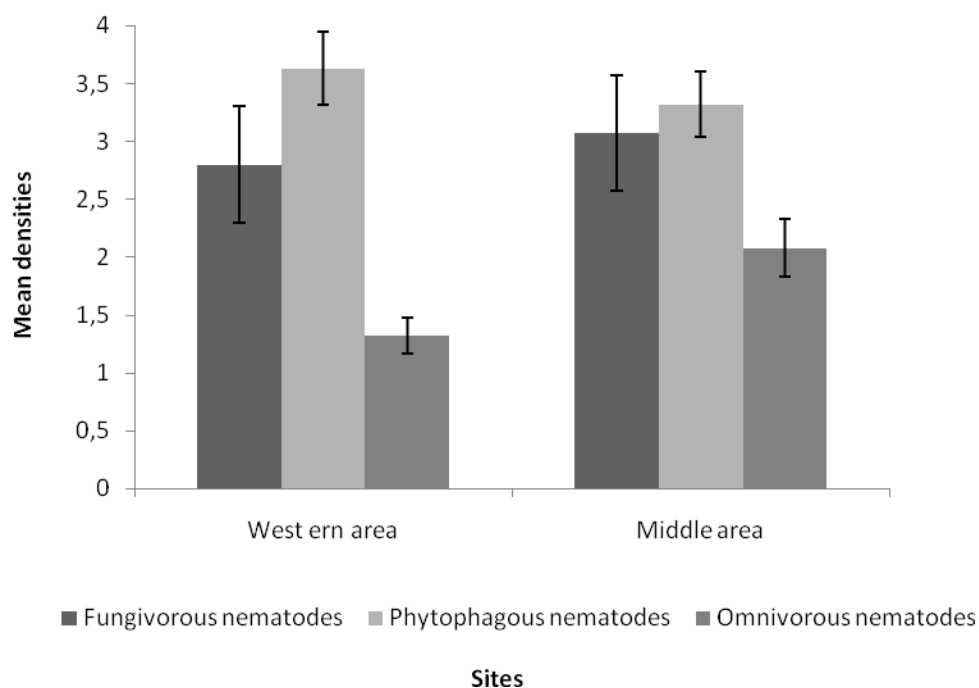


Figure 2: Average densities of trophic groups at central vineyards and Western Vineyards in North Algeria

In the samples of the prospected sites of the west and centre areas, the results reveal the predominance of the phytophagous nematodes group (Figure 2). However the abundance of this last is more marked in the west. Whereas for the two fungivorous and omnivorous trophic groups, they are more abundant in the centre.

The fungivorous and the omnivores are more frequent in the central stations than in those of the West. At the level of the area of Mostaganem, the two prospected stations had the highest densities of the phytophagous nematodes. On the other hand at the level of the centre, the Bourkika station showed the highest density of phytophagous followed by that of Mouzaia. As for the group of the omnivores, it was announced that in two stations, one in the West (Chelef) and the other in the Centre (Birtouta).

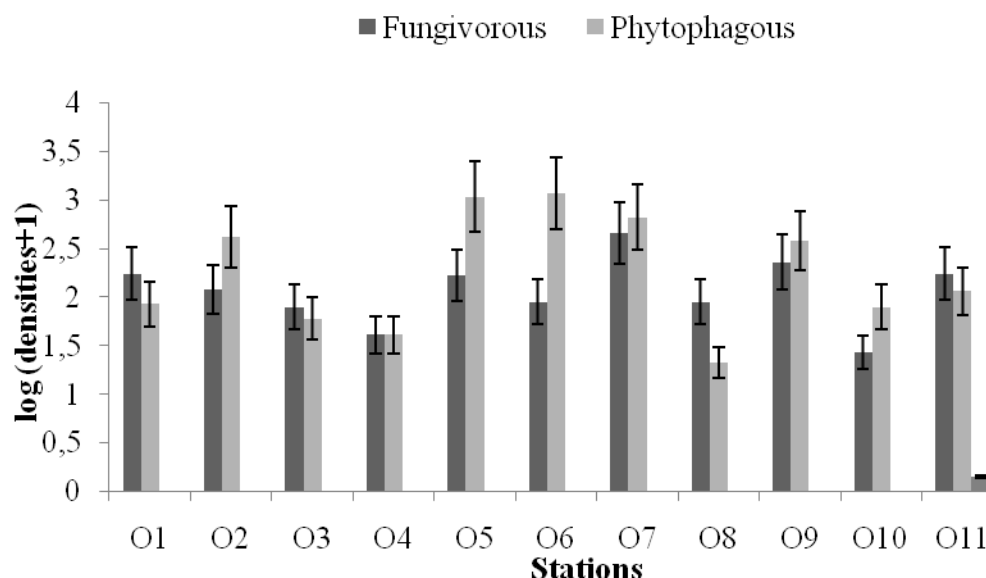


Figure 3: Average densities of different trophic groups in the Western Vineyards of Algeria

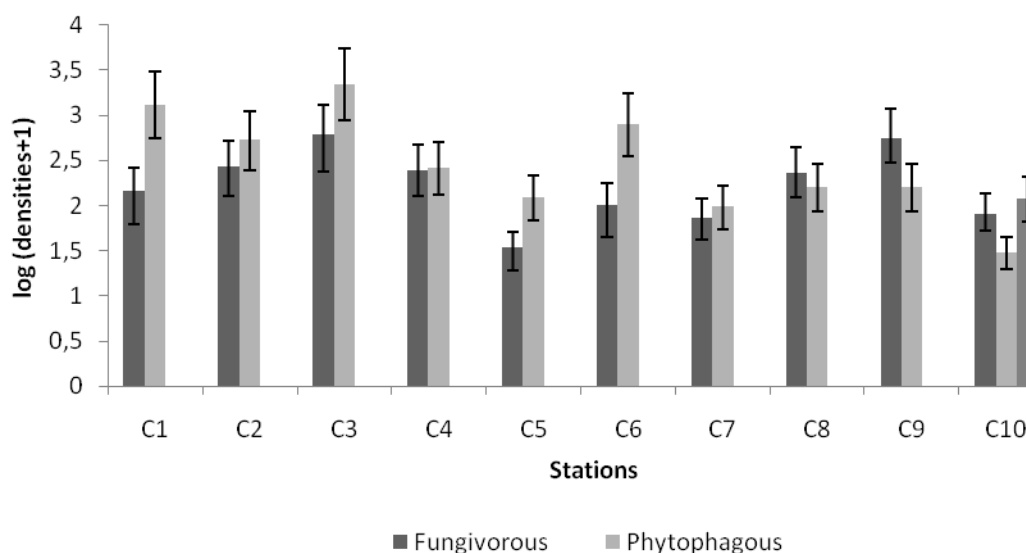


Figure 4: Average densities of different trophic groups in the central Vineyards area of Algeria

The results on figure 3 show that the phytophagous group is dominating in the majority of the studied sites except for the stations: Hammam Bouhdjar (O1), Boutlelis (O3), Commar (O8) and Chelef (O11). On the other hand, in Boufatis (O4) we recorded similar densities for the group of fungivorous and the phytophagous ones. For the omnivorous nematodes their presence was only announced in the site of Chelef (O11).

The samples taken in central area have in general detected high densities of the phytophagous nematodes compared with those of fungivorous (Figure 4). However, we note in certain stations the predominance of the fungivorous group as in Ain Defla (Oued Zeboudj (C9)), Benchikaou 1 or Benchikaou 2 (C8) and BirTouta (C10) (ITAF, station)). As regards the omnivorous nematodes (*Dorylaimus*), it was announced only in the site of the ITAF station with a density of 70 N/dm³, (Figure 4).

The analysis of the phytophagous nematodes densities by the DCA explains the affinity of some taxons compared to the prospected vineyards areas.

The calculation of Euclidean distance on the basis of similarity of (- 2), it results in three very mixed groups (Figures 5 and 6), of which the first group gathers the taxon according to: *Pratylenchoides* in quotes of Mamounia (O7).

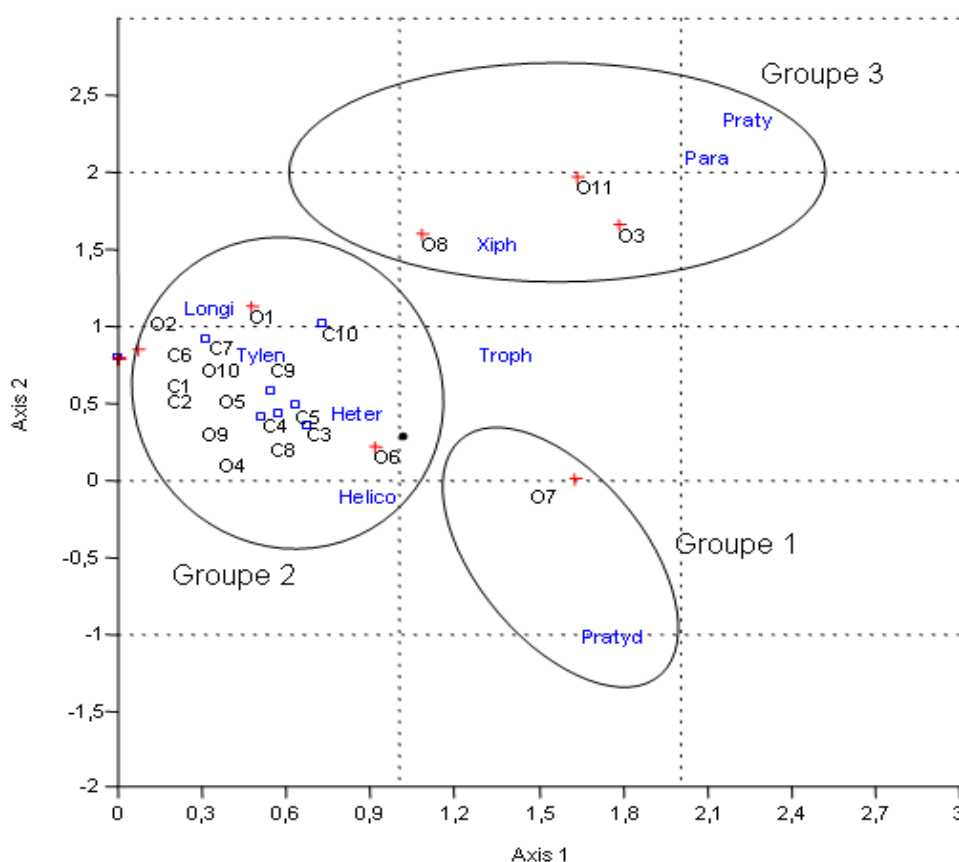


Figure 5: The main component analysis (DCA) of the distribution of nematode genera, in the different vineyards stations explored

Heter : *Heterodera*, Praty : *Pratylenchoides*, Praty : *Pratylenchus*, Helico : *helicotylenchus*, Tylen : *Tylenchorhynchus*, Troph : *Trophurus*, Xiph : *Xiphinema*, Longi : *Longidorus*, Para : *Paratylenchus*.

The second group included the species of the kinds: *Longidorus*, *Tylenchorhynchus*, *Heterodera* and *Helicotylenchus* in the areas: Hassi El Ghella (O2), Hammam Bouhdjar (O1), Stidia (O5), Sidi Bel Abbès (O10), Boufatis (O4), Mostaganem (O6), Wadi Harbil (C6), Benchikaou 1 (C7), Birtouta (C10), Mouzaia (C1), Meftah (C2), Ain Defla (C9), Meurad (C4), Bourkika (C3), Benchikaou 2 (C8) and Chebli (C5), and the last group which gathers the taxons: *Xiphinema*, *Paratylenchus*, *Pratylenchus*, and sites of Mamounia (O8), Boutlelis (O3) and Chelef (O11), (Figure 6).

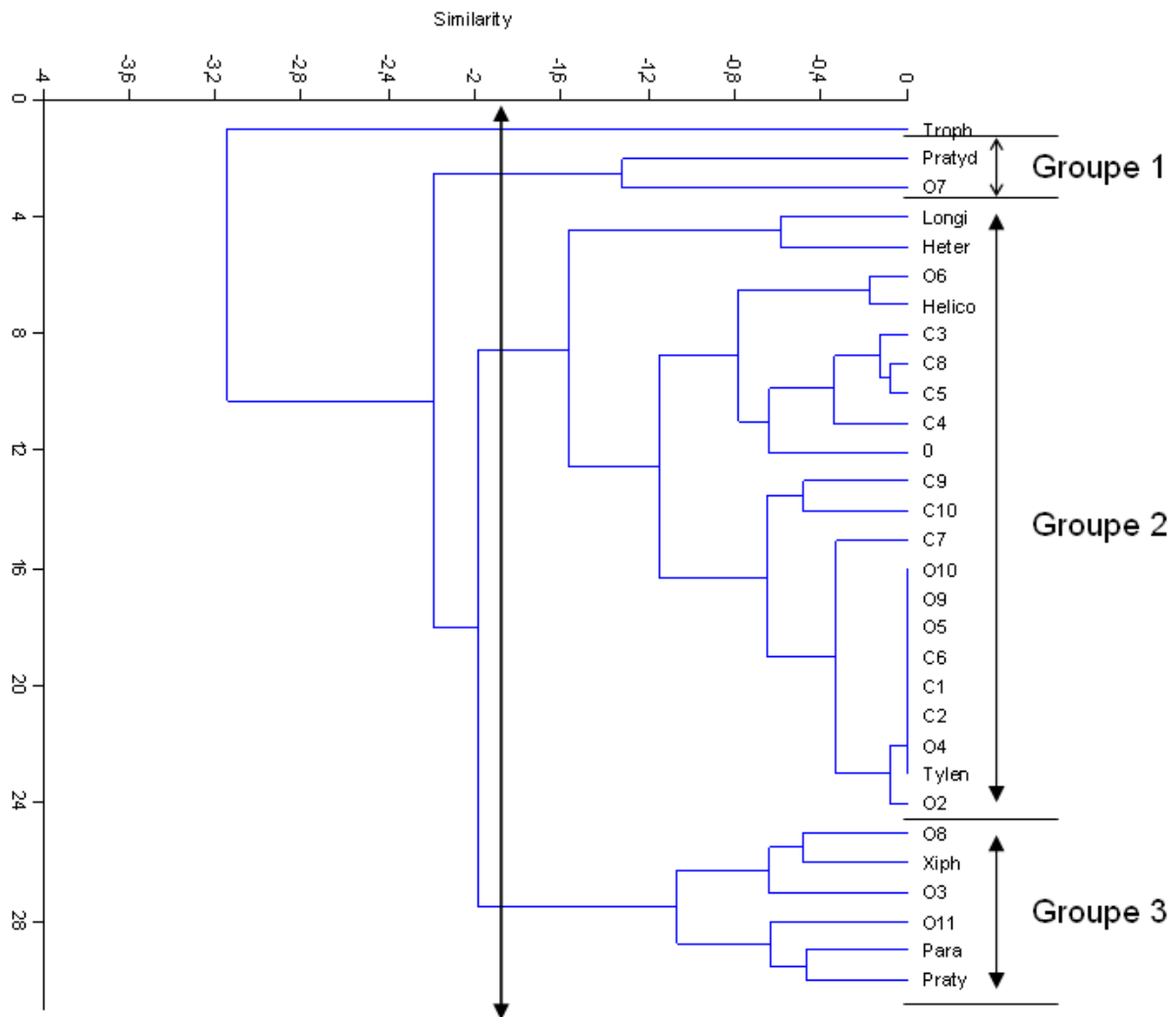


Figure 6: Ascending hierarchical classification of the description of dendrogram

C1 : Mouzaia, C2 : Meftah, C3 : Bourkika, C4 : Meurad, C5 : Chebli, C6 : Oued Harbil, C7 :Benchikaou 1, C8 : Benchikaou 2, C10 : Birtouta, C9 : Ain Defla, O1: Hammam Bouhdjar, O2 : Hassi El Ghella, O3: Boutlelis, O4: Boufatis, O5: Mostaganem1, O6: Stidia, O7: Mamounia, O8: Commar, O9: Relizane, O10: Sidi bel Abbés, O11 :Ténes,

DISCUSSION

The study of the nematode fauna in Algeria wine production brings about an important diversity of several kinds of pledged nematodes to the culture of the vine in the two great wine production names of national interest.

The total inventory of the communities of nematodes linked with this culture reveals three trophic groups, especially formed by the phytophagous in first position of nine kinds ; *Paratylenchus sp.*, *Tylenchorhynchus sp.*, *Xiphinema sp.*, *Helicotylenchus sp.*, *Longidorus sp.*, *Pratylenchus sp.*, *Heterodera sp.*, *Pratylenchoides sp.*, and *Trophorus sp.* , followed by the fungivorous ones; in second position, with the presence of *Aphelenchus sp.*, *Tylenchus sp.*, *Ditylenchus sp.*, *Aphelenchoides sp.*, *Coslenchus sp.* and *Psilenchus sp.*, and finally the omnivores which are represented only by one single kind of *Dorylaimus sp.* Their total average densities are about 41%, 37% and 22% respectively for the three trophic groups mentioned above.

Due to a lack of research work on the nematodes of the vine in Algeria and considering the literature which offers few data on the pledged species to this culture in our country, our results are confronted with those of the Mediterranean regions.

In Tunisia in the area of Raf Raf vineyards, only five genera of nematodes represented by specimen proving to be parasite to the vine such as, *Xiphinema*, *Criconemela*, *Rotylenchulus*, *Longidorus* and *Meloidogyne* [13].

Our results are also comparable by Spanish vineyards, with a great abundance of *Tylenchides* represented mainly by, *Meloidogyne* and *Dorylaimidae* represented by *Xiphinema*, *Longidorus*, *Paralongidorus* and *Trichodorus* [14].

The comprehensive assessment of the populations inventoried in two wine production names having been the subject of our study shows that the group of phytophagous is the most represented in the West and Central areas.

In the West of the country we note a prevalence of phytophagous compared with the fungivorous, whereas the omnivores seem to be very little represented [8-9].

In addition within the vineyards of the centre, the examination of the distribution of the nematodes by trophic groups although it remains in favour of the phytophagous, the share of fungivorous remains equally important compared with those of the omnivores.

The examination of the average densities of the trophic groups in the various sites of the West shows that the phytophagous ones remain always prevalent at the level of the stations of Hassi El Ghalla, Stidia, Mostaganem 2, Mamounia and Relizane. It should be noted that these stations show features of the light and fertile grounds soils which allow a good proliferation and distribution of the phytophagous [3-15]. However the presence of fungivorous is made know in the sum total of the samples from the of the Western vineyards with relatively important densities.

As for the omnivores their presences were reported only in the station of Ténès (Chelef) with relatively very low densities. The variability in the abundance, of trophic groups observed in the various wine agro-ecosystems, is in close relationship with the health of the ground. It seems that the management of the arable lands has had an impact on the communities of nematode. We suppose that the presence of *Dorylaimus* (omnivorous nematode) at Ténès station, could explain a certain balance in the ground of this station compared with the others. Indeed, several researches works point out that the nematodes are useful bio - indicators in the ground ecosystems [16].

The predatory and omnivore nematodes are the most sensitive to the disturbances of the environment [17-18], whereas the bacteriophagic and fungivorous nematodes tolerate various chemical rates of conventional residue applied in conventional agriculture [19].

The examination of the distribution of the average density of the trophic groups in the central area shows a prevalence of phytophagous in the stations of Bourkika, Oued Harbil, Benchikaou1, Mouzaia and Meftah; very old oriented wine production stations. In this direction a similar distribution in the areas where the practice of the vine growing is old in the south of France [15].

In the same way the fungivorous nematodes are omnipresent in all the prospected stations with average densities almost similar to those of the West. It should be noted that only the station of Bir Touta (ITAF) presents omnivore nematodes with an important density.

The statistical analysis of the variations of the nematologic settlements pledged to the vine in the prospected areas is in agreement with that of ascending hierarchy classification of phytophagous nematodes in the area of the centre and the West. It reveals three quite distinct groups, of which the first is represented by the taxon *Pratylenchoides* at the level of the station of Mamounia (Mascara).

The second group generates the followings kinds; *Longidorus*, *Tylenchorhynchus*, *Heterodera* and *Helicotylenchus* within the stations of Hassi el Ghalla and, Bouhdjar (Ain Temouchent), Stidia (Mostaganem), Sidi Bel Abbès, Boufatis (Oran), Mostaganem, Oued Harbil and Benchikaou (Médéa), Birtouta (Algiers), Mouzaia, Chebli and Meftah (Blida), Ain Defla.

The last group covers the following taxons; *Xiphinema*, *Paratylenchus*, *Pratylenchus*, at the level of the stations of Mamounia (Mascara), Boutlelis (Oran) and Ténès (Chelef).

To our knowledge this variation of the densities depends on several factors particularly nature the nature, the texture and the structure of the soil. On the other hand the maintenance work of the ground as well as the techniques of rotations may also have a link in this distribution. In these order, the contribution of compost, as well as the work of the ground, induced a modification of the physicochemical characteristics of the ground as well as a modification of the specific structure of the settlement of phytoparasite nematodes [20].

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