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REDUCING PLANT PARASITIC NEMATODES BY THE MONONCHIDA NEMATODE ORDER

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Abstract

The inventory of nematodes associated with Alfa in the Mergueb natural reserve located in Ain Elhadjel- Wilaya of M'Sila (35 ° 35' N 03 ° 56' E), characterized by a semi-arid bioclimate, revealed the diversity of thirteen genus. In a second area, the experimental station ITAFV Médéa (36 ° 11' N; 02 ° 50' E) located in the semi-arid bioclimatic stage, seventeen genus of nematodes found in the differents vineyard soils. These nematode genus divided according to their diets in four trophic groups: phytophagous (*Paratylenchus sp. Tylenchorhynchus sp., Pratylenchus sp., Nothotylenchus sp.* and *Xiphinema sp.*, the fungivorous (*Aphelenchus sp., Tylenchus sp.,* and *Ditylenchus sp.*), the bacteriovorous (*Rhabditis sp., Cephalobus sp.* and *Chiloplachus sp.*) and omnivorous predator (*Dorylaimus sp.* and *Discolaimus sp.*) while the nematode's densities vary depending to the study sites. This study of nematode populations associated with Vine and Alfa in the northerrn of Algeria, allowed us to enhance the effect of the predatory nematodes Mononchida order. Our investigations have focused on a set of eight stations. The results express the degree of predation of nematodes by the Mononchida order on different trophic groups of nematodes while *Mononchus* is positively correlated to the bacterivorous and fungivorous nematodes but negatively to plant parasitic nematodes.

Keywords: Trophic Group, Predation, Alfa, Vine, Mononchida

Introduction

According to Mutin (1977), the biological activity, for the most part, is localized in the rhizosphere at a depth of 30 to 40 cm. This biological activity takes place only through the intervention of existing organisms in the soil such as earthworms, mites and nematodes. These are microscopic worms (the order of 1 millimeter in length).). They present a great taxonomic and functional diversity (different eating behaviors, very variable capacities to colonize the environment). They ranked by Gomes, et al., (2003) according to their feeding behavior in five major groups, fungivores, bacterivores, plant parasites (phytophages), predators and omnivores. Of the five trophic groups of nematodes, the group of phytophages only which causes damage on crops (reduction of harvests in relation to their density of population) as Meloidogyne, Heterodera, Helicotylenchus, Pratylenchus, Xiphinema....). This damage caused by phytophagous nematodes has a very important economic impact on a worldwide scale. In Europe, they are responsible for damage of up to 10% of cereal production and lead to crop reductions of 20 to 30% in Mediterranean citrus fruit orchards. The damage they cause in the US is $ 6 billion annually (Cayrol et al., 1992). Reduce the number of plant parasitic nematodes in the soil leads to reduce the number of necrotic cells and restore the assimilative function of the root systems, it is the principle of chemical struggle. With the emergence of environmental problems posed by the use of nematicides and pesticides in general, research is naturally oriented towards the development of biological struggle methods based on the same principle (Duponnois and Cadet, 1994; Cadet 1985; Cadet, Quénéhervé, Topart and Marie-Luce, 1994), using biological agents such as fungi, bacteria and other predators such as nematodes. The inventory of nematodes associated with the alfa and viticulture in Algeria allows us to have thorough idea about predator-prey relationships between these nematodes in their edaphic environment. In Algeria, no researcher has worked on the predation of nematodes. which encouraged us to achieve this modest work

Methodology

The inventory of nematodes associated with viticulture (Medea) and Alfa in Mergueb natural reserve (Ain el Hadjel) allows us to highlight the role of Mononchida predators against nematode communities associated with these plants' hosts. For this purpose, we selected eight parcels (stations) for our study.

Samples were collected from two areas, the first is the Mergueb natural reserve (35°35 ' N; 04 °7'E) located in the cool arid bioclimatic stage and in a second area the experimental station ITAFV Médéa (36 ° 11 'N; 02 ° 50'E) located in the cool semi-arid bioclimatic stage.(Fig. 1) To achieve this faunistic study, we collected 10 soil samples with a weight of 200g each harvested in the rhizosphere of plants selected on the diagonal of each plot to a depth of up to 70 cm. These samples are combined into a single sample in a referenced bag (the date, place and the plant). Nematodes are extracted from the ground by the pail's extraction method of Dalmasso (1966) called flotation and sedimentation method, and then identified and counted under the binocular microscope. Nematode populations in the soil are expressed in number of nematodes per dm3 (N / dm3).

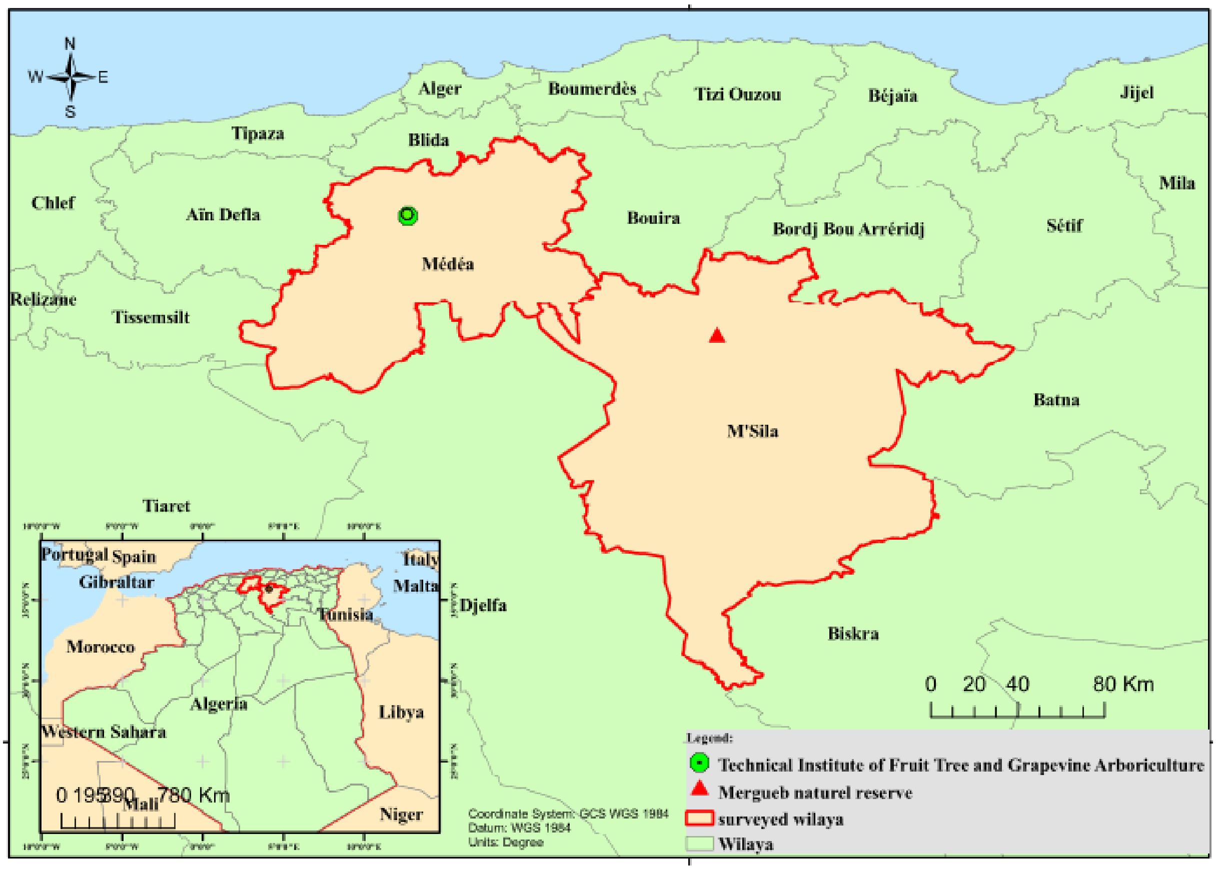


Fig.1 Location of the ITAFV (Medea) station and the Mergueb natural reserve (M'sila) (Berrabah et al., 2016 "edit")

Operating data

Data analysis and graphics were performed using the software "SYSTAT worms. 12, Excel 2009 and SPSS TM "using the global linear model (GLM). The hypothesis of equality of the variation in the stations is tested by calculating the Euclidean distance to a factor controlled by the software PAST -Palaeontological Statistics, ver. 1.81.- PAlaeontological STatistics, ver. 1.81. (Hammer and *al.*, 2001). The correlations between trophic groups and especially with the predator are highlighted by Pearson correlation coefficient by the same software PAST.

Results and Discussion

1. Inventory of nematodes found in the study areas

The completion of this study allows us to identify 17 genus of nematodes in the different soils of vineyard and Alfa studied in northern Algeria (Ain Elhadjel and Medea) and to distribute them according to their diets (Yeate and *al.*, 1993):

-Phytophagous nematodes (*Pratylenchus, Pratylenchus, Pratylenchus, Scutellonema, Tylenchorhynchus, Xiphinema, Nothotylenchus* and *Helicotylenchus*);
-Fungivorous nematodes (*Aphelenchoides, Aphelenchus, Ditylenchus, Psilenchus* and *Tylenchus*);
- Bacterivorous nematodes (*Rhabditis, Cephalobus* and *Chiloplacus*);
- Predator nematodes (*Mononchus*).

Analysis of the results by the General Linear Model (GLM) reveals significant differences in the densities of trophic groups (P <0. 05, P = 0.049) (Fig. 2):

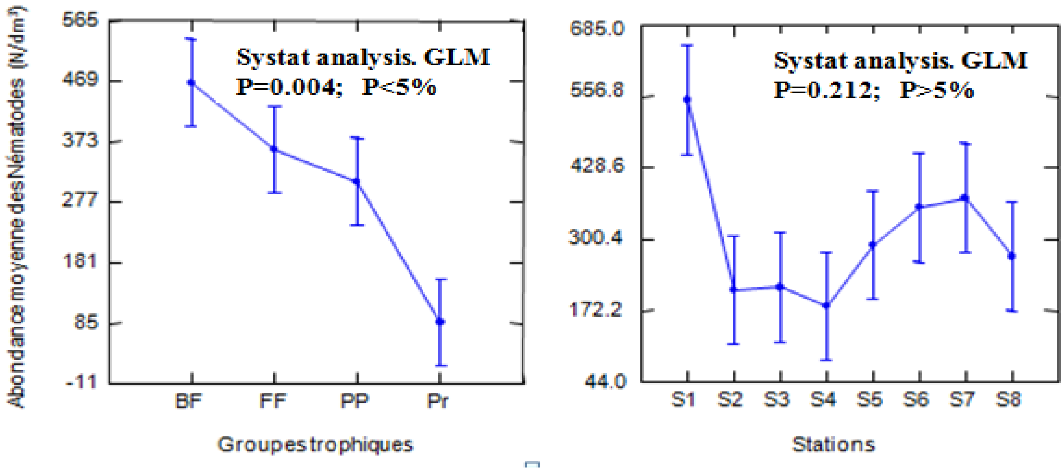


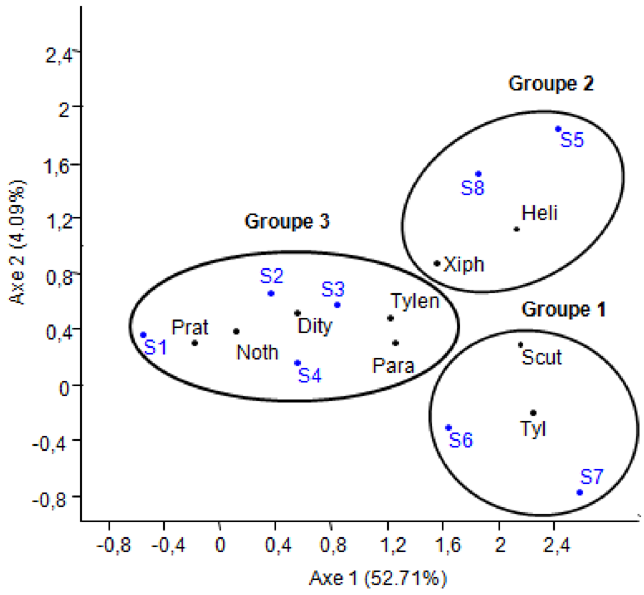
Fig.2 - G.L.M. Model applied to the global average density (N/dm^3) of diverses nematodes found in the study areas.

PP: phytophagous nematodes; BF: bacteria-feeding nematode; FF: fungivorous nematodes; OP: predator-omnivorous nematode. S1-S4: Ain Elhadjel stations, S5-S8: Medea stations.

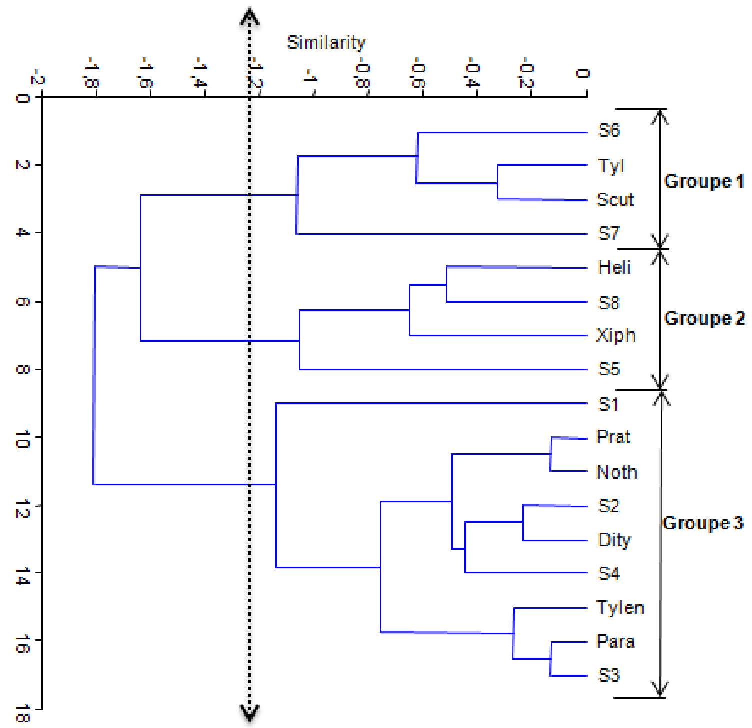
The abundance of bacterivorous and fungivorous in our habitats is likely related to the biological activity of the soil. Furthermore, several research works show that predators and omnivorous nematodes are the most sensitive to environmental disturbances (Bongers and Bongers, 1998; Georgieva et al., 2002), while the bacterivorous and fungivorous nematodes tolerate various stress related agriculture (Fu et al., 2000).

2. Variation of the density of phytophagous nematodes in the explored sites

The analysis of phytophagous nematodes densities by Detrended Correspondence Analysis (DCA) explains the affinity of some taxa compared to the surveyed correlation between the *Monochus* predator and the phytophagous, while positive correlations are recorded between bacterivorous / fungivorous / *Monochus* and also between phytophagous / bacterivorous and fungivorous / bacterivorous. In perspective, it appears interesting in future studies to areas. Calculating Euclidean distance based on similarity (-1.2), allows for heterogeneous resortir three groups (Fig. 3):



1-Detrended correspondence



2- Hierarchical clustering

Fig.3 - Variation of the density of herbivores in the surveyed sites.

Para: Paratylenchus, **Prat:** Pratylenchus**, Noth:** Nothotylenchus, **Heli:** Helicotylenchus, **Scu**: Scutellonema, **Dity:** Ditylenchus, **Tyl:** Tylenchus, **Tylen:** Tylenchorhynchus, **Xiph:** Xiphenema. **S1-S4:** Stations From Mergueb Natural Reserve, **S5-S8**: Wine stations.

The first group consists of *Scutellonema* and *Tylenchorhynchus* sp. at stations S6 and S7. The second group detects the presence of *Helicotylenchus* and *Xiphinema* in S5 and S8 stations. The third group *includes* phytophagous nematodes (*Tylenchus, Ditylenchus, Paratylenchus, Pratylenchus and Nothotylenchus*) that are present in the stations of the Mergueb nature reserve (S1-S4).

The spatial variation of nematode shows their abundance in some studied sites compared to others. These results are confirmed by Cadet (1998) who demonstrated that the presence of the plant does not necessarily determine the species of nematodes which are capable to parasite it. For the same plants, species of nematodes that are present in sandy soils are often different from those of clay soils (Estioko and Reyes, 1984).

3. Nematodes predation effect of Mononchida order

To evaluate the order of Mononchida nematode predation effect on different trophic groups met on both host plants (vines and Alfa), we have selected the correlation analysis that highlights the data recorded in Table 1. In this table, the values of Pearson are below the diagonal, the associated probabilities are positioned above the diagonal.

Table1. Correlations found between trophic groups in the studied areas.

	Mononchus	BF	FF	PP
Mononchus	0	0,0076349	0,018122	0,04158
BF	0,7517	0	0,049623	0,0087974
FF	0,69277	0,59276	0	0,16311
PP	-0,62067	0,74297	0,4517	0

These results highlights a positive correlation between phytophagous and bacterivorous (p = 0.0087974) and fungivorous and bacterivorous (p = 0.049623) which are also good indicators of fertility, insofar as they develop over bacteria or fungi associated with the presence of the organic matter (Sarah, 1995) the bacterivorous nematodes therefore always abound in rich organic soils (Yeates et al., 1993). There is also a negative correlation between the phytophagous and *Monochus* predator (p = 0.04158). While positive correlations are recorded between bacterivorous, fungivorous and *Monochus* with respective probabilities (p = 0.007634) and (p = 0.018122) expressed by Several authors that confirmed the utility of *Mononchus* as a biological control agent; the first of them being Cobb in 1917 who proposed the use of this nematode to fight against phytophagous nematodes of sugarcane and Steiner and Heinly in 1922.

Conclusions

The results show that the group of bacterivorous nematodes abounds in the studied sites followed by that of fungivorous and herbivores. Calculating Euclidean distance-based similarity (-1.2) highlights three heterogeneous groups following the variability of nematode abundance in the studied sites. Using the Pearson correlation coefficient shows a negative consider the food preferences of these predatory nematodes' vis-a-vis the different kinds of phytophagous to know whether their use in crop protection would be of interest and identify opportunities for their integration into a pest management program.

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