Research Paper Agriculture

Nematodes Diversity in Northen Vineyards of Algeria

Faiza Hoceini	MA. Laboratory of Agricultural and Forest Entomology. National School of Agronomy, Alger
Farid Bounaceur	Dr. Faculty of Natural Sciences and Life, Ibn Khaldoun University, Tiaret.
Bahia Doumandji-Mitiche	Pr. Laboratory of Agricultural and Forest Entomology. National School of Agronomy, Alger

ABSTRACT

Research on nematodes associated with vine in 15 areas focused on various aspects, including their occurrence and geographical distribution, for 17 genera, that according to their feeding habits, can be classified into four major groups: plant parasites, bacterial, fungal, predators -omnivores feeders, the main species of the genera Pratylenchus, Paratylenchus, Scutellonema, Tylenchorhynchus, Xiphinema et Helicotylenchus. Significant spatial variation of trophic groups and nematode communities effects were elucidated using Global Lineair Model to express nematode community composition

KEYWORDS Nematode community, spatial variation, trophic structure, vine.

Introduction

The vine (Vitis vinifera), worldwide cultivated, is often attacked by several parasits, such as Nematodes (Nemathelmintha, Nematoda). Among these nematodes, various species can coexist in the same vineyard and can cause serious damages. Nematodes are widely distributed in soil, and their communities are made up of diverse species with different life spans and different reproductive and survival capacities while the major part of them recycle nutrients by feeding plant tissue and microorganisms and liberating minerals easy absorpted by plant roots. Recently, many nematologists have focused on the changes of nematode community structure in different vegetation systems, ranging from native to intensified agriculture systems. For this, Our study aims to determine the spatial Variation, relationship between abundance, diversity and trophic structure of the soil nematode communities in vine.

Materials and methods

1. Site description and climate

The fallow lands used in this study were located in the notthern of Algeria (13845N to 15840W). This region is considered as highly anthropised according to its agronomic potentialities, with more than 70 ha/km2. These sites were characterised by mediterranean climat (sub-continental). Rainffal is mainly in winter and spring, where annual rainfall on average is 650 mm. Nine vineyards were studied with diverse varieties (Cinsault, Dattier de Beiyrouth, Cardinal and Carignan) and ages (down to 30 years) in the northern of Algeria. The vineyards cover areas of 01 ha –0 8 ha, planted with a distance of plantation of 4 m x 2 m.

2. Sampling procedure

Soil samples were collected from 50 to 70 cm depths during April 2013, under the randomly plant rhizosphere of Vitis vinifera. At each site 01 ha plot was delimited and within each plot permanent transect were laid out in a zone representative of the surrounding natural vegetation. About 1000 cm3 of soil were collected in each site during the rainy season (Mars-April 2013).

3. Sample processing for nematode study

In the laboratory, each soil sample was thoroughly mixed and divided into four parts. One part of 250 cm3 was used for nematode processing. The rest was mixed to provide a bulk soil sample for soil analysis. The nematodes were extracted from the soil by flottaison and sedimentation method (Dalmasso, 1966) then identified and numbered under the dissecting microscope. Nematode populations were exprimed by individuals nematode in dm3 of soil (N/dm3).

4. Statistical analysis

To compare between nematodes taxa, tophic groups and vineyards (localities), SYSTAT vers. 12, SPSS 2009 et Excel TM was performed and the means were separated by global lineair model (G.L.M) at a level of significance $\alpha = 5\%$.

Results and discussion

1. Total number of nematodes

The presence of a suitable host plant does not mean that it will necessarily be attacked by the feudaled nematode species, even if they are artificially inoculated. Indeed, some faunistic surveys demonstrated that the distribution of certain nematode species strongly correspond to that of soil type (Blair et al., 1999).

A significant difference was observed between average nematode density ($P<0.05$, $p=0.000$) in the study areas (Table no.1). The average total number of nematodes ranged between 64 and 168 individuals 100 g-1 dry soil (Graph no. 1): The total number of nematodes under V2, V6 and V9 reached peak values of 164±05 individuals, and those under V1, V3, V5 and V8 reached a similar trend with 140±10 individuals. The values under V4 and V7 showed the lowest number of total nematodes (respectively 67 and 64).

2. Nematode taxa

Annual cycles differ between species and between years depending on the life history of species, food availability and quality, biotic interactions with other organisms, and the physical-chemical environment. Soil moisture and temperature are frequently mentioned as major factors affecting population fluctuations (Norton & Niblack 1991). However, also host plant dynamics and productivity are important factors regulating their activity (Yeates 1982; Norton 1989).

A significant difference was observed between nematode taxa abundance ($P<0.05$, $p=0.049$) in the study areas (Table I). In our samples we found 17 genera belonging to thirteen fam-

ilies where Aphelenchus, Tylenchus, Cephalobus, Dorylaimus and Ditylenchus were the dominant taxa, their mean relative abundance was 16.15 %, 12.90 %, 12.33 %, 10.55% and 8.00 %, respectively (Table no. 2). The average abundance of these nematode populations was higher than the plant-parasite nematode densities (Paratylenchus sp., Pratylenchus sp., Scutellonema sp., Helichotylenchus sp. and Xiphinema sp.) however, the predatory-omnivorous (Discolaimus sp. and Mononchus sp.) have the lowest density (Graph no. 1).

3. Trophic groups

Nematodes play a major role in decomposition and nutrient cycling in soil food webs. These organisms are the most abundant multi-cellular organisms in terrestrial and aquatic ecosystems (Bongers and Bongers, 1998). Competition between plant parasitic nematodes is due to occupation of space, physical change of the host plant that decreases its suitability, or destruction of feeding sites and it is most severe between species with similar feeding habits. while The predatory nematodes may suppress plant-parasitic nematodes through predation. The enhancement of predatory nematodes also may contribute to increased nutrient mineralization as nutrients from microbes consumed by bacterivorous nematodes are released at the predatory trophic levels (Yeates & Wardle, 1996).

A Significant differences were found between Trophics groups ($P< 0.05$, $p=0.047$) under the vine areas (Table no. 1).Nematodes were placed in four groups (Table no. 2): the free-living nematodes (PP), bacterivorous (BF), predatory-omnivorous (OP) and fungivorous nematodes (FF) which some plant-parasitic nematodes belong to this group. The most abondant group is the fungivorous species and plant-parasitic nematodes (Graph no. 1). The bacteriovore populations under vine reached minimum value, while those of predatory-omnivorous reached the least value.

Conclusion

In the presente work, Total population abundance nematode ranged from 64 to 168 individuals per 100 g soil, represented by 17 genera, that according to their feeding habits, can be classified into five major groups: plant-parasites, bacterials, fungals, predator and omnivores feeders. Significant spatial variation were elucidated using global lineair model (G.L.M.) applicable to express nematode community composition and spatial vatiation in grapevine lands. The results also showed a significant number of phytophagous and fungivorous nematodes, compared to bacteriovores nematode in Vineyards. While, some fungivorous nematodes which belong also to plant-parasitic nematodes Were the most abondant populations in the study vine lands in Algeria.

1: Aphelenchus sp., 2: Aphelenchoides sp., 3: Cephalobus sp., 4: Discolaimus sp., 5: Ditylenchus sp., 6: Dorylaimus sp., 7: Helichotylenchus sp., 8: Mononchus sp., 9: Paratylenchus sp.,10: Pratylenchus sp, 11: Psilenchus sp., 12: Rhabditis sp., 13: Scutellonema sp., 14:Tylenchus sp., 15: Tylenchorhynchus sp., 16: Xiphinema sp. and 17: Chiloplacus sp. V1 : Ain Temouchante, V2 : Annaba, V3 : Ghilizane, V4 : Mostaganem, V5 : Oran, V6: Sidi Belabes, V7 : Skikda, V8 : Taaref and V9 : Tlemcen. PP : nématodes phytophages ; BF : nématodes bactériovores; FF : nématodes fongivores ; OP : nématodes prédateurs –omnivores.

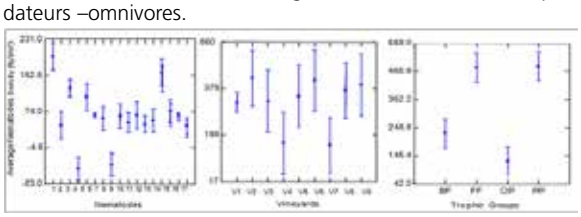
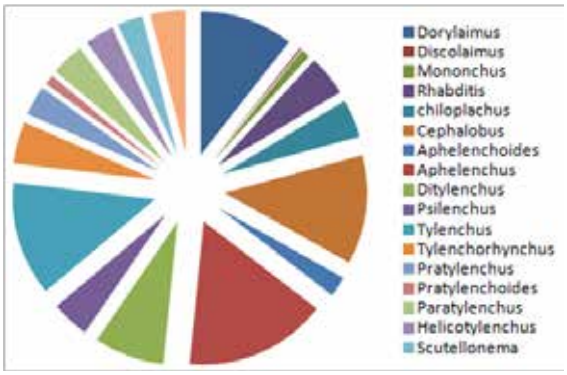


Table no. 1 Graph no. 1 : G.L.M. Model applied to the global average density (N/dm3) of diverses nematodes found in the study areas.

Source	Sum of Squares	Df	df Mean-Square	F ratio	P
Vineyard	47209.703	8	5901.213	1.98	0.049
Nematode	263185.214	14	18798.944	6.307	0
Trophic Group	32611.894	2	16305.947	5.47	0.005
Error	405384.414	136	2980.768		

Genus	Family	Trophic group	C-P	Absolute Abundance (N/dm3)	Relative Abundance (%)
Mononchus	Mononchidae	OP	4	100	1.032
Dorylaimus	Dorylaimidae	OP	4	1025	10.583
Discolaimus	Discolaimidae	OP	4	20	0.206
Rhabditis	Rhabditidae	BF	2	445	4.594
Cephalobus	Cephalobidae	BF	2	1195	12.338
Chiloplacus	Cephalobidae	BF	2	420	4.336
Aphelenchus	Aphelenchidae	FF-PP	2	1565	16.159
Aphelenchoides	Aphelenchoididae	FF-PP	2	225	2.323
Tylenchus	Tylenchidae	FF-PP	2	1250	12.906
Ditylenchus	Tylenchidae	FF-PP	2	775	8.002
Psilenchus	Tylenchidae	FF	3	420	4.336
Tylenchorhynchus	Belonolaimidae	PP	2	460	4.749
Pratylenchus	Pratylenchidae	PP	3	325	3.355
Paratylenchus	Tylenchulidae	PP	2	365	3.768
Helicotylenchus	Hoplolaimidae	PP	3	320	3.304
Scutellonema	Hoplolaimidae	PP	3	280	2.891
Xiphenema	Longidoridae	PP	5	385	3.975
Total				9685	100

Table no. 2 Graph no. 2 : Abundance of nematode populations found in spatial sampling on vineyards.



REFERENCES

Blair, B.L. Stirling G.R. and Whittle P.J.L., 1999 - Distribution of pest nematodes on sugarcane in South Queensland and relationship to soil texture, cultivar, crop age and region. Aust. J. Exp. Agric. 39, 43–49.| Bongers T. and Bongers, M. (1998) Functional diversity of nematodes. Appl. Soil Ecol. 10, 239–251.| Dalmasso, A. (1966) Méthodes simples d'extraction des nématodes du sol. Revue d'Ecologie et de Biologie du Sol, 3: 473- 478.| Norton D.C., 1989 - Abiotic soil factors and plant-parasitic nematode communities. J. Nematol. 21, 299–307. | Norton D. C. and Niblack T. L., 1991 - Biology and ecology of nematodes. In: Nickle W.R. (ed.) Manual of agricultural nematology. Marcel Dekker, Inc., New York, pp. 47–72.| Yeates G.W., 1987 - How plants affect nematodes, Adv. Ecol. Res. 17 61–113.| Yeates G. W. and Wardle D. A., 1996 - Nematodes as predators and prey: relationships to biological control and soil possesses. Pedobiologia 40:43–5.