

SURVEY OF PLANT PARASITIC NEMATODES GENERA ASSOCIATED WITH SUGAR BEET PLANTATIONS IN DAKAHLIA GOVERNORATE.

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ABSTRACT

A survey of plant parasitic nematodes genera associated with the rhizosphere of seven sugarbeet cvs. Kawemira, Monte-bionco, Deprez-poly N, Sultan, Nejama, Athos-poly and Farida grown at five counties of Dakhlia governorate (Egypt) was carried out during the sugar beet growing season 2007/2008/2009. Nine nematode genera were recorded in the surveyed sugar beet fields. Based on their frequency of occurrence, these genera can be arranged in ascending order as follows: *Meloidogyne* (J2) (22.6%), *Trichodorus* (19.8%), *Hirschmanniella* (13.4%), *Helicotylenchus* (10.4%), *Tylenchus* (6.5%), *Pratylenchus* (4.7%), *Dorylaimus* (3.4%), *Rotylenchulus* (1.7%), and *Tylenchorhynchus* (1.3%). Among the seven true nematode genera recorded, *Meloidogyne* and *Trichodorus* seemed to be the major pest of sugar beet plantations in this work. Meanwhile, clay soil with 413 out of 700 soil samples examined encountered the highest number of nematode genera (7) followed by loamy (5) and clay loam (4).

Keywords: Survey nematodes genera, sugar beet cultivars, *Meloidogyne* spp. Loamy.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is an important arable crop, traditionally used for sugar extraction all over the world. Plant parasitic nematodes are considered as one of the most important plant pathogens, since these organisms play a detectable role in limiting the productivity of such economic agriculture crops i.e. sugarbeet. Its total cultivated area reached 131.2 thousands feddans with an average 20.49 tons /Feddan* of sugarbeet tubers in the season of 2003 in Egypt, where it is grown in all type of soils especially, in newly reclaimed sand areas such as El-Hamoal Barrary, West Nubaruaia, and Al-Bostan regions. Sugarbeet plants are subjected to be attacked by several plant parasitic nematodes in many countries. In Egypt, several researches carried out a survey work in sugarbeet producing areas and recorded the presence of nine nematode namely *Criconemoides*, *Ditylenchus myceliophagus*, *Helicotylenchus dihystra*, *Heterodera* sp., *Hoplolaimus* sp., *Meloidogyne incognita* and *M. javanica*, *Paratylenchus* sp., *Rotylenchulus reniformis* and *Tylenchus* spp. in different localities i.e. El-Hamoul Barary and west Nubaruaia. Nematode genera, *Meloidogyne* and *Rotylenchulus* were dominantly found in all the examined fields with high population densities (Ibrahim, 1982, Oteifa and El-Gindi, 1982 and Abd El-Massih, 1985 and Maareg *et.al.*, 1988 and Maareg and Hassanein, 1999).

In recent years, sugar beet is becoming an important crop in Egypt for supporting the expansion of Egyptian sugar industry, therefore efforts to protect the crop from the most destructive pests and diseases are crucial.

* Feddan = 4200m²

Nematological survey is necessary in providing information on the probability and magnitude of crop losses due to nematode infection, especially with *Meloidogyne* spp. Their wide host range and favourable environmental conditions provoked suitable control measure to achieve reasonable results. However, information on such nematode genera associated with sugarbeet plantations in Dakahlia governorate is not complete. Therefore, the aim of the present work deals with surveying plant parasitic nematode genera associated with sugarbeet plantations within various counties of Dakahlia governorate.

MATERIALS AND METHODS

Survey of Plant Parasitic Nematodes Associated with Sugar beet Plants in Dakahlia Governorate:

A total of 700 soil samples were randomly collected from rhizosphere of sugar beet plants grown in five counties i.e Belkas, Bany-Ebaed, Dekernse, Mansoura, Sinbellawain of Dakahlia governorate during 2007/2008/2009 seasons. These soil samples represented seven sugar beet cultivars i.e. Kawemira, Monte-bionco, Deprez -poly N, Sultan, Nejama, Athos-poly and Farida. Samples were obtained by digging the soil to a depth of about 15-20 cm from the rhizosphere of the growing plants. Samples were also obtained at 30 days after seed germination. Soil samples of about one kg each were placed in plastic bags and sent directly to the nematology laboratory of Nematology Research Unit, Agriculture Zoology Department, Faculty of Agriculture Mansoura University and kept in the refrigerator at 4°C until nematode extraction, Then, soil samples were thoroughly mixed and a volume of 250g soil was used to extract nematodes according to sieving and modified Baermann technique (Goodey, 1957). Each soil sample was soaked in tap water for 20 minutes, then the mixture was agitated. Direct sieving through 60 and 325 mesh sieves was employed. Resulting suspension was transferred on a soft tissue paper fitted on the Baerman for separating active nematodes from soil particles (Goodey, 1957). After 48 hours, water in the plate containing nematodes were transferred to a plastic cup. Identification of nematode genera in repeated aliquots (1ml each) in each soil sample was based on the morphological characters of the adult and larval forms according to Mai and Lyon (1975). The Hawksely counting slide under 10×40 magnification was used for determining the number of each nematode genus and recorded.

RESULTS AND DISCUSSION

Frequency of Occurrence and Population Density of Plant Parasitic Nematode Genera Associated with The Rhizosphere of Sugarbeet Plantations Grown in Certain Counties of Dakahlia Governorate.

Data in Table (1) show that nine nematode genera belonging to eight families were detected from the rhizosphere of sugarbeet plantations at the examined five counties i.e. Belqas, Bany-Ebed, Dekerns, Sinbellawain and

Mansoura of Dakahlia governorate from where seventy composite soil samples were taken during the growing seasons of 2007/2008/2009. These genera were *Helicotylenchus* (Hoplolaimidae), *Hirschmanniella* (Pratylenchidae), *Meloidogyne* (Meloidogynidae), *Pratylenchus* (Pratylenchidae), *Rotylenchulus* (Hoplolaimidae), *Trichodorus* (Trichodoridae), *Tylenchorhynchus* (Tylenchorhynchidae), *Dorylaimus* (Dorylaimidae) and *Tylenchus* (Tylenchidae).

Table (1): Frequency occurrence and population density of nematode genera associated with Sugarbeet plantations grown in certain counties of Dakahlia governorate.

Nematode genera	Occurrence of nematode genera per 250 g soil within each county of Dakahlia						Total N=700	F.o. %	No of infested counties
	Belqas *n=187	Sinbellaw ain *n=126	Bany-Ebaed *n=100	Dekerns *n=147	Mansour *a n=140				
True plant parasistes									
<i>Helicotylenchus</i>	3(61.39)	12(32.5)	11(29.81)	9(39.33)	8(62.63)	73	10.4	5	
<i>Hirschmanniella</i>	25(87.68)	17(42.46)	6(30.83)	12(31.77)	34(96)	94	13.4	5	
<i>Meloidogyne(j2)</i>	70(85.01)	24(42.82)	10(31.4)	18(29.41)	36(96.26)	158	22.6	5	
<i>Pratylenchus</i>	23(82.13)	0	4(29.75)	0	6(75)	33	4.7	3	
<i>Rotylenchulus</i>	0	8(29.5)	4(39.25)	0	0	12	1.7	2	
<i>Trichodorus</i>	27(59.74)	28(37.83)	22(31.27)	21(32.28)	40(58.95)	139	19.8	5	
<i>Tylenchorhynchus</i>	9(68.22)	0	0	0	0	9	1.3	1	
Total	193	89	37	60	124				
Suspected plant parasistes									
<i>Dorylaimus</i>	18(54.27)	0	6(31.33)	0	0	24	3.4	2	
<i>Tylenchus</i>	23(67.26)	0	8(31.62)	15(35.46)	0	46	6.5	3	
Total	41	0	14	15	0				
Total occurrence	234	89		75	124				
Nematode genera/ county	8	5	8	5	5				

*n= number of soil samples.

Number between parentheses represented the average of nematode population density per 250 g. soil.

*/% F.O = (Number of samples containing a genus / number of collected samples) x100

Soil samples recovered from Belqas and Bany-Ebed county reveal the presence of six of the true plant parasitic nematode genera plus two of the suspected ones. These nematode genera were recorded to be: *Helicotylenchus*, *Hirschmanniella*, *Meloidogyne*, *Pratylenchus*, *Trichodorus*, *Dorylaimus*, *Tylenchus* plus *Tylenchorhynchus* for Belqas and *Rotylenchulus* for Bany-Ebed only. With respect to Belqas county, *Meloidogyne*, *Helicotylenchus*, *Trichodorus*, *Hirschmanniella*, *Pratylenchus* and *Tylenchus* genera seemed to be the most prevailing nematode pests as they occurred at the rates of 70, 33, 27, 25, 23 and 23 times with percent occurrence of 37.4, 17.6, 14.4, 13.36, 12.29 and 12.29%, respectively. Moreover, the nematode genera, *Dorylaimus*, and *Tylenchorhynchus* were less common as they occurred at the rate of 18 and 9 with percent occurrence of 9.6 and 4.8 %, respectively. It was also evident that the rice root nematode, *Hirschmanniella* spp., the root-knot nematode, *Meloidogyne* spp., the root

lesion nematode, *Pratylenchus* spp., and the stubby root nematode, *Trichodorus* spp. were recorded with an average of 87.68, 85.01, 82.13 and 59.74 individuals per 250g. soil, respectively. Concerning Bany-Ebed county, *Trichodorus*, *Helicotylenchus*, *Meloidogyne* seemed to be the most prevailing nematode pests of the true plant parasitic nematodes as they occurred at rates of 22, 11, 10 and 6 times with an average of 31.27, 29.81, 31.4 and 30.83 individuals per 250g. soil, respectively. The nematode genera, *Pratylenchus* and *Rotylenchulus* were less common as they occurred at the rates of 4 times for each with an average of 29.75 and 39.25 individuals per 250g. soil, respectively. Soil samples collected from Sinbellwain, and Mansoura reveal the presence of five of the true plant parasites and none of the suspected ones, however soil samples of Dekerns reveal four of the former and one of the latter. *Trichodorus*, *Meloidogyne* and *Hirschmanniella* genera seemed to be the most prevailing nematode pests on sugarbeet growing in Mansoura county as they occurred at the rates of 40, 36 and 34 times with an average of 58.9, 96.26 and 96.0 individuals per 250g soil, respectively. Similar trend was recorded for these three nematode pests i.e. *Trichodorus*, *Meloidogyne* and *Hirschmanniella* within the rhizosphere of sugarbeet plants at Sinbellawain and Dekerns counties since they appeared to be the most prevailing nematode genera as they occurred at the rates of 28, 24 and 17 times with an average of 37.8, 42.8 and 42.5 individuals per 250g. soil, respectively for Sinbellawain county, whereas for Dekerns county these nematode genera occurred at the rates of 21, 18 and 12 times with an average of 32.28, 29.4 and 31.8 individuals per 250g. soil, respectively.

In general, among the seven true plant parasitic nematode genera, *Meloidogyne* and *Trichodorus* seemed to be the major pests as they occurred at rate of 158 and 139 times with percent occurrence of 22.8 and 19.8 % whereas, the nematode genera, *Helicotylenchus*, *Hirschmanniella* and *Pratylenchus* showed moderate distribution as they occurred at rates of 73, 94 and 33 times with percent occurrence of 14.4, 13.4 and 4.7%, respectively, while *Rotylenchulus* and *Tylenchorhynchus* had the lowest values of distribution as they occurred at rate of 12 and 9 times with percent occurrence of 1.7 and 1.3 % respectively. The two suspected plant parasitic nematode genera, i.e. *Dorylaimus* and *Tylenchus* proved to be of major importance as they occurred at rates of 24 and 46 times with percent occurrence of 3.4 and 6.5 %, respectively. Various counties of the surveyed area within Dakahlia governorate showed difference in the frequency occurrence of plant nematode genera (Table1), since their values were ranged from 5 to 9 genera, whereas the following counties localities, Belqas and Bany-Ebed, appeared to yield the highest number of nematode genera recorded with values of 8 genera, each. Obviously, *Meloidogyne* and *Trichodorus* were the dominant true nematode genera recovered from the five counties studied, then *Pratylenchus* and *Tylenchus* that were present in the soil of 3 localities each, whereas, *Rotylenchulus*, *Dorylaimus*, and *Tylenchorhynchus* were only detected from soil of 2 and 1 localities, respectively (Table,1).

Regarding the seven hundred composite soil samples that were collected from the rhizosphere of sugarbeet plants, results in Table (2)

indicated that the sugarbeet plants cv. Farida encountered the nine of nematode genera recorded, followed by cv. Athos-poly (8), Sultan (7), Nejama (7) and Deprez-poly N (6), whereas sugarbeet cvs. Monte-bionco and Kawemira encountered the least number of nematode genera (5) each, respectively.. Data also reveal that the highest densities of nematode individuals per 250 g. soil averaged 80.52, 68.62 and 37.75 for the root-knot nematode, *Meloidogyne* spp., the root lesion nematode, *Pratylenchus* spp., and the stubby root nematode, *Trichodorus* spp. in the rhizosphere of sugarbeet plant cv. Deprez poly N, while an average of 103, 83.1 and 71.3 individuals were recorded for the reniform nematode, *Rotylenchulus* spp., the root lesion nematode, *Pratylenchus* spp. and the spiral nematode, *Helicotylenchulus* spp. in the rhizosphere of sugarbeet plant cv. Nejama, respectively. In conclusion, *Helicotylenchulus* and *Hirschmanniella* were the most prevailing nematode genera as they found in the rhizosphere of the seven surveyed sugarbeet cultivars, followed by *Pratylenchus* spp (6), *Rotylenchulus* spp., *Trichodorus* spp. and *Tylenchorhynchus* spp were recovered from the rhizosphere of five sugarbeet cultivars, but *Meloidogyne* spp was only found in the rhizosphere of four sugarbeet cultivars i.e. Deprez poly N, Athos- poly Monte-bionco and Farida, respectively (Table2) .

With regard to soil types i.e. clay, clay loam and loamy, the occurrence of plant nematode genera reveal that among the true plant parasitic nematodes, *Meloidogyne* (J2), *Trichodorus*, *Helicotylenchulus* and *Hirschmanniella* were abundant in their distribution in the three soil types surveyed as they occurred at rates of 142, 99, 87 and 75 times with percent occurrence of 20.2, 14.1, 12.4 and 10.7%, respectively (Table. 3). The nematode genera, *Pratylenchus*, *Tylenchorhynchus* and *Rotylenchulus* showed minor values at the rates of 15, 13 and 8 times with percentage occurrence of 2.1, 1.8 and 1.1 %, respectively.. The suspected parasitic nematode genera recovered i.e. *Dorylaimus* and *Tylenchus* showed considerable distribution as they occurred at rates of 22 and 24 times with percentage levels of 3.1 and 3.4%, respectively. Moreover, it was also evident that clay soil encountered the highest number of true nematode genera (7) with total occurrence of 255 times, followed by loamy (5) and clay loamy (4) soils with total occurrence of 124 and 60, respectively. where the nematode genera i.e. *Rotylenchulus*, *Tylenchorhynchus* and *Dorylaimus* were absent in those two soil types (Table.3).

Apparently, this work recorded the presence of 5 or 6 or 7 or 8 or 9 nematode genera associated with the rhizosphere of the sugarbeet Kawemira, Monte-bionco, Deprez-poly N, Sultan, Nejama, Athos-poly and Farida that were grown in five counties i.e. Belqas, Bany- Ebaed, Dekernse, Sinbellawin and Mansoura of Dakahlia governorate.

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As a whole, it is not surprising that the soil rhizosphere of sugarbeet revealed the presence of true plant parasitic nematode genera only that recovered from a total of 700 soil samples examined , especially, *Meloidogyne* and *Trichodorus* which seemed to be the major pest as its occurred at rate 158 and 139 times with percent occurrence of 22.8 and 19.8 % , whereas the nematode genera, *Helicotylenchulus*, *Hirschmanniella* and *Pratylenchulus* showed moderate distribution while *Rotylenchulus* and *Tylenchorhynchus* had the lowest values of distribution within the cultivated sugarbeet cultivars in such soil type in this study i.e. clay or clay loamy or loamy, since clay soil encountered the highest number of nematode genera (7) followed by loamy (5) and clay loamy (4) , respectively. This is expected since plant parasitic nematodes are generally in favour of light soils (Steiner,1950) . Meanwhile , results of the present investigation on nematological survey is in accordance with the findings of Maareg *et.al* (1988) and Maareg and Hassanien (1999) who recorded 10 or 9 true nematode genera associated with sugarbeet plants.

Table (3): Relative infestation of soil types by the various Sugarbeet plantations associated with plant parasitic nematodes.

Nematode genera	Soil type and number of samples (n)			Total n=700	Frequency occurrence %	No.of infested soil types
	Clay n=413	Clay loamy n=147	Loamy n=140			
True plant parasites:						
<i>Helicotylenchulus</i>	42(49.52)	9(39.33)	36(62.63)	87	12.4	3
<i>Hirschmanniella</i>	49(55.53)	18(31.77)	8(96)	75	10.7	3
<i>Meloidogyne</i>	96(59.26)	12(29.41)	34(96.26)	142	20.2	3
<i>Pratylenchulus</i>	9(50.33)	0	6(75)	15	2.1	2
<i>Rotylenchulus</i>	8(29.86)	0	0	8	1.1	1
<i>Trichodorus</i>	38(52.84)	21(32.28)	40(58.95)	99	14.1	3
<i>Tylenchorhynchus</i>	13(53.31)	0	0	13	1.8	1
Total	255	60	124			
Suspected plant parasites:						
<i>Dorylaimus</i>	22(52.77)	0	0	22	3.1	1
<i>Tylenchus</i>	9(75.22)	15(35.46)	0	24	3.4	2
Total	31	15	0			
Nematode genera per soil type	9	5	5			

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حصر لاجناس النيماطودا المصاحبة لزراعات بنجر السكر في محافظة الدقهلية احمد جمال الشريف و دينا صلاح الدين سراج الدين وحدة بحوث النيماطولوجي – قسم الحيوان الزراعي- كلية الزراعة – جامعة المنصورة

تم إجراء حصر لاجناس النيماطودا المصاحبة للمجال الجذري لنباتات سبع أصناف من بنجر السكر وهم كوميرا – مونتيبانكو – دبيرة – سلطان- نجما – أثوس – فريدا – المنزرعة في ٥ مراكز لمحافظة الدقهلية (مصر) خلال مواسم زراعات بنجر السكر ٢٠٠٧/٢٠٠٨/٢٠٠٩.

أسفرت الدراسة عن تسجيل ٩ اجناس نيماطودا في حقول بنجر السكر في هذه الدراسة وهي حسب أهميتها تصاعديا بالنسبة لمعدل تواجدها (*Meloidogyne* (J2) ٢٢.٦%) و (*Trichodorus* ١٩.٨%) و (*Hirschmanniella* ١٣.٤%) و (*Helicotylenchus* ١٠.٤%) و (*Tylenchus* ٦.٥%) و (*Pratylenchus* ٤.٧%) و (*Dorylaimus* ٣.٤%) و (*Rotylenchulus* ١.٧%) و (*Tylenchorhynchus* ١.٣%).

كما او ضحت الدراسة ان جنس النيماطودا *Meloidogyne* و *Trichodorus* هما الافاتان الاساسيتان لزراعات بنجر السكر من السبع اجناس حقيقية التطفل المسجلة . وفي الوقت نفسه ان التربة الطميية والتي اشتملت على ٤١٣ عينة من إجمالي سبعمائة عينة تم جمعها في هذه الدراسة احتوت علي أعلى الاعداد من الاجناس النيماطودا المكتشفة وهم ٩ اجناس يليها التربة الطينية (٥ اجناس) ثم التربة الطميية الطينية (٤ اجناس) فقط علي التوالي.

ملحوظة : هذا البحث مستخرج من رسالة المؤلف الثاني لدرجة الماجستير في الحيوان الزراعي (نيماطودا)

قام بتحكيم البحث

كلية الزراعة – جامعة المنصورة

كلية الزراعة – جامعة القاهرة

أ. د/ فاطمه عبد المحسن مصطفى

أ. د/ عبد المنعم ياسين الجندي

Table (2) Frequency occurrence and population density of nematode genera associated with certain sugarbeet cultivars grown in certain fields of Dakahlia governorate.

Nematode genera	Occurrence of nematode genera per 250 g soil in seven sugerbeet cultivars								Total	F.o. %	No. of infested county
	Deprez-poly N n=100*	Athos-poly *n=100	Monte-bionco n=100*	Farida *n=100	Sultan *n=100	Nejama *n=100	Kawemira n= 100*				
True plant parasistes											
<i>Helicotylenchus</i>	25(44.68)	9(60.33)	12(33.66)	17(44.17)	7(41)	12(71.33)	9(40.6)	91	13.0	7	
<i>Hirschmaniella</i>	5(56)	24(86.95)	31(34.12)	6(38.83)	5(49.6)	12(39.91)	11(34.18)	94	13.2	7	
<i>Meloidogyne</i>	17(80.52)	10(78.9)	10(41.4)	15(42.93)	0	0	0	52	7.4	4	
<i>Pratylenchus</i>	8(68.62)	6(50.5)	0	4(31.25)	10(59.5)	43(83.11)	7(30.71)	78	11.1	6	
<i>Rotylenchulus</i>	0	4(38.5)	0	2(31)	4(37.5)	8(103)	4(27.25)	22	3.1	5	
<i>Trichodorus</i>	20(37.75)	10(54.8)	23(46.73)	14(36.28)	0	3(29)	0	70	10	5	
<i>Tylenchorhynchus</i>	0	11(45.72)	0	3(56.66)	5(43.6)	26(50.76)	12(40.08)	57	8.1	5	
Total	75	74	76	61	31	104	43				
Suspected plant parasistes											
<i>Dorylaimus</i>	0	0	2(31)	11(41.72)	11(36.8)	0	0	24	3.3	3	
<i>Tylenchus</i>	7(41.28)	14(34.42)	0	10(37.9)	4(34.5)	1(42)	0	36	5.1	5	
Total	7	14	2	21	15	1	0				
Total occurrence	82	88	78	82	46	105	43				
Nematode genera/ cultivar	6	8	5	9	7	7	5				

* Number between parentheses showed the average of nematode population density per 250 g. soil