

## **SURVEY OF PLANT PARASITIC NEMATODE GENERA ASSOCIATED WITH PEANUT PLANTATIONS WITH REFERENCE TO SEASONAL FLUCTUATION OF PREVAILING NEMATODE SPECIES.**

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### **ABSTRACT**

A survey of plant parasitic nematodes associated with the rhizosphere of peanut cvs. Giza 4, Giza 5 and Aramanch grown at six counties of Sharkia, Ismailia and Behera governorates (Egypt) was carried out during the peanut growing season of 2006, in addition, a seasonal fluctuation of certain plant parasitic nematodes in naturally infested field cultivated with peanut cultivar Giza 4 at Sharkia governorate was also studied. Thirteen nematode genera were recorded in surveyed peanut fields. Based on their frequency of occurrence, these genera can be arranged in ascending order as follows: *Hemicriconemoides* (0.2%), *Helicotylenchus* (0.8%), *Criconemella* (1.7%), *Longidorus* (2.1%), *Rotylenchulus* (3.6%), *Pratylenchus*(4.3%), *Xiphinema* (6.8%), *Tylenchus* (15.0%), *Heterodera* (39.6%), *Aphelenchus* (40.4%), *Tylenchorhynchus* (40.9%), *Dorylaimus* (42.6%), and *Meloidogyne* (48.1%). A field cultivated with peanut Giza 4 located at Sangha village in Kafr Saker county of Sharkia governorate which were naturally infested with nematode species i.e. *Meloidogyne javanica* , *Pratylenchus penetrans* ,*Helicotylenchus pseudorobustus* , *Tylenchorhynchus claytoni*, and *Heterodera avenae* were chosen to study nematode population behaviour starting from April to November 2007. Means of the initial population for the tested five nematode species were 46, 10, 12, 35 and 5 individuals per 250g soil at the beginning of peanut sowing seeds, respectively. The population of each nematode species was gradually increased as the temperature increased, and reached their peaks in August, where a complete peanut plant growth occurred. At this time their population densities were recorded to be 197, 32, 97, 152, and 25 individuals per 250g soil, respectively. Eventually the decline of nematode population densities were happened at harvest time on September where their minimum population densities were recorded on November 2007 when low temperature was evident, as well as, absence of host occurred. These minimum population densities were recorded to be 70, 10, 34, 70, and 10 individuals per 250g soil, respectively.

**Keywords:** Survey, nematode genera, peanut cultivars, seasonal fluctuation. five nematode species, temperature.

### **INTRODUCTION**

Peanut; *Arachis hypogaea* L. is one of the most important legume and oil crops for human consumption and animal feeding. The total cultivated area reached to 23573590 hectare for the season of 2005 all over the world. In Egypt peanut is grown in light soils as well as in newly reclaimed sand areas where cultivated area recorded to be 60330 hectare for the season of 2005, (FAO,2007) several plant parasitic nematodes, i.e. the root-knot nematode, *Meloidogyne* spp. (Sasser, 1977), the root lesion nematode

*Pratylenchus brachyurus* (Loof, 1964), the sting nematode, *Belonolaimus gracilis* (Owens, 1957), and the ring nematode, *Criconemoides ornatus* (Ibrahim and El Saedy, 1976), were recorded and are widely distributed in the cultivated peanut area in many parts of the world causing remarkable crop losses. Nematological survey is necessary in providing information on the probability and magnitude of crop losses due to nematode infection. Therefore, the aim of the present work deals with (1) surveying nematode genera associated with cultivated peanut in three governorates i.e. Sharkia, Ismailia and Behera in Egypt during the growing seasons of 2006 and (2) studying the seasonal fluctuation of the prevailing nematode species on peanut plants under field conditions.

## **MATERIALS AND METHODS**

### **A. Nematode assay:**

Four hundred and seventy two composite soil samples were collected from the rhizosphere of peanut plants, during the growing season of 2006. These soil samples represented three Egyptian peanut cultivars i.e. Giza 4, Giza 5 and Aramanch, where the first cultivar was grown in two counties of Sharkia governorate (El-Salhia and Kafr Saker), while the second cultivar was grown in two counties of Ismailia governorate (El-Kassaseen and Ismailia), whereas the third cultivar was grown in two counties of Behera governorate (El-Delingat and Kom-Hamada). Each soil sample (250g) was separately kept in a plastic bag, refrigerated at 4°C and then proceeds for nematode recovery. Extraction of nematodes from soil was accomplished by sieving and modified Baermann technique (Goodey, 1957). Identification of nematode genera in repeated aliquots (1m/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 was used for determining the number of each genus and recorded.

### **B. Seasonal fluctuation of certain nematode species on peanut plants:**

A sandy loam soil field (one feddan) cultivated with peanut cv. Giza 4 located at Sangha village in Kafr Saker county, at Sharkia governorate, Egypt, which was naturally infested with the nematode species i.e. *Meloidogyne javanica*, *Pratylenchus penetrans*, *Helicotylenchus pseudorobustus*, *Tylenchorhynchus claytoni*, and *Heterodera avenae*. These species were used to study the fluctuation of nematode population starting from April to November of 2007, however, the peanut growing season was carried out during the period from June to September in this work. The root-knot nematode was identified to species by perineal pattern according to Taylor *et al.* (1955), and other selected nematode species were identified according to the morphometrics of the body for adult females of the three former species, whereas, juveniles of the latter nematode species, (Handoo and Golden, 1989; Handoo, 2000; Sher, 1966 and Taylor, 1957). Five locations were randomly selected, marked and labeled as sampling sites. Then, samples were taken from the sampling sites at monthly intervals. A total of five soil sub-samples were taken at each sampling site to form a composite sample. The samples sent to the Nematology laboratory and kept in

refrigerator at 4°C until extraction as previously mentioned. Population density of nematode species /250 g soil was monthly determined and recorded during the period of investigation. Temperature was monthly recorded at the time sampling.

## RESULTS AND DISCUSSION

Data in Table (1) recorded the presence of ten genera of true plant parasitic nematodes and three genera of suspected parasitic nematodes recovered from 472 soil samples collected from the rhizosphere of peanut plants. These nematode genera were identified as: *Criconemella*, *Helicotylenchus*, *Hemicriconemoides*, *Heterodera*, *Longidorus*, *Meloidogyne*, *Pratylenchus*, *Rotylenchulus*, *Tylenchorhynchus*, and *Xiphinema*, as true plant parasites as well as *Aphelenchus*, *Dorylaimus* and *Tylenchus* as suspected parasites during the season 2006. The peanut cv. Giza 4 grown in two counties of Sharkia governorate encountered nine of true plant parasitic nematode genera; and three of suspected ones. These nematode genera were: *Criconemella*, *Helicotylenchus*, *Hemicriconemoides*, *Heterodera*, *Longidorus*, *Meloidogyne*, *Pratylenchus*, *Tylenchorhynchus*, and *Xiphinema*, ; and *Aphelenchus*, *Dorylaimus*, and *Tylenchus*. Meanwhile, *Tylenchorhynchus* and *Heterodera* genera seemed to be the most prevailing nematode pests on peanut cv. Giza 4 as they occurred at the rates of 87 and 82 times with percent occurrence of 50% and 47.1%, respectively. The nematode genera, *Meloidogyne*, *Tylenchus*, *Pratylenchus*, *Xiphinema*, and *Criconemella* showed moderate distributions as they occurred at the rates of 27, 26, 15, 8 and 5 times with percent occurrence of 15.5, 14.9, 8.6, 4.6 and 2.9%, respectively, whereas, the genera *Hemicriconemoides*, *Helicotylenchus*, and *Longidorus* were less common as they occurred at the rate of 1, 2 and 3 times with percent occurrence of 0.6, 1.1 and 1.7%, respectively. It was also evident that Kafr Saker county encountered the largest number of nematode genera (11) followed by El-Sahia (9). The stunt nematode, *Tylenchorhynchus* spp. was recorded 87 out of 174 soil samples examined and ranked first in Kafr Saker county with the rate of 50 times and an average of 147 individuals per 250g soil.

Moreover, peanut cv. Aramanch grown in two counties of Behera governorate encountered eight of the true plant parasitic nematode genera plus three of the suspected ones. These nematode genera were identified as: *Criconemella*, , *Heterodera*, *Longidorus*, *Meloidogyne*, *Pratylenchus*, *Rotylenchulus*, *Tylenchorhynchus* and *Xiphinema*, ; besides *Aphelenchus*, *Dorylaimus* and *Tylenchus*. Meanwhile, *Meloidogyne*, *Heterodera* and *Tylenchorhynchus* genera seemed to be the most prevailing nematode pests on peanut cv. Aramanch as they occurred at the rates of 159, 68 and 59 times with percent occurrence of 98.1, 42, and 36.4, respectively. Moreover, the nematode genera *Dorylaimus*, *Tylenchus*, *Xiphinema*, *Rotylenchulus* and *Longidorus* showed moderate distributions as they occurred at the rates of 31, 24, 20, 15 and 6 times with percent occurrence of 19.1, 14.8, 12.3, 9.3 and 3.7%, respectively, whereas, the genera *Criconemella* and *Pratylenchus* were less common as they occurred at the rate of 2 and 1 times with percent occurrence of 1.2 and 0.1%, respectively.

Table (1): Frequency occurrence and population density of nematode genera associated with peanut plantations grown in certain fields of Sharkia, Ismailia and Behra governorates.

Nematode genera	Occurrence of nematode genera per 250g soil within each county of peanut cultivars												Total	% F.O
	El-Behera n=162 Aramanch		Total	% F.O	El-Ismalia n=136 Giza 5		Total	% F.O	Sharkia n=174 Giza 4		Total	% F.O		
	El-Dainga n=108	Komhamada n=54			El-Hasasin n=54	Ismalia n=82			El-Salhia n=83	Kaf Saker n=91				
<b>True plant parasites</b>														
<i>Criconebella</i>	-	2(28)	2	1.2	1(26)	-	1	0.9	-	5(23.4)	5	2.9	8	1.7
<i>Helicotylenchus</i>	-	-	-	0	1(16)	1(17)	2	1.7	1(45)	1(52)	2	1.1	4	0.8
<i>Hemicricone- moides</i>	-	-	-	0	-	-	-	-	-	1(21)	1	0.6	1	0.2
<i>Heterodera</i>	44(56)	24(34.4)	68	42	5(24)	32(55)	37	31.4	19(51.2)	63(69.1)	82	47.1	187	39.6
<i>Longidorus</i>	4(32.8)	2(22)	6	3.7	1(19)	-	1	0.9	3(46)	-	3	1.7	10	2.1
<i>Meloidogyne</i>	107(99)	52(167.3)	159	98.1	26(23.1)	15(40)	41	34.7	20(49.7)	7(27.7)	27	15.5	227	48.1
<i>Pratylenchus</i>	1(17)	-	1	0.1	2(24.5)	1(12)	3	2.5	-	15(68.8)	15	8.6	19	4.3
<i>Rotylenchulus</i>	-	15(28.2)	15	9.3	-	2(16)	2	1.7	-	-	-	-	17	3.6
<i>Tylenchorynchus</i>	59(41.5)	-	59	36.4	20(23.7)	27(34)	47	39.4	37(56.1)	50(147)	87	50	193	40.9
<i>Xiphinema</i>	12(21)	8(9.5)	20	12.3	2(16.5)	2(32)	4	3.4	7(44.1)	1(35)	8	4.6	32	6.8
<b>Total</b>	<b>227</b>	<b>103</b>			<b>58</b>	<b>80</b>			<b>87</b>	<b>143</b>	<b>-</b>	<b>-</b>		
<b>Suspected plant parasites</b>														
<i>Aphelenchus</i>	20(70.5)	27(32.1)	47	29.0	26(25.1)	6(2.2)	32	27.1	56(67.6)	56(63.5)	112	47.7	191	40.4
<i>Dorylaimus</i>	19(53.3)	12(46.5)	31	19.1	28(26.6)	18(33)	46	38.9	59(67.1)	65(40.6)	124	71.3	201	42.6
<i>Tylenchus</i>	17(23.6)	7(26.4)	24	14.8	19(22.8)	2(18)	21	17.8	4(25)	22(45.2)	26	14.9	71	15.0
<b>Total</b>	<b>56</b>	<b>46</b>			<b>73</b>	<b>26</b>			<b>90</b>	<b>143</b>				
<b>Total occurrence</b>	<b>283</b>	<b>149</b>			<b>131</b>	<b>106</b>			<b>177</b>	<b>286</b>				
<b>Nematode general/ county</b>	<b>9</b>	<b>9</b>			<b>11</b>	<b>10</b>			<b>9</b>	<b>11</b>				

\*n= number of soil samples.

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

% F.O(Frequency of occurrence) = (Number of samples containing a genus / number of collected samples) ×100

It was also evident that El-Delengate and Komhamada counties (Behera governorate) have an equal number of nematode genera (9). Meanwhile, the root-knot nematode, *Meloidogyne* spp., the stunt nematode, *Tylenchorhynchus* spp. and the cyst nematode, *Heterodera* spp. were recorded from 159, 59 and 68 soil samples examined and ranked first in El-Delengate county at the rate of 107, 59 and 44 times with an average of 99, 41.5 and 56 individuals per 250g soil, respectively.

The grown peanut cv. Giza 5 in two counties of Ismalia governorate encountered nine of the true plant parasites and three of the suspected ones for this peanut cultivar. *Tylenchorhynchus*, *Meloidogyne* and *Heterodera* genera seemed to be the most prevailing nematode pests on peanut cv. Giza 5 as they occurred at the rates of 47, 41 and 37 times with percent occurrence of 39.4, 34.7 and 31.4%, respectively. Moreover, the nematode genera *Aphelenchus*, *Tylenchus* and *Xiphinema*, showed moderate distribution as they occurred at the rates of 32, 21 and 4 times with percent occurrence of 27.1, 17.8 and 3.4%, respectively, whereas, *Pratylenchus*, *Rotylenchulus*, *Helicotylenchus*, *Criconebella* and *Longidorus* were less common genera as they occurred at the rate of 3, 2, 2, 1 and 1 times with percent occurrence of 2.5, 1.7, 1.7, 0.9 and 0.9%, respectively. It was also evident that El-Kassasin county encountered the largest number of nematode genera (11) followed by Ismalia (10). The stunt nematodes, *Tylenchorhynchus* spp. were recovered from 47 out of 136 soil samples examined and ranked the first in Ismalia county with the rate of 27 times and an average of 34 individuals per 250g soil.

In general, *Meloidogyne*, *Tylenchorhynchus*, and *Heterodera*, seemed to be the most prevailing nematode pests in the rhizosphere of the peanut cvs. Giza4&5 and Aramanch as they occurred at the rates of 227, 193 and 187 times with percent occurrence of 48.1, 40.9 and 39.6%, respectively. However, *Hemicriconemoides* was less common as it occurred one time with percent occurrence of 0.2%.

Data in Table (2) show the seasonal fluctuation of five true plant parasitic nematode species i.e. *Meloidogyne javanica*, *Pratylenchus penetrans*, *Helicotylenchus pseudorobustus*, *Tylenchorhynchus claytoni* and, *Heterodera avenae* in peanut field cultivated with Giza 4 cultivar in Sangha village, Kafr Saker county (Sharkia governorate) during the growing season of 2007 (June to September). Obviously, means of the initial population for the tested five nematode species were 46, 10, 12, 35 and 5 individuals per 250g soil at the beginning of peanut sowing seeds, respectively, (Table 2& Figs.1 and 2). In general, the population of each nematode species gradually increased as the temperature increased, (Figs 1&2) and reached their peaks in August, where a complete peanut plant growth occurred. These nematode population densities were recorded to be 197, 32, 97, 152, and 25 individuals per 250g soil, respectively. Then the decline of nematode population densities were happened at harvest time on September 2007 when their minimum population densities were recorded on November when low temperature (Figs.1&2) as well as, absence of host occurred. These minimum densities were recorded to be 70, 10, 34, 70, and 10 individuals per 250g soil, respectively.

Table (2): Seasonal fluctuation of the five plant parasitic nematode species associated with peanut cv. Giza 4 under field condition at Sharkia governorate, where the real growing season of peanut from June to September in this study.

Season	Month	Average of soil temperature	*Nematode species and their population densities per 250g soil				
			<i>Meloidogyne javanica</i>	<i>Pratylenchus penetrans</i>	<i>Helicotylenchus pseudorobustus</i>	<i>Tylenchothynchus claytoni</i>	<i>Heterodera avenae</i>
Spring	April	24.6	33	10	13	30	3
	May	28.3	59	10	11	39	7
	Mean	27.0	46	10	12	35	5
Summer	June	29.4	68	13	17	58	10
	July	29.7	88	17	67	128	14
	August	32.04	197	32	97	152	25
	Mean	30.38	154	21	60	113	16
Autumn	September	30.2	118	21	49	100	24
	October	28.5	72	16	31	119	13
	November	24.3	70	10	34	70	10
	Mean	27.6	98	16	38	96	16

\*Each is the mean of five soil samples.

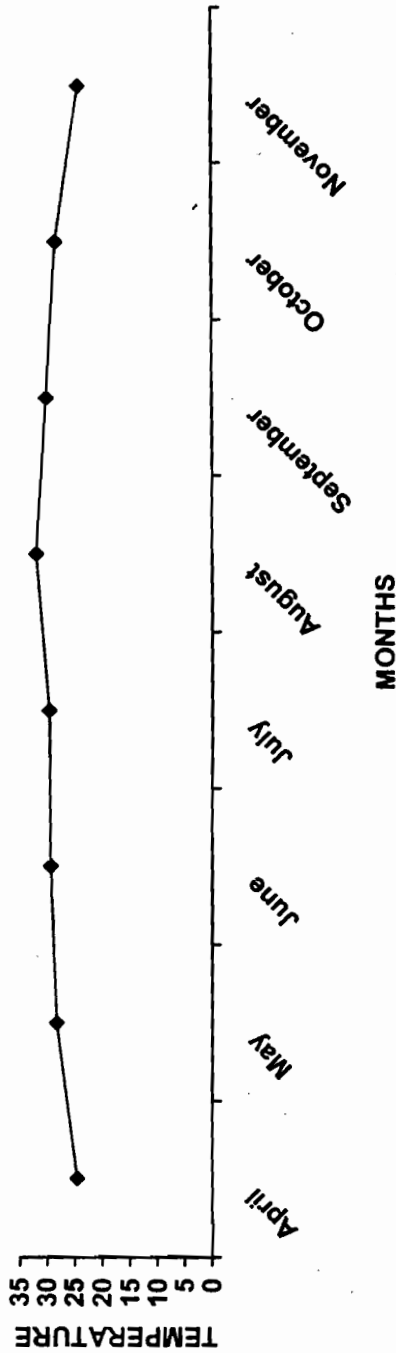


Fig. (1): Average of soil temperature from April to November 2007.

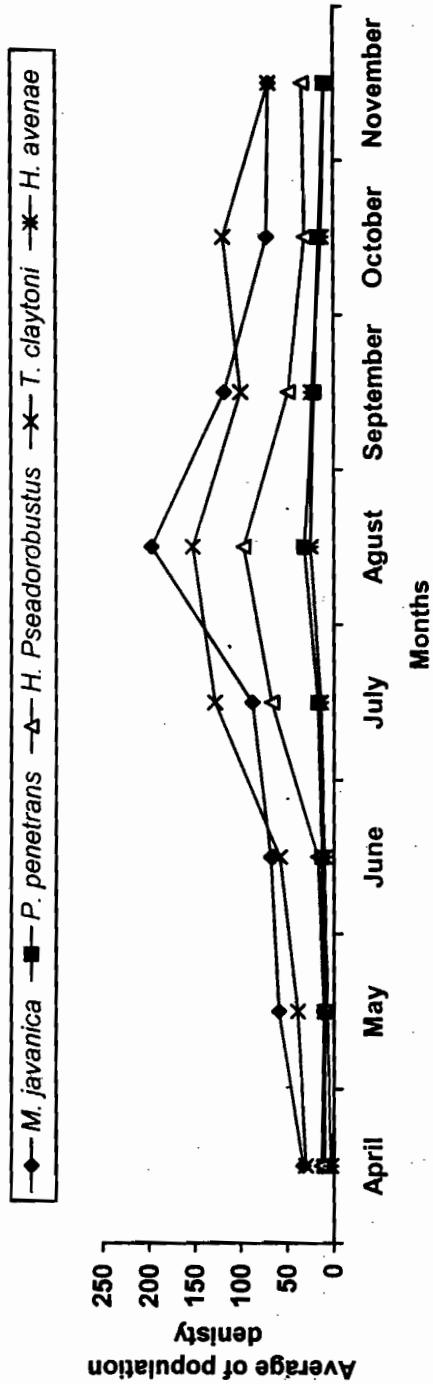


Fig. (2): Seasonal fluctuation of five plant parasitic nematode species associated with peanut cv. Giza 4 under field conditions at Sharkia governorate.

Apparently this work reported the presence of 8 or 9 or 10 nematode genera associated with the rhizosphere of the peanut cvs. Aramanch or Giza 4 or Giza 5 that were grown in two counties each at Behera or Sharkia or Ismailia governorates, respectively. As a whole, it is not surprising that the soil rhizosphere of peanut revealed the presence of 13 nematode genera that recovered from a total of 472 soil samples examined, especially *Meloidogyne*, *Heterodera* and *Tylenchorhynchus* which seemed to be the most prevailing nematode pests on the cultivated peanut in such light soil i.e. sandy loam soil the surveyed governorates. This is expected since plant parasitic nematodes are generally in favour of light soils (Steiner, 1950). Meanwhile, results of the present research on nematological survey is in accordance with the findings of Khalil, (1991), who recorded the frequency occurrence of *Meloidogyne* (83%), *Tylenchorhynchus* (63.1%), *Pratylenchus* (40.9%), *Criconemoides* (18.4%), *Helicotylenchus* (20.3%), *Heterodera* (19.1%), *Hoplolaimus* (18.8%), *Longidorus* (12.5%), *Rotylenchulus* (10.0%), *Trichodorus* (17.8%), *Ditylenchus* (8.1%) and *Tylenchus* (17.8%), in peanut plantations at different localities of several governorates in Egypt. The present data concerned with seasonal fluctuation of such nematode species i.e. *M. javanica*, *P. penetrans*, *H. pseudorobustus*, *T. claytoni* and *H.avenae* showed that these species reached their peaks in August with the maximum population densities per 250 g soil along with highest temperature and then decreased as the temperature diminished in September. The present findings of such seasonal fluctuations are in agreement with those of El- Mosalamy (2005), who found that nematodes were found in relatively low population densities during March then increased gradually through April, May and June to reach their highest peaks in July at which the soil temperature reached the maximum degree, then gradual decrease in population density occurred till October at which nematode reached their modest densities. It is worthy to note that nematode population of either *H. avenae* or *P. penetrans* were lower than other nematode species tested during the seasonal fluctuation study. This may be due to peanut plant cv. Giza 4 was not the suitable host comparing to *M. javanica*, *H. pseudorobustus* and *T. claytoni*, since their population densities increased up to 6.13, 2.38 and 6.0 folds over those two nematode species at harvesting time, respectively.

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## حصر لاجناس النيماطودا المصاحبة لزراعات الفول السوداني مع الاشارة الي التذبذب الموسمي للانواع السائدة منها.

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تشتمل هذه الدراسة على حصر لاجناس النيماطودا المصاحبة لنباتات الفول السوداني صنف جيزة ٤ وجيزة ٥ و اراماتش المنزرعة في منطقتين فقط في احد المحافظات التالية الشرقية و الاسماعيلية والبحيرة خلال الموسم ٢٠٠٦ . وكذلك دراسة التذبذب الموسمي لخمسة انواع من النيماطودا السائدة في حقل مصاب طبيعيا منزرع بالفول السوداني صنف جيزة ٤ في محافظة الشرقية .

واسفرت الدراسة عن وجود ١٣ جنسا من النيماطودا في منطقة المجال الجذري لنباتات الفول السوداني صنف جيزة ٤ , جيزة ٥ و اراماتش المنزرعة في ثلاث محافظات هي الشرقية و الاسماعيلية والبحيرة خلال الموسم ٢٠٠٦ , وهي حسب اهميتها تصاعديا بالنسبة لمعدل تواجدها و كانت النيماطودا الحلقية *Hemicriciconemoides* و *Helicotylenchus* و *Criconemella* و *Longidorus* و *Rotylenchulus* و *Pratylenchus* و *Xiphinema* و *Tylenchus* و *Aphelenchus* و *Heterodera* و *Tylenchorhynchus* و *Dorylaimus* و *Meloidogyne*. واتضح ان نيماطودا تعقد الجذور *Meloidogyne* spp. كانت اكثر الاجناس انتشارا حيث كانت نسبة تواجدها ٤٨,١% بينما كانت النيماطودا الحلقية *Hemicriciconemoides* spp. انتشارا حيث كانت نسبة تواجدها ٠,٢% .

كما اظهرت الدراسة زيادة تدريجية في تعداد انواع النيماطودا *Meloidogyne javanica* و *Pratylenchus penetrans* و *Helicotylenchus pseudorobustus* و *Heterodera avenae* و *Tylenchorhynchus claytoni* ابتداء من شهر ابريل حتى شهر نوفمبر ٢٠٠٧ . حيث كان التعداد الابتدائي ٤٦ و ١٠ و ١٢ و ٣٥ و ٥ فرد لكل ٢٥٠ جرام تربة علي الترتيب. يلي ذلك زيادة تدريجية في تعداد النيماطودا حتي يصل الي اعلي تعداد لها في شهر اغسطس مع ارتفاع درجة الحرارة ووصول العائل الي مرحلة متقدمة من النمو بقيم هي ١٩٧ و ٣٢ و ٩٧ و ١٥٢ و ٢٥ فرد لكل ٢٥٠ جرام علي الترتيب . ثم حدث انخفاض تدريجي في التعداد مع انخفاض درجة الحرارة وغياب العائل حيث سجل اعدادا هي ٧٠ و ١٠ و ٣٤ و ٧٠ و ١٠ فرد لكل ٢٥٠ جرام علي التوالي خلال شهر نوفمبر ٢٠٠٧ .