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IMPACT OF CERTAIN ANIMAL ORGANIC MANURES INTEGRATED WITH *Serratia marcescens* ON *Meloidogyne incognita* INFECTING PEACH PLANT WITH REFERENCE TO SOIL MICROORGANISMS AND MITES.

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ABSTRACT

The effect of sterilized or non-sterilized organic animal manures i.e. chicken, horse, pigeon, mixed with *Serratia marcescens* in comparison with Oxamyl in controlling *Meloidogyne incognita* infecting Balady peach plant cv. Meet-Ghamr under greenhouse conditions showed that the unsterilized chicken manure and pigeon-dung accomplished the highest percentage of nematode reduction when applied either singly or integrated with Oxamyl or *S. marcescens* with values of 99.70, 98.80 or 98.78 and 99.68 or 98.57 and 97.60%, respectively. Moreover, the sterilized horse manure or pigeon-dung that applied either singly or mixed with Oxamyl or *S. marcescens* also achieved the highest percentage of nematode reduction with values of 99.5, 72.9 or 97.60, 99.67 or 98.77, 97.9%, respectively.

However, the unsterilized horse manure as well as the sterilized chicken manure in a single application gave the least values of nematode reduction with values of 72.9 and 44.90%, respectively.

In general, the unsterilized organic manures gave better results than the sterilized manures tested in improving plant growth response and suppressing nematode population whether in soil or root. A dramatic reduction in total counts of bacteria, fungi and actinomycetes was noticed in non-sterilized animal manures at 90 days after nematode inoculation. Mites identified from animal manures were related to Mesostigmata, Prostigmata and Cryptostigmata groups.

The sterilized organic manures showed significant increase in N, P and K, concentrations in dry shoot of peach plant exceeding those of nematode alone. The total chlorophyll was significantly increased by the sterilized pigeon-dung alone or mixed with Oxamyl or by the unsterilized horse manure integrated with *S. marcescens*.
Keywords: Peach plant, Integrated control, Organic animal manures, *M. incognita*, *S. marcescens*, Oxamyl.

INTRODUCTION

Peach (*Prunus persica*, L. Batsch) is one of the most important commercially deciduous fruit trees in Egypt, especially in Dakahlia, Behira and Menoufyia Governorates.

In Egypt, the root-knot nematodes, *M. incognita* and *M. javanica* are considered as serious nematode pests in peach orchards (Oteifa, 1964). Nematode damage has limited the establishment, yield and longevity of peach during the last decades. Chemical control of root-knot nematode has successfully minimized the effect of this nematode below damaging levels. However, environmental, health problems and disturbance in the biological balance of nature due to the extensive use of nematicides, in addition to high cost of such chemicals enhanced scientists to search for another alternatives.

The addition of organic matters to soils has been known to improve soil structure, aid in water retention, provide nutrients through its decomposition and might stimulate natural enemies. Thus improving soil conditions might reduce plant stress which in turn can make the stress caused by plant parasitic nematodes less severe or apparent, therefore, great attention has been given, among nematologists, to the use of animal organic manure, i.e. chicken, horse, pigeon and others for the management of root-knot nematodes as alternative control strategies (Gamliel and Stapleton, 1993; Kaplan and Noe, 1993; Waceke and Waudo, 1993; El-Naggar *et al.*, 1994; Ali, 1995; Nahar *et al.*, 1996; Riegel *et al.*, 1996; Akhtar and Mahmood, 1997; Amin and Youssef, 1998; Barbolina and Arkhipchenko, 1999; El-Zawahray, 2000; Maareg *et al.*, 2000; Pandey and Sikora, 2000; Siddiqui *et al.*, 2001; and Zasada and Ferris, 2001).

El-Naggar *et al.* (1994) recorded that the highest reduction in the number of egg masses of *Rotylenchulus reniformis* was obtained by Sincocin 5% (76.7%) followed by pigeon manure and sewage water. However, the highest reduction in soil nematode population was 79.5% as a result of using pigeon manure.

Ali (1995) revealed that although all organic amendments tested were significantly better than the control. Poultry manure was more effective in reducing *M. javanica* damage and increasing mungbean (*Vigna radiata* cv. AKM 8803) growth, followed by oilseed cakes of *Azadirachta indica* then *Ricinus communis* in experimental field plots.

Nahar *et al.* (1996) tested the effectiveness of *Tagetes* sp., poultry manure, pigeon manure, poultry + pigeon manure and mustard oil cake for the management of *M. incognita* on tomato, and found that amendment of soil with all the organic amendments reduced root-knot nematode severity and improved growth of tomato plants. The best results were recorded with mixed application of poultry and pigeon manures followed by poultry manure, mustard oil cake, pigeon manure and *Tagetes* sp.

Riegel *et al.* (1996) determined the effects of chicken litter at the rates of 0.25%, 0.5% and 1% litter by dry weight of soil on *M. incognita* in cotton, cv. DPL50, in field microplots. They found that at 92 and 184 days after planting nematode population densities decreased linearly with increasing rate of litter. They also noticed that fungal and bacterial population densities fluctuated throughout the growing season.

El-Zawahry (2000) studied the effect of different organic manures; farmyard, goat, rabbits, poultry and pigeon on root-knot nematode infesting faba bean. She showed that organic manure treatments increased plant growth and reduced nematode population in soil and roots. He also indicated that application of farmyard manure significantly increased growth of faba bean and reduced nematode development (51%), number of nematode eggs (69%), nematode population (52%) and root gall index (down to 3.2).

Pokharel (2000) conducted an experiment in chickpea cv. Dhanus growing in soil naturally infesting with *Meloidogyne* spp. treated with poultry manure; goat manure; farmyard manure; chemical fertilizers (NPK), and carbofuran. He noticed that highest chickpea yield and lowest root-knot index were recorded in the poultry manure treatment in both years (1996 and 1998) as compared to control.

Therefore, the present investigation was carried out: to assess the impact of integrated control of *M. incognita* infecting peach seedlings using certain animal organic manures integrated with *S. marcescens* or Oxamyl under greenhouse conditions.

MATERIALS AND METHODS

The experiment was conducted in order to determine the effect of the three following organic manures; chicken manure, horse manure and pigeon-dung integrated with *S. marcescens* as a biological control agent and Oxamyl as a nematicide in controlling *M. incognita* infecting peach seedlings under green house conditions.

Sixty-nine seeds of Balady peach cv. Meet-Ghamr were stratified according to Nour El-Deen (2002). Three months later, seeds were separately sown in 25-cm-d. plastic pots (one seed/pot) filled with steam-sterilized sandy loam soil (1:1, v:v).

The three following animal organic manures; chicken manure, horse manure and pigeon-dung were collected from various farms in Mansoura country. From each type of the manures a part was sterilized at 100°C in drying oven for one hour and left for cooling before use, while the rest part was left unsterilized.

Bacterial inoculum of *S. marcescens* strain NRRL.B.959 was prepared according to Mostafa *et al.* (2002). Twenty four seedlings of Balady peach cv. Meet-Ghamr were inoculated with the bacteria after 45 days from planting with a concentration of 100 ml of 10^8 cfu ml^{-1}/pot. Two weeks later, sixty six seedlings were inoculated with six egg masses of *M. incognita*. Three untreated and uninoculated seedlings were served as control.

Fifty grams of sterilized or non-sterilized chicken manure, horse manure and pigeon-dung were separately added per pot alone or in combination with Oxamyl or bacteria after 10 days from egg mass inoculation. Oxamyl as a nematicide was used alone at the recommended dose (0.6 gm) or in combination with each organic manure or bacteria at its half dose (0.3 gm). Each organic manure was incorporated alone or in combination with bacterial inocula or Oxamyl into soil simultaneously. Each treatment was replicated three times.

Therefore treatments were as follows:

1- Sterilized chicken manure + *M. incognita*,
2- Sterilized horse manure + *M. incognita*,
3- Sterilized Pigeon-dung + *M. incognita*,
4- Sterilized chicken manure + *S. marcescens* + *M. incognita*,
5- Sterilized horse manure + *S. marcescens* + *M. incognita*,
6- Sterilized Pigeon-dung + *S. marcescens* + *M. incognita*,
7- Sterilized chicken manure + Oxamyl + *M. incognita*,
8- Sterilized horse manure + Oxamyl + *M. incognita*,
9- Sterilized Pigeon-dung + Oxamyl + *M. incognita*,
10- Non-sterilized chicken manure + *M. incognita*,

11- Non-sterilized horse manure + *M. incognita*,
12- Non-sterilized Pigeon-dung + *M. incognita*,
13- Non-sterilized chicken manure + *S. marcescens* + *M. incognita*,
14- Non-sterilized horse manure + *S. marcescens* + *M. incognita*,
15- Non-sterilized Pigeon-dung + *S. marcescens* + *M. incognita*,
16- Non-sterilized chicken manure + Oxamyl + *M. incognita*,
17- Non-sterilized horse manure + Oxamyl + *M. incognita*,
18- Non-sterilized Pigeon-dung + Oxamyl + *M. incognita*,
19- Oxamyl + *M. incognita*,
20- *S. marcescens* + Oxamyl + *M. incognita*,
21- *S. marcescens* + *M. incognita*,
22- Uninoculated - untreated plant and
23- Nematode alone.

Pots were randomly arranged on a greenhouse bench at 30 $\pm$ 5°C. Plants were received water, and conventional pesticides to control mites and insects as needed. After 90 days from nematode inoculation, plants were removed. Data dealing with lengths and diameters of shoot and root; and fresh weights of shoot and root as well as shoot dry weight were obtained. Number of branches, number of leaves and weights of 10 leaf discs were also recorded. Infected peach roots were stained in 0.01 hot lactic acid fuchsin (Byrd *et al.*, 1983), and number of developmental stages, females, galls and egg masses were recorded. The root gall index and egg mass index were estimated. *M. incognita* second-stage juveniles were then extracted from soil by sieving and modified Baermann technique (Goodey, 1957), counted and recorded.

Regarding N, P and K determination, 0.2 gm of dry weight of peach shoot was subjected to chemical analysis according to procedure of Jakson (1967). Chlorophyll content was also determined in leaves of the harvested plants according to Fadeel (1962) and Wellburn and Lichtenthaler (1984). Bacterial, fungal and actinomycetes counts in the three types of animal manures, i.e. chicken manure, horse manure and pigeon-dung were assayed twice; at beginning of the experiment and at the harvest time (10 and 90 days after nematode inoculation). Counts of bacteria and fungi were determined by plate count technique. For each manure, a 10 g sample was placed into a beaker with 90 ml of sterile water and shacked. Further dilutions were made and the suspensions were plated onto Nutrient Agar for bacterial and actinomycetes enumeration. For fungal count, Czapek's medium was used. Serial dilutions were made to 10^8/g for bacteria and 10^6/g for fungi and actinomycetes.

Characteristic colonies of bacteria were described and transferred to agar slants. Slides were then prepared from these slants for microscopical examination and identified in Microbiology Dept., while fungal isolates were identified in plant Pathology Dept., Fac. of Agric., Mansoura Univ., Mansoura, Egypt.

Mites were also isolated from non-sterilized organic manure using Berlese funnel technique. Samples of each organic manure (500 g) were placed in funnels for 24 hrs. Mites were received in petri-dishes provided with watered cotton. Specimens were mounted in Hoyer's and examined by a stereomicroscope (Krantz, 1976). All individuals of mite groups were counted and recorded.

Data were also subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984) followed by Duncan's multiple range test to compare means (Duncan, 1955).

RESULTS

Data in Table (1) illustrate the effect of the following sterilized organic manures, i.e. chicken manure, horse manure or pigeon-dung applied either alone or integrated with *S. marcescens* or Oxamyl on growth of peach infected with *M. incognita.* All tested treatments caused detectable improvement in total plant fresh weight as well as dry shoot weights of infected peach with various degrees. It is obvious that pots received the prokaryotic bacterium, *S. marcescens* alone showed maximum and significant increase in fresh shoot and root weight as well as number of branches as compared to those received nematode alone (ck). Among the three sterilized manures tested, pigeon-dung appeared to be more effective in increasing plant fresh weight as well as dry shoot weight, than chicken or horse manure with percentages of increase over control (pots received nematode alone) averaging 31.7% and 82.5%, respectively. However, significant increase in the previous criteria was also noticed in treatment of *S. marcescens* integrated with either pigeon-dung or Oxamyl with percentage of increase over control averaging 55.9% and 159.5%, 52.6% and 84.7%, respectively followed by integration of Oxamyl + pigeon-dung with percentages of increase averaging 42.3% and 144.9% respectively. On the other hand, the lowest percentage of increase in plant fresh and dry shoot weight of peach was achieved by single applications of Oxamyl, horse manure or chicken manure with values of 31.6% and 72.7% or 10.8% and 49.5% or 5.4% and 9.7%, respectively.

Data in Table (2) reveal the effect of the non-sterilized organic manures, i.e. chicken manure, horse manure and pigeon-dung alone or in combination either with *S. marcescens* or Oxamyl on growth of Balady peach cv. Meet-Ghamr. Results indicated that most tested treatments obviously caused remarkable increase in peach plant growth with various degrees. It is evident that pots received *S. marcescens* alone showed significant increment in all growth parameters except that of root length when compared with those of the nematode alone treatment. Among the three tested unsterilized manures, pigeon-dung seemed to be more effective in increasing plant fresh weight as well as dry shoot weight than chicken or horse manure with percentages of increase over control averaged 50.3% and 107.6%, respectively. However, significant increase in the previous criteria was also resulted from application of chicken manure integrated with either Oxamyl or *S. marcescens* with percentage of increase over control averaging 107.6% and 284.8%, 61.8% and 144.7%, respectively followed by integration of Oxamyl plus horse manure with percentage of increase averaged 60.8% and 142.0%, respectively.

As a whole it can be indicated that Oxamyl integrated with chicken manure was ranked first in increasing plant fresh weight of peach infected with *M. incognita* followed by *S. marcescens* alone then *S. marcescens* integrated with chicken manure with percentage of increase averaged 107.6, 99.5 and 61.8%, respectively. It is worth to note that *S. marcescens* alone significantly increased diameters of shoots and roots which were 0.38 and 0.37 cm, respectively when compared to those of healthy plants as well as those of nematode alone treatment which amounted to 0.32, 0.28 and 0.26, 0.29 cm, respectively. Among the tested materials, *S. marcescens* integrated with either chicken manure or pigeon-dung found to be more effective in increasing number of shoot branches, number of shoot leaves and weight of ten leaf discs (Table 2). Moreover, the concomitant applications of chicken manure plus Oxamyl (0.3 gm/pot) achieved the best results of plant growth criteria i.e. number of shoot branches, number of shoot leaves, weight of 10 leaf discs, percentage of increase in fresh weight of whole plant and shoot dry weight with values of 21.3, 542.5, 0.145,107.6% and 284.8%, respectively.

Data presented in Table (3) show the impact of certain sterilized and unsterilized organic manures on nitrogen, phosphorus and potassium concentrations in peach plant infected with *M. incognita*. It was evident that nitrogen and potassium concentrations were significantly reduced by nematode infection. With regard to sterilized organic manure, most tested treatments showed significant increase in N, P and K concentrations exceeding those of nematode alone treatment as well as those of untreated or uninoculated plants. The highest increment in nitrogen concentration was achieved by the application of sterilized chicken manure integrated with Oxamyl followed by chicken manure alone, then pigeon-dung plus *S. marcescens*, with values of 51.4, 49.8 and 46.8 mg/g, respectively. Similar trend was noticed with phosphorus concentration. However, pigeon-dung integrated with *S. marcescens* ranked the first in increasing potassium concentration, followed by Oxamyl then chicken manure integrated with Oxamyl. Data also show that pigeon-dung alone or integrated with Oxamyl significantly increased total chlorophyll content in related to nematode alone. With regard to unsterilized organic manure, horse manure integrated with Oxamyl showed the highest increment in nitrogen concentration followed by single application of Oxamyl, then concomitant application of chicken manure plus Oxamyl, with values of 44.5, 44.0 and 43.2 mg/g, respectively. Similar trend was noticed with phosphorus concentration whereas, horse manure integrated with Oxamyl gave the highest value of increase in phosphorus concentration (0.659 ppm). However, Oxamyl alone ranked the first in increasing potassium concentration, followed by single application of *S. marcescens*, then pigeon-dung integrated with Oxamyl (Table 3). It was also evident that horse manure integrated with *S. marcescens* significantly increased total chlorophyll content in comparison to nematode alone as well as untreated - uninoculated plants.

Table(3): N, P and K concentration and chlorophyll content in dry shoot of peach plant cv. Meet-Ghamr influenced by *M. incognita* infection treated with certain sterilized and non- sterilized organic manures alone and in combination either with *S. marcescens* or Oxamyl under greenhouse conditions.

Treatments	N mg/gm	P Ppm	K Ppm	Chlorophyll content A µg/g	B µg/g	Total µg/g
Sterilized						
Chicken manure	49.8 ab	0.618 ab	38.5 bcdefgh	860.3 bcd	561.7 bcd	1422.0 bcde
Horse manure	33.6 de	0.482 bcdef	38.7 bcdefgh	797.0 bcd	433.5 cd	1231.0 bcde
Pigeon-dung	41.4 abcd	0.433 cdef	41.6 abcdefg	2149.0 a	1776.0 a	3925.0 a
Chicken manure + *S. marcescens*	44.1 abcd	0.544 abcd	45.9 abcd	1270.0 b	814.5 bcd	2085.0 bcd
Horse manure + *S. marcescens*	26.9 ef	0.379 defg	32.3 fgh	686.7 cd	378.7 cd	1065.0 cde
Pigeon-dung + *S. marcescens*	46.9 abc	0.509 bcde	49.6 a	1306.0 b	851.5 bcd	2157.0 bc
Chicken manure + Oxamyl	51.4 a	0.705 a	48.0 abc	1241.0 b	742.7 bcd	1983.0 bcde
Horse manure + Oxamyl	33.6 de	0.577 abc	43.7 abcde	1007.0 bcd	688.5 bcd	1696.0 bcde
Pigeon-dung + Oxamyl	38.2 cd	0.536 abcde	43.9 abcde	1281.0 b	1051.0 b	2332.0 b
Non- sterilized						
Chicken manure	37.5 cd	0.aa21 2 g	29.6 h	831.7 bcd	530.0 bcd	1362.0 bcde
Horse manure	37. cd	0.230 g	28.2 h	657.0 d	358.0 d	1015.0 de
Pigeon-dung	42.4 abcd	0.363 defg	35.0 efgh	960.5 bcd	659.5 bcd	1620.0 bcde
Chicken manure + *S. marcescens*	42.3 abcd	0.532 abcde	34.1 efgh	1014.0 bcd	692.0 bcd	1706.0 bcde
Horse manure + *S. marcescens*	37.1 cde	0.516 bcde	31.4 gh	1311.0 b	982.5 bc	2293.0 b
Pigeon-dung + *S. marcescens*	36.6 cde	0.496 bcde	31.5 gh	1092.0 bcd	419.3 cd	1511.0 bcde
Chicken manure + Oxamyl	43.2 abcd	0.485 bcdef	34.8 efgh	956.7 bcd	814.7 bcd	1771.0 bcde
Horse manure + Oxamyl	44.5 abcd	0.659 ab	37.8 cdefgh	635.0 d	243.4 d	878.4 e
Pigeon-dung + Oxamyl	41.0 abcd	0.307 fg	40.7 abcdefg	823.0 bcd	500.3 bcd	1323.0 bcde
S. marcescens + Oxamyl	23.2 f	0.351 efg	35.6 defgh	1234.0 bc	1061.0 b	2295.0 b
S. marcescens	21.4 f	0.370 defg	42.8 abcdef	889.5 bcd	496.5 bcd	1386.0 bcde
Oxamyl	44.0 abcd	0.386 defg	48.5 ab	809.4 bcd	429.0 cd	1238.0 bcde
Uninoculated and untreated plant	40.2 bcd	0.244 g	38.5 bcdefgh	541.7 d	372.0 cd	913.7 e
Nematode alone	21.2 f	0.231 g	14.8 i	1354. b	857.5 bcd	2212.0 b

Each value is a mean of three replicates.

Means in each column followed by the same letter(s) did not differ at $P < 0.05$ according to Duncan's multiple-range test.

Data in Table (4) reveal the impact of previous sterilized or non-sterilized organic manures; chicken manure, horse manure and pigeon-dung applied singly or concomitantly with the prokaryotic bacterium *S. marcescens* or Oxamyl on population densities and root galling as well as egg masses number of *M. incognita* infecting Balady peach cv. Meet-Ghamr. With regard to sterilized organic manures, results indicated that populations of *M. incognita* whether in root or soil were significantly affected by the application of tested materials. The suppressive effect relative to untreated-inoculated treatment (ck) ranged between 44.93 and 99.67%. Root gall numbers were also significantly suppressed by all treatments with root gall indices ranged between 2.7 to 5.0. Similar trend was noticed with egg mass number, with egg mass indices ranged between 0.7 to 3.3. Concomitant treatments obviously gave better results than single treatment did (Table 4). Among single application, it was evident that the highest percentage of reduction in nematode population was obtained from pots received sterilized horse manure (99.50%) followed by those receiving the biocontrol agent *S. marcescens* (90.10%). However, in concomitant treatments pigeon-dung plus Oxamyl achieved the highest percentage of nematode reduction followed by horse manure plus *S. marcescens*, then pigeon-dung + *S. marcescens* and horse manure plus Oxamyl with values of 99.67, 98.8, 97.9 and 97.6%, respectively. These previous results indicated that the use of sterilized horse manure applied singly or mixed with either Oxamyl or *S. marcescens* showed the best treatment in controlling *M. incognita* infecting peach seedlings.

Obviously, the sterilized pigeon-dung when applied singly gave 72% nematode reduction, while, when it was mixed with either Oxamyl or *S. marcescens* it achieved the highest percentage of nematode reduction with values of 99.67% and 97.90%, respectively (Table 4).

With regard to unsterilized organic manure and their effects on population densities of *M. incognita* infecting peach, it is evident that all treatments showed nematicidal properties against *M. incognita* to a certain extent (Table 4). The suppressive effect of such materials in terms of reduction in nematode counts ranged between 72.86 to 99.72%. Root gall numbers were also significantly suppressed by all treatments with values ranged between 14.0 to 410.0 and root gall indices ranged between 2.7 to 5.0. On the other hand, no significant differences were noticed among treatments in egg masses number except that of *S. marcescens* plus Oxamyl. Among single applications, it was clear that pots received unsterilized chicken manure gave the highest percentage of reduction in nematode population (99.72%) followed by those received pigeon-dung (98.78%), then those of the biocontrol agent *S. marcescens* (90.10%). However, in concomitant treatments, chicken manure integrated with Oxamyl significantly suppressed nematode population and gall formation giving highest percentage of reduction as compared with those of other treatments. Moreover, no significant differences were noticed among concomitant treatments except in case of *S. marcescens* integrated with Oxamyl (Table 4).

With respect to the unsterilized organic manures tested, it is obvious from Table (4) that the use of chicken manure or pigeon-dung applied singly or in combination with either *S. marcescens* or Oxamyl caused the highest percentage reduction in *M. incognita* counts with values of 99.7, 98.8 and 99.68%, or 98.78, 97.6 and 98.57%, respectively. However, when unsterilized horse manure applied singly it caused only 72.86% of the nematode reduction, but, when it was mixed with Oxamyl or *S. marcescens* percentage of nematode reduction increased to be 97.4 or 98.9%, respectively.

The comparative effect of the two application types of the organic manures on total plant fresh weight of peach cv. Meet-Ghamr infected with *M. incognita* as well as on percentage of nematode reduction are shown in Figures (1 and 2). From Fig. (1), it can be noticed that among the two types of application, the non-sterilized organic manures caused greater improvement in total peach plant fresh weight more than the sterilized organic manure. The highest percentage of increase in peach plant fresh weight over that of the nematode alone treatment was achieved by unsterilized chicken manure plus Oxamyl. Sterilized chicken manure integrated with *S. marcescens* gave the highest value of such growth parameter; however, the single application showed the least value.

Regarding the effect of the two application types of the organic manures on *M. incognita* infecting peach plants, the non-sterilized organic manures applied singly or concomitantly with *S. marcescens* suppressed total nematode population than sterilized organic manures except single application of horse manure and concomitant application of pigeon-dung plus. *S. marcescens* or Oxamyl. It is clear that unsterilized chicken manure applied singly or combined with Oxamyl gave the highest percentages of reduction in nematode populations. The two types of application caused almost equal values of reduction in nematode populations when applied concomitantly either with *S. marcescens* or Oxamyl except chicken manure plus *S. marcescens* (Fig. 2).

As shown in Table (5) results indicate that all tested treatments affected the rate of reproduction of *M. incognita* infecting Balady peach cv. Meet-Ghamr. With regard to sterilized organic manures, the lowest rate of reproduction was achieved by the application of chicken manure integrated with Oxamyl followed by single application of chicken manure with values amounted to 2.61 and 3.17%, respectively. However, concomitant application of chicken manure plus *S. marcescens* gave the highest rate of reproduction as compared with that of the nematode alone treatment (Table 5). The other tested treatments had values of rate of reproduction exceeded that of the control.

As for sterilized organic manures, it was obvious that *M. incognita* did not reproduce on plants treated with horse manure alone. However, concomitant application of pigeon-dung plus Oxamyl ranked the second in rate of reproduction with value of 1.07% (Table 5). On the other hand, rate of reproduction had equal values when *S. marcescens* was applied either alone or integrated with chicken manure.

Table 5: Development of *M. incognita* on Meet-Ghamr peach seedlings treated with certain sterilized and non- sterilized organic manures applied alone and in combination either with *S. marcescens* or Oxamyl under greenhouse conditions.

Treatments	Young stages	Females	Egg-laying females	**Rate of reproduction (R.R.) %
Sterilized				
Chicken manure	3005.0 b	52.0 efg	1.7 c	3.17
Horse manure	0.0 f	28.3 fg	2.7 c	8.71
Pigeon-dung	1269.0 d	234.7 d	22.7 bc	8.82
Chicken manure + *S. marcescens*	1255.0 d	75.3 efg	10.0 c	11.72
Horse manure + *S.marcescens*	4.0 f	64.0 efg	6.3 c	8.96
Pigeon-dung + *S. marcescens*	25.3 f	91.0 efg	9.7 c	9.63
Chicken manure + Oxamyl	4.7 f	138.3 e	3.7 c	2.61
Horse manure + Oxamyl	37.0 f	97.67 efg	4.0 c	3.93
Pigeon-dung + Oxamyl	8.0 f	10.33 g	1.0 c	8.83
Non- sterilized				
Chicken manure	0.0 f	15.3 fg	2.0 c	11.56
Horse manure	1484.0 c	23.3 fg	0.0 c	0.0
Pigeon-dung	10.7 f	57.0 efg	7.7 c	11.90
Chicken manure+*S.marcescens*	0.0 f	64.7 efg	1.0 c	1.52
Horse manure + *S. marcescens*	22.0 f	37.3 efg	2.0 c	5.09
Pigeon-dung + *S. marcescens*	17.3 f	114.7 ef	3.7 c	3.13
Chicken manure + Oxamyl	11.7 f	6.0 g	1.0 c	14.28
Horse manure + Oxamyl	25.3 f	117.0 ef	5.0 c	4.09
Pigeon-dung + Oxamyl	14.3 f	65.0 efg	0.7 c	1.07
S. marcescens + Oxamyl	259.3 e	374.7 c	40.3 b	9.71
S. marcescens	229.0 e	323.0 c	5.0 c	1.52
Oxamyl	143.3 ef	647.0 b	21.7 bc	3.25
Nematode alone	3794.0 a	1757.0 a	118.7 a	6.33

Each value is a the mean of three replicates.
Means in each column followed by the same letter(s) did not differ at P < 0.05 according to Duncan's multiple-range test.

$$\text{** Rate of reproduction (R.R.)} = \frac{\text{Count of egg-laying females}}{\text{Total counts of females + egg-laying females}} \times 100$$

Analysing non-sterilized animal manures revealed the presence of different microbial organisms such as fungi, actinomycetes and bacteria. Different groups of mites were also noticed.

Data presented in Table (6) show the total counts of bacterial, fungal and actinomycetes colonies in three types of animal manures. At 10 days after nematode inoculation, bacterial colonies were more prevalent in chicken manure. However, horse and pigeon manures showed the least total counts of bacterial colonies.

Otherwise, fungal colonies were more prevalent in horse manure followed by chicken then pigeon manure. It is also evident that actinomycetes colonies were found in lower rates in the three types of animal manures. As a whole it can be noticed that pigeon-dung encountered the lowest number of microbial colonies followed by chicken manure then horse manure.

Bacteria identified from animal manures were belong to two groups, Bacilli and Cocci, Fungi identified from chicken amended soil included

Aspergillus niger, A. flavus, Penicillium, Mucor, Fusarium. A. flavus was the most numerous identified species followed by *A. niger, A. niger, A. tamerii, Verticillium* and *Pencillium* were isolated from horse amended soil, but the latter was the most prevalent. *A. niger* was the only species recovered from pigeon-dung. Mites identified from animal manures were belong to Mesostigmata, Prostigmata and Cryptostigmata (Table 6).

Data presented in Table (7) reveal the total bacterial, actinomycetes and fungal colonies as influenced by the application of unsterilized organic manures, i.e. chicken manure, horse manure and pigeon-dung singly or integrated with Oxamyl or *S. marcescens in vivo*. A dramatic reduction in total counts of microbial organisms in animal manures after 90 days of nematode inoculation (Table 7) as compared with those occurred after 10 days of nematode inoculation (Table 6). However, an obvious difference in total counts was noticed among treatments. It is clear that single application of pigeon-dung gave the highest counts of fungi followed by chicken manure integrated with Oxamyl or chicken manure alone with values of 0.057 x 10^6, 0.045 x 10^6 and 0.040 x 10^6, respectively. However, the least value of fungal counts was resulted by pigeon-dung integrated with Oxamyl which recorded 0.008 x 10^6. Regarding total counts of bacteria, concomitant treatment of pigeon-dung plus Oxamyl gave the highest value of bacterial total counts which amounted to 0.25 x 10^8. On the other hand, the highest increase in actinomycetes counts was obtained from pots received horse manure alone with value of 0.37x 10^6. However, pigeon-dung combined with either Oxamyl or *S. marcescens* ranked the second in increasing total counts of actinomycetes with values of 0.33 x 10^6 and 0.25 x 10^6, respectively.

Table (7): Total bacterial colony, actinomycetes and fungal counts in experimental soils treated with non-heated chicken, horse and pigeon manures at the end of the experiment.

Treatments	Total count		
	Bacteria x 10^8 cfu/g	Fungi x 10^6 cfu/g	Actinomycetes x 10^6 cfu/g
Chicken manure + *M. incognita*	0.03	0.040	0.07
Horse manure + *M. incognita*	0.19	0.015	0.37
Pigeon-dung + *M. incognita*	0.16	0.057	0.09
Chicken manure+*S. Marcescens*+*M. incognita*	0.11	0.014	0.21
Horse manure + *S. Marcescens* + *M. incognita*	0.05	0.032	0.13
Pigeon-dung + *S. Marcescens* + *M. incognita*	0.23	0.036	0.25
Chicken manure + Oxamyl + *M. incognita*	0.22	0.045	0.14
Horse manure + Oxamyl + *M. incognita*	0.03	0.024	0.05
Pigeon-dung + Oxamyl+ *M. incognita*	0.25	0.008	0.33

DISCUSSION

Regarding, the effect of the sterilized or non-sterilized organic manures applied singly or integrated with *S. mercesens* or Oxamyl on *M. incognita* infecting Balady peach plant cv. Meet-Ghamr, unheated pigeon-dung or chicken manure appeared to be the most effective in increasing plant fresh weight and dry shoot weight as well as in reducing nematode population.

These results are also in accordance with the work of El-Naggar *et al*. (1994) who found that the highest reduction in soil nematode population of *Rotylenchulus reniformis* infecting cowpea, *Vigna sinensis* was obtained by pigeon-dung. In general, unsterilized organic manure gave better results than sterilized manure in improving plant growth parameters and in suppressing nematode population whether in soil or root. However, non significant difference was noticed with sterilized or non-sterilized manures in nematode reduction. Moreover, the sterilized horse manure or pigeon-dung that applied either singly or mixed with Oxamyl or *S. marcescens* achieved also the highest percentage of nematode reduction.

These results support the findings of Oduor-Owino and Waudo (1996); Akhtar and Mahmood (1997); Marull *et al*. (1997); Conn and Larzarovits (1999) and Rajesh *et al*. (1999) in respect to poultry manure and El-Zawahry (2000) in related to pigeon-dung. Improving peach plant growth and suppression of root knot nematodes following the application of chicken and pigeon manures could be attributed to the presence of significant quantities of N, P, K, Ca, Mg and micronutrients in the organic matter (Ndegwa *et al*., 1991 and Sims and Wolf, 1994). Organic amendments enhance soil fertility, improve biological and physical properties of soil, help in controlling root-knot nematodes and increase plant growth. Since the majority of nitrogen in pigeon or poultry manure is in the form of uric acid and can be rapidly converted to ammonium nitrogen if temperature, pH and mositure are suitable for microbial activity (Sims and Wolf, 1994). The ammonium produced has been shown to kill plant parasitic nematodes (Eno *et al*., 1955). However, the dramatic reduction in microorganisms, fungi, bacteria and actinomycetes at 90 days after nematode inoculation did not support the hypothesis that organic amendments will stimulate the development of populations of microorganisms (Main *et al*., 1982 and Riegel *et al*., (1996) that could be substances toxic to nematodes.

REFERENCES

Akhtar, M. and I. Mahmood (1997). Integrated nematode control in potato, *Solanum tubersum*. International Pest Control, 38(2): 62-64.

Ali, S.S. (1995). Management of *Meloidogyne javanica* through organic amendments in mungbean. Indian J. Pulses Research, 8(2): 204-208.

Amin, A.W. and M.M.A. Youssef (1998). Effect of organic amendments on the parasitism of *Meloidogyne javanica* and *Rotylenchulus reniformis* and growth of sunflower. Pakistan J. Nematol., 26(1): 63–70.

Barbolina, I. and I. Arkhipchenko (1999).Effect of biofertilizer from animal production wastes on the growth, yield and nematode infection of tomato. Ekologiczne aspekty mechanizacji nawozenia, ochrony roslin, uprawy glebyi zbioru roslin uprawnych. Recenzowane Materialy VI Miedzynarodowego Sympozjum, Warszawa, Polska, 23-24 Wrzesien, 1999: 76-82.

Byrd, D.W.; T. Kirkpatrick and K. Barker (1983). An improved technique for clearing and staining plant tissues for detection of nematodes. J. Nematol., 15(3): 142-143.

Conn, K.L. and G. Larzarovits (1999). Impact of animal manures on verticillium wilt, potato scab and soil microbial populations. Canadian Journal of Plant Pathology, 21(1): 81-92.

Duncan, D.B. (1955).Multiple range and multiple, F-test Biometrics, 11: 1-42.

El-Naggar, H.I.; H.H. Hendy; A.A. Osman and A.A. Farahat (1994). The impact of organic soil supplement on *Rotylenchulus reniformis* infecting cowpea, *Vigna sinensis*. Bulletin of Faculty of Agriculture, Cairo Univ., 45(4): 895-904.

El-Zawahry, A.M. (2000). Effect of organic manure on infection of faba bean by root-knot nematode. Assiut Journal of Agricultural Sciences., 31(4): 79-88.

Eno, C.F.; W.G. Blue and J.M. Good (1955). Effects of anhydrous ammonia on nematodes, fungi and bacteria in some Florida soils, Soil Sci., 19: 55-58.

Fadeel's, A.A. (1962). Location and properties of chloroplasts and pigment determination in roots. Physiol. Plant, 15: 130-147.

Gamliel, A. and J.J. Stapleton (1993). Effect of chicken compost or ammonium phosphate and solarization on pathogen control, rhizosphere microorganisms, and lettuce growth. Plant Disease, 77(9): 886-891.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research 2nd Ed., John Wiley and Sons. Inc. New York.

Goodey, J.B. (1957). Laboratory methods for work with plant and soil nematodes. Tech. Bull. No. 2 Min. Agric. Fish Ed. London pp. 47.

Jakson, M.L. (1967). Soil Chemical Analysis. Prentic. Hall of India, New Delhi. 498 pp.

Kaplan, M. and J.P. Noe (1993). Effect of chicken excrement amendments on *Meloidogyne arenaria*. J. Nematol., 25(1): 71-77.

Krantz, G.W. (1976). A manual of Acarology, 2nd ed. Oregon State University Book Stores, Inc., Corvallis, OR 509 pp.

Maareg, M.F.; F.M. Salem and A.M. Ebieda (2000). Effect of certain organic and Inorganic soil amendments of *Meloidogyne javanica* in sandy soil. Egyptian J. Agronematol., 4(1/2): 82-94.

Main, I.H.; G. Godoy; R. Shelby; R. Rodriguez-Kabana and G. Morgan-Jones (1982). Chitin amendments for control of *Meloidogyne arenaria* infested soil. Nematropica, 12: 71 – 84.

Marull, J.; J. Pinochet and R. Rodriguez-Kabana (1997). Agricultural and municipal compost residues for control of root-knot nematodes in tomato and pepper. Compost Science and Utilization, 5(1): 6-15.

Mostafa, Fatma A.M.; A.G. El-Sherif, A.R. Refaei and A.H. Nour El-Deen (2002). Impact of certain Biofertilizers and *Serratia marcescens* on *Meloidogyne incognita* infecting peach plants. J. Agric. Sci. Mansoura Univ., 27(6): 4145 – 4154.

Nahar, M.S.; M.I. Huq; M.S. Islam and M.H. Hossain (1996). Efficacy of organic soil amendment for the management of root-knot of tomato. Bangladesh Journal of Plant Pathology, 12(1/2): 17-20.

Ndegwa, P.M.; S.A. Thompson and W.C. Merka (1991). Fractionation of poultry litter for enhanced utilization. Trans. Am. Soc. Agric. Eng., 34: 992-997.

Nour El-Deen, A.H. (2002). Studies on some plant parasitic nematodes associated with peach orchards. M.Sc. Thesis, Fac. of Agric. Mansoura Univ., pp. 94.

Oduor-Owino, P. and S.W. Waudo (1996). Effect of delay in planting after application of chicken manure on *Meloidogyne javanica* and *Paecilomyces lilacinus*. Nematologia Mediterranea, 24(1): 7-11.

Oteifa, B.A. (1964). A taxonomic guide to the common genera of soil and plant nematodes with a supplement on current known economic parasitic species of U.A.R. contribution of the National Research Center, Nematology Unit, Giza, U.A.R.

Pandey, R. and R.A. Sikora (2000). Influence of aqueous extracts of organic matter on the sensitivity of *Heterodera schachtii* Schmidt and *Meloidogyne incognita* (Kofoid and White) Chitwood eggs to *Verticillium chlamydosporium* Goddard infection. Zeitschrift fur Pflanzenkrankheiten und P Flanzenschutz, 107(5): 494-497.

Pokharel, R.R. (2000). Effect of organic manures, fertilizers, and nematode (nematicide) on the control of root-knot nematode and yield in ckickpea. International. Chickpea and Pigeonpea Nerwsletter., 7: 18-19.

Rajesh, V.; J. Singh and R.K. Jain (1999). Effect of few organic manures against root-knot nematode (*Meloidogyne incognita*) infesting cotton (*Gossypium hirsutum*). Proceedings of national symposium on rational approaches in nematode management for sustainable agriculture. Anand, India, 23-25 November, 1999, :10-12.

Riegel, C.; F.A. Fernandez and J.P. Noe (1996). *Meloidogyne incognita* infested soil amended with chicken litter. J. Nematol., 28(3): 569-378.

Siddiqui, Z.A.; A. Iqbal and I. Mahmood (2001). Effects of *Pseudomonas flourescens* and fertilizers on the reproduction of *Meloidogyne incognita* and growth of tomato. Applied Soil Ecology.,16(2):179-185.

Sims, J.T. and D.C. Wolf (1994). Poultry waste management: Agricultural and environmental issues. Adv. Agron., 52: 1-83.

Waceke, J.W. and S.W. Waudo (1993). Effect of soil amendments on pathogenicity of *Meloidogyne incognita* on okra. International J. Pest Management, 39(4): 385-389.

Wellburn, A.R. and H. Lichtenthaler (1984). Formula and program to determine total carotenoids and chlorophylls a and b of leaf extracts in different solvents. In: Advances in Photosynthesis Research, Vol. 2 (Ed. by C. Sybesma), pp. 9-12. Martinus Nijhoff/Dr W. Junk. The Hague, Boston, Lancaster.

Zasada, I.A. and H. Ferris (2001). Changes in nematode community structure after the application of plant amendments. Phytopathology, 91: S146. Publication No. P-2001-0131-SON.

تأثير بعض المخلفات العضوية الحيوانية وبكتريا "سيراتيا ماركينس" على "ميليدوجين إنكوجنيتا" التى تصيب نبات الخوخ مع الإشارة إلى ميكروبات التربة والحلم٠

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أوضحت دراسة تأثير المخلفات العضوية الحيوانية (الدواجن – الخيول – الجمام) المعقمة وغير المعقمة مخلوطة مع بكتريا "سيراتيا ماركينس" بالمقارنة مع مبيد الفايديت فى مكافحة نيماتودا تعقد الجذور "ميليدوجين انكوجنيتا" التى تصيب نبات الخوخ البلدى صنف ميت غمر تحت ظروف الصوبة أن مخلفات الدواجن والحمام الغير معقمة أعطت أعلى نسبة نقص فى أعداد النيماتودا عدما أضيفت بمفردها أو مخلوطة مع الفايديت أو البكتريا بقيم ٧ر٩٩، ٨ر٩٨% أو ٧٨ر٩٨، ٦٨ر٩٩% أو ٥٧ر٩٨، ٦ر٩٧% على التوالى٠ زيادة على ذلك أعطت مخلفات الخيول والحمام المعقمة المضافة بمفردها أو مخلوطة مع الفايديت أو البكتريا أعلى نسب نقص فى أعداد النيماتودا بقيم ٥ر٩٩، ٩ر٧٢% أو ٦ر٩٧، ٦٧ر٩٩% أو ٧٧ر٩٨، ٩ر٩٧% علىالتوالى٠
ورغم ذلك فإن مخلفات الخيول العضوية الغير معقمة، وكذا مخلفات الدواجن المعقمة المضافة بمفردها أعطت أقل القيم فى نقص تعداد النيماتودا بقيم ٨ر٧٢ و٩ر٤٤% على التوالى٠
وبصفة عامة فلقد أعطت المخلفات العضوية الحيوانية المختبرة الغير معقمة أحسن النتائج عن مثيلتها المعقمة فى تحسين نمو النباتات وخفض أعداد النيماتودا سواء فى التربة أو الجذر٠ وقد لوحظ نقص واضح فى العد الكلى للبكتريا أو الفطريات أو الأكتينوميسيتس فى المخلفات الحيوانية العضوية الغير معقمة بعد ٩٠ يوم من إضافة عدوى النيماتودا٠ كما دل تعريف الحلم الموجود فى تلك المخلفات أنه ينتمى إلى مجموعات ميزوستجماتا وبروستجماتا وكريبتوستجماتا٠
أوضحت المعاملة بالمخلفات العضوية المعقمة زيادة معنوية فى تركيزات النيتروجين والفوسفور والبوتاسيوم فى المجموع الخضرى الجاف لنباتات الخوخ بالمقارنة بالغير معاملة٠ كما أوضحت المعاملة بمخلفات الحمام المعقمة بمفردها أو مخلوطة بمبيد الفايديت أو مخلفات الخيول الغير معقمة مخلوطة بالبكتريا زيادة فى الكلوروفيل الكلى بدرجة معنوية٠