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ECO-FRIENDLY MANAGEMENT OF ROOT-KNOT NEMATODE AND ROOT ROT DISEASE INFECTING PEPPER PLANTS BY APPLICATION COMPOST AND TEA COMPOST

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ABSTRACT: The present work was conducted to study the efficacy of compost powder and compost extract (tea) in the management of root rot and root-knot nematode disease complex infecting pepper plants under *in vitro* and *in vivo*. The inhibitory effect of compost extract concentrations (25%, 50%, 75 and 100%) on *Fusarium solani* (Mart.) Sacc and *Rhizoctonia solani* Kühn were evaluated, the latter was higher sensitive than *F. solani* by 88.33% and 82.83%, respectively at 100% concentration. The results also, showed that nematicidal effect of unsterilized compost tea (65.98% and 52.3%) was significantly more than sterilized compost tea (54.02% and 45.9%) on the rate of *Meloidogyne incognita* egg hatching and juvenile mortality, respectively in all tested concentrations. *In vivo*, the obtained results cleared a decrease in the root rot incidence percentage in disease complex of both compost powder and compost tea extract to 22.1% and 20.1% compared with control treatment. Application of compost powder with the recommended dose, as well as the compost tea extract, led to a significant decrease in gall number (64 and 59 galls/root) compared to the comparative treatment (108 galls/root). This result has led to a significant reduction in egg-masses formation. Furthermore, the obtained results indicated that plant growth parameters significantly increased (plant length, fresh and dry weights) by the application of compost and compost tea extract. In general, application of compost and compost tea extract might be a safe and eco-friendly tool in the sustainable management of disease complex.

Key words: Compost tea, compost powder, root knot nematode, root rot, disease complex, pepper.

INTRODUCTION

Pepper (*Capsicum annum* L.) is one of the most important vegetable crops in many countries of the world. In Egypt, it supply`s its importance as being a vegetable crop having marketing and exporting values.

Pepper plants are label to be attack by several soil borne pathogenic fungi which are responsible for serious diseases (root rot caused by *Fusarium solani* (Mart.) Sacc and *Rhizoctonia solani* Kühn, root knot nematode caused by *Meloidogyne incognita* (Kofoid and White) Chitwood and disease complex. In general, complex diseases are highly destructive and difficult to control **(Kamali *et al*., 2015)**. Although chemical fungicides and nematicides are effective, easy to apply and show rapid effects, they have begun withdrawn from the market owing to concerns about public health and environmental safety (**Sasanelli *et al*., 2011)**. Also, have higher cost of application, limited availability in many developing countries or their diminished effectiveness following repeated applications (**Ahmad and Siddiqui, 2009**).

Attention to safe environment against pesticide hazard has led researcher to investigate about alternative strategies including the use of compost, one of promising management, that can used to suppress nematode populations, increase soil health and plant vigor. Composts

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produced from various organic residues have been reported to suppress populations of nematodes and other plant disease pathogens (**Zakaria *et al*., 2013**).

Recently, several studies concerned the effectiveness of compost and compost inspected as soil amendments in managing complex disease *i.e*. compost tea extract, were conducted. Considerable progress in the use of compost as soil amendment for the control of complex disease under greenhouse conditions has been reported by **El-Masry *et al*. (2002), Zhu *et al*. (2006) and Zhao *et al*. (2014).**

Many studies emphasized that nematode populations were greatly suppressed after compost application (**Addabbo *et al*., 2011; Sasanelli *et al*., 2011). Meyer *et al*. (2011) and Ravindra *et al*. (2014)** reported that compost was investigated as an amendment for suppressing populations of *M. incognita* and improve plant vigor in consequence.

Therefore, the objective of the present study was to evaluate the effect of compost and compost tea extract on controlling the causal organisms (two soil borne fungi and root knot nematode) infecting pepper roots under both laboratory and greenhouse conditions.

MATERIALS AND METHODS

Two experiments were carried out at the Plant Path. Dept., Fac. Agric., Zagazig. Univ., Egypt under laboratory and greenhouse conditions in order to determine the effectiveness of compost and compost extract on *M. incognita*, *Fusarium solani* and *Rhizoctonia solani* infecting pepper plant.

Laboratory Experiments

Preparation of egg-masses and second stage juveniles and nematode species identification

The population of *Meloidogyne* species used in these experiments was obtained from infected pepper roots collected from newly reclaimed sandy soil of El-Khatara Project, Sharkia Governorate. The species of nematode were identified based on morphology of perineal pattern of mature females and morphometry of second stage juveniles according to **Taylor and Sasser (1978) and Eisenback *et al*. (1981).** Perineal patterns were prepared based on the technique descrided by **Taylor and Netscher (1974)**.

Collecting inocula was prepared as fellows: Pepper galled roots were soaked in tap water for one hour to remove adhering soil particles. Egg-masses needed for experiment were hand picked up from small galls using fine forceps. The obtained egg-masses were surface sterilized in 0.5% sodium hypochlorite (Chlorex) for 3 min., and quickly washed several times with sterile water to remove residues of the sterilant by passing the solution through a 200-mesh (75µm) sieve. The collected egg- masses were then refrigerated overnight at 5°C and assayed next day **(Hussey and Barker, 1973).**

To obtain second stage juveniles, egg-masses were incubated in distilled water for 5 days at 28±2°C. Freshly hatched juveniles were separated daily using a micropipette after sedimentation of egg-masses.

Source of the pathogenic fungi

Pathogenic fungal genera were isolated from infected pepper roots disease complex following the methods adopted by **Agrios (2005)** and identified according to **Barnett and Hunter (1999) and Sneh *et al.* (1992)** after conducted pathogenicity test according to **Singleton *et al*. (1992)**.

Preparation of compost extracts

Laboratory studies were conducted with compost powder obtained from Shade Company, Zagazig District, Sharkia Governorate, Egypt. Compost extract (compost tea) was prepared from powder compost according to **Brinton *et al*. (1996)** and chemically analyzed (Table1) at the Soil Science Dept., Fac. Agric., Zagazig Univ. The extract was served as compost tea standard solution, then diluted to make four concentrations (*i.e.* 25, 50, 75 and 100 mg/ml).

Evaluation of the compost extracts inhibitory effect on pathogenic fungi

Compost tea was added individually to conical flasks containing sterilized PDA medium before its solidification to obtain the following concentrations (*i.e.* 25, 50, 75,100 mg/ml) and

Table 1. Chemical analysis of plant compost tea

Analysis	Unit	Results
N	g/kg	3.3
P	g/kg	0.25
K	g/kg	1.50
Ca	g/kg	2.66
Fe	g/kg	2.57
Cu	g/kg	9.5
Organic matter	Mg/kg soil	663
C/N		16:1
pH	(1: 14)	8.3
Ash		68.0%

mixed gently then disbanded in sterilized Petri-p1ates (9 cm diameter) sterilized water was added in control treatment instead of compost tea. Dishes were individually inoculated with equal discs (5-mm diameter) taken from 7 days old cultures of pathogenic fungi *Fusarium solani* and *Rhizoctonia solani*, and then incubated at 25±2°C. Linear growth of fungi was measured, when the control dishes reached full growth and the growth diameter average, was calculated. Each treatment was represented by three dishes as replicates. Reduction percentage was calculated in comparison with control treatment according to the following equation:

$$\text{Reduction (\%)} = \frac{\text{Control-treatment}}{\text{Control}} \times 100$$

Influence of tea compost on *M. incognita* egg hatching

Ten egg-masses of *M. incognita* uniform size were added to ten ml of each concentration (0, 25, 50, 75 and 100%) of sterilized and unsterilized compost extract in 9 cm diameter Petri-dishes. The control treatment was prepared using sterilized distilled water without compost tea. Each treatment was replicated three times. All treatments were left in dark under room temperature. After exposure for two days at 28 ± 4°C number of hatched juveniles were counted using a research microscope (100X magnification). Hatching inhibition percentage was calculated in comparison with control treatment using the following equation:

$$\text{Inhibation (\%)} = \frac{\text{Control-treatment}}{\text{Control}} \times 100$$

Influence of tea compost on *M. incognita* juvenile mortality

Dilutions from each compost tea (0, 25, 50, 75 and 100%) were prepared as mentioned before. Ten milliliters of each concentration of sterilized and unsterilized compost extract were placed in 9 cm diameter Petri-dishe. About 100 newly hatched second stage juveniles in 0.2 ml of water were added to each Petri-dish. All Petri-dishes were kept at room temperature of 28±4°C. The control treatment was 10 ml sterilized distilled water with the same number of juveniles. Three replicates were used for each particular treatment. Two days later, others exhibited number of dead juveniles as those showing no movement (J shape) and the active juveniles with normal movement were counted using 100X magnification. Mortality percentage was calculated according to the following equation:

$$\text{Mortality (\%)} = \frac{\text{Dead juveniles}}{\text{(Live + dead) juveniles}} \times 100$$

Greenhouse Experiments

Soil infestation

These experiments were conducted using pepper seedlings cv. (top star) obtained from El-Shalqany Company, Zagazig, Sharkia Governorate, Egypt. When the seedlings were 30 days old, the apparently healthy seedlings were individually transplanted into 20 cm diameter sterilized plastic pots implicate 2 kg autocalved sterilized sandy loam soil (1:1 *V/V*) and irrigated daily using tap water.

After 7 days of transplanting, *F. solani* or *R. solani* and *M. incognita* soil was individually infested or combined in sequence according to the following treatments:

1. Soil infested only with *M. incognita*.
2. Soil infested only with *F. solani*.
3. Soil infested only with *R. solani*.
4. Soil infested with *M. incognita* 7 days prior to infestation with *F. solani*.
5. Soil infested with *M. incognita* 7 days prior to infestation with *R. solani*.
7. Control (non- infested soil).

A pot culture experiment was designed under greenhouse conditions. Infestation was carried out by adding 200 ml of Potato Dextrose Broth (PDB) of the pathogenic fungi at the rate of 5% of the soil weight. Furthermore, 1000 freshly hatched second stage juveniles (J_2) of root-knot nematode in10 ml were placed in holes around the intact pepper root system using a pipette for each pot of nematode treatments. All treatments were replicated 4 times. Disease complex was determined when *F. solani* or *R. solani* and *M. incognita* infected the plants at the same time.

Determination of complex disease as affected by compost powder and tea compost

Powder compost and compost tea were evaluated to study their efficiency in management of disease complex. The powder compost was mixed with the soil at a rate of 10 g/kg soil as well as 100 ml of compost tea contaminated soil 14 days before infestation at temperature of 18 : 20^{o}C. Seven days before pepper transplanting, the soil in pots was infested individually with *M. incognita*, *F solani*, R *solani* and combination of *M. incognita* + *F. solani* and/or *R. solani* simultaneously in soil. In control treatment, transplants were only treated with water.

Pathological parameters

Disease assessment was recorded on number of galls and egg-masses per plant and gall index. Whereas, rating of root-knot index were calculated according to **Taylor and Sasser (1978)** and **Hussey and Janssen (2002).** In addition, percent of root rot was calculated according to the methods described by **Cooke *et al*.** (**2006**).

Effectiveness of compost powder and tea compost on plant growth parameters

Growth parameters including plant height in cm, fresh and dry weights in gram were determined. Entire root system along with the soil was tapped out of the pot and washed in a container with a gentle stream of water. For obtaining fresh and dry weight, the roots were pressed gently between two pads of blotting paper then the fresh weight was recorded using electronic balance. Dry weight was recorded after drying the roots in oven under 70°C for several days until constant weight.

Statistical Analysis

Data were statistically analysed according to the procedures reported by **Snedecor and Cochran (1980)**, using the computer program Costat version 6.400. Averages were compared by Duncan's multiple range test at 5% (**Duncan, 1955**).

RESULTS AND DISCUSSION

Causal Organisms Identification

According to the identification criteria, the prevailing fungi isolated from the infected pepper roots were proven to be *Fusarium solani* (Mart.) Sacc and *Rhizoctonia solani* Kühn. Also, *Meloidogyne* species was identified to be *Meloidogyne incognita* (Kofoid and White) Chitwood.

Table 2. Mycelial growth reduction percentage as affected by different concentrations of compost tea

Tea compost concentration (%)	Causal orgnaism		Average
	Rhizoctonia solani [A]	*Fusarium solani* [B]	
Control	00 [e]	00 [e]	00 [e]
25	25.50 [d]	28.00 [d]	26.75 [d]
50	45.66 [c]	52.33 [c]	49.00[c]
75	70. 70 [b]	74.13 [b]	72.07 [b]
100	88.33 [a]	82.83 [a]	85.59[a]

Data followed by the same small letter in columns are not significantly differed at $P<0.05$.

Evaluation of the Tea Compost Inhibitory Effect on Pathogenic Fungi

Results in Table 2 reveal that tea compost at 100% concentration gave the best average reduction percent against *Rhizoctonia solani* mycelial growth being 88.33% followed by *Fusarium solani* recording 82.83%. All tested concentrations of the compost extract showed significant reduction percent effect at ($P< 0.05$). A steady increase in linear growth reduction percent was detected with increasing tested compost extract concentration. All of the previous general average results showed that *R. solani* was more sensitive (88.33%) than *F. solani* (82.83%) at different concentrations concerning linear growth and/or inhibition percentage. These results are in agreement with those reported by **Hibar *et al*. (2006)**. Sensitivity of *R. solani* might be due to that the pathogen don't produce spores which consider more resistant fungal structure than mycelium against used compost extracts as a control product.

The primary effect of the compost tea is apparently of microbiological nature. Sterilized or micron filtered compost extracts usually exhibit significant growth reduction against pathogens. This does not rule out that in some cases sterile extracts will possess suppressive effects. There is some evidence that chemicals such as siderophores, pseudobactins, and pseudomycins produced by *Pseudomonas* spp. in compost exert a powerful chemical that have suppressive effect against phytopathogenic organisms. Antibiotics have been observed to be formed by *Bacillus subtilis* in compost and inhibit the germination and/or growth of many fungi **(Brinton and Tränkner, 1996; Kone *et al.*, 2010; Xu *et al.*, 2012)**.

Influence of Compost Extracts on *Meloidogyne incognita* Egg Hatching

Sterilized and unsterilized compost tea obviously reduced numbers of *M. incognita* hatched juveniles after two days of exposure as compared to water control (Table 3). The inhibition of nematode hatching was significantly affected at ($P< 0.05$) by nematoxic compounds released from composted materials and the concentration applied (**Zhu *et al.*, 2006; Osei *et al.*, 2011**). The interactions between these factors were also significant. On the other hand, examined compost tea and concentrations displayed significant effect on numbers of juveniles that exhibited no perceptible movements and enumerated as dead. Moreover, observable differences were detected between sterilized and unsterilized compost extract.

The tested compost tea concentrations differed significantly in their ability to abrupt egg hatching and increase juvenile mortality. Unsterilized compost extract displayed higher significant effects at ($P< 0.05$) on egg hatching and juvenile mortality as compared to the parallel values for sterilized compost extract. General averages of egg hatching reduction percent of unsterilized and sterilized compost extract were 65.98% and 54.02%, respectively, while the parallel values for juvenile mortality were 52.33 and 45.9%, respectively. These results are in agreement with those reported by **Litterick *et al*. (2004), Meyer *et al*. (2011), Osei *et al*. (2011) and Olabiyi and Oladeji (2014)**.

Table 3. Egg hatching percentage and juvenile mortality of *Meloidogyne incognita* as affected by four different concentrations of compost tea sterilized or unsterilized *in vitro*

Concentration	Hatching inhibition (%)		Juvenile mortality (%)	
	1	2	1	2
Control	0[e]	0[e]	0[e]	0[e]
25	57.74[d]	69.94[d]	22.67[d]	20.33[d]
50	68.80[c]	75.13[c]	41.07[c]	50.33[c]
75	77.61[b]	84.80[b]	65.67[b]	90.67[b]
100	95.83[a]	100[a]	90.22[a]	100[a]
Average	54.02[B]	65.98[A]	45.9[B]	52.3[A]

1: sterilized compost extract. 2 : unsterilized compost extract

- Values followed by the same small letter in columns or capital letters in rows are not significantly differed at 5%.

The effectiveness of compost tea on percent reduction of fungal growth and the low reproduction of nematodes in this study were probably due to secondary substances produced by compost tea, as previously mentioned (**Darby *et al.*, 2006; Abdel-Kader *et al.*, 2013; Rizvi *et al.*, 2018**) such as phenolic compounds, steroids, triterpenes, anthraquinones, flavonoid heterosides, saponin heterosides, condensed tannins, hydrolyzable tannins, and sugars that are exuded from the examined compost materials. Some of these substances, such as terpene compounds-sand flavonoid glycosides, have proven nematicidal and antifungal activity (**Du *et al.*, 2011; Lopes *et al.*, 2019**). Also microbial components and populations play important roles in the inhibitory mechanism of compost extracts (**Xu *et al.*, 2012; Silva *et al.*, 2018a**).

Determination of Disease Complex Management as Affected by Powder Compost and Compost Tea

Results in Table 4 and Fig. 1 show that both powder compost and compost tea significantly ($P \leq 0.05$) reduced the disease incidence of pepper root rot grown under greenhouse conditions compared with the untreated control. Statistical analysis indicates that there was no significant differences between powder compost and/or compost tea were registered for controlling root rot in disease complex.

Results presented in Table 4 and Fig. 2 imply that the tested compost (powder compost and compost tea) applied at all treatments, significantly impaired gall formation, egg-masses, final population as well as nematode build up and egg production comparing with un-treated treatment.

Differences in nematode reduction percentage were obvious among powder compost and/or compost tea while, no significant differences were obtained concerning compost type. The highest reduction in galls and egg-masses nematode number, reveal the best results when both compost (powder and tea) were applied. Compost suppressing final galls and egg-masses formation values that averaged 64 and 59 galls/root system and 28.33 and 35.11 egg-mass/root system. On the other hand, untreated treatment valued 108 galls/root system and 56 egg-masses/root system, respectively.

Results of the present study are in harmony with those reported by **Abdel-Bary *et al.* (2014)** who indicated that compost tea significantly reduced formation of nematode galls, egg-masses, the developmental stages and the final population nematode. On the other hand, many reports indicated that compost tea application improved growth of infected plants and diminished nematode population **(Cayuela *et al.*, 2008; El-Morsy *et al.*, 2016)**.

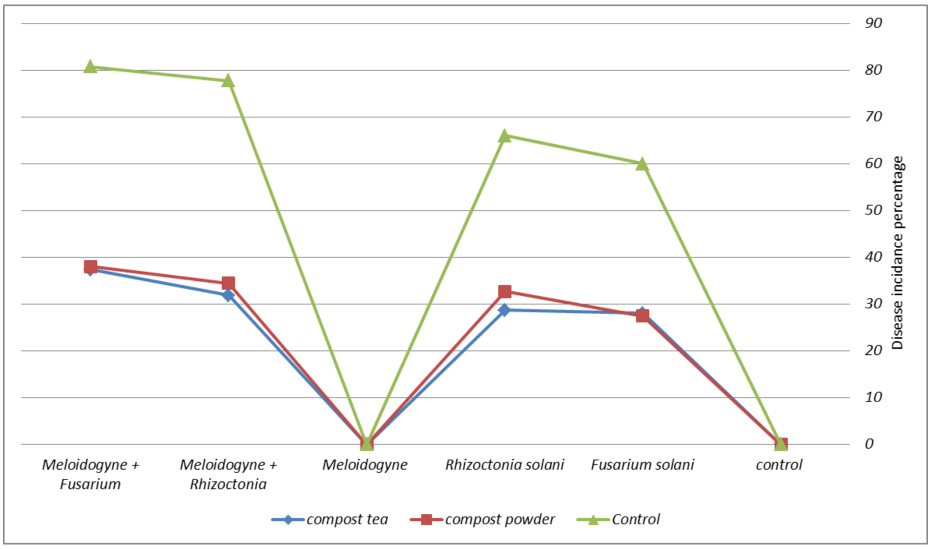

Fig. 1. Effect of tea and powder compost on percentage of pepper root rot disease incidance and root knot nematode disease complex mangement

Table 4. Effect of tea and powder compost on percentage management of pepper root rot and root knot nematode disease complex

	Treatment	Root rot infection (%)	No. of nematode galls	No. of nematode egg-mass	Gall index
Control	**Control treatments**	0[e]	0		
	Fusarium solani	60[c]	0		
	Rhizoctonia solani	66[c]	0		
	Meloidogyne incognita	0[e]	105.33 [a]	63.00	5
	M. incognita and *R. solani*	77.7[b]	110.67 [a]	52.00	5
	M. incognita and *F. solani*	80.7[a]	108.00 [a]	53.00	5
	Average	47.4[A]	108 [A]	56.00 [A]	
Powder compost	**Control compost**	0[e]	0		
	Fusarium solani	27.46[d]	0		
	Rhizoctonia solani	32.67[c]	0		
	Meloidogne incognita	0[e]	66.67 [a]	32.00 [a]	3
	M. incognita and *F. solani*	34.42[b]	61.67 [a]	25.00 [a b]	3
	M. incognita and *R. solani*	38[a]	65.33 [a]	28.00 [c]	3
	Average	22.1[B]	64 [C]	28.33[C]	
Tea compost	**Control tea compost**	0[e]	0		
	Fusarium solani	28[c]	0		
	Rhizoctonia solani	28.67[c]	0		
	Meloidogyne incognita	0[e]	61.67 [a]	33.67 [b]	3
	M. incognita and *F. solani*	31.9[b]	59.00 [a]	39.67 [a]	3
	M. incognita and *R. solani*	37.33[a]	56.33 [a]	32.00 [b]	3
	Average	20.1 [B]	59 [B]	35.11 [B]	-

Values followed by the same small letter in columns or capital letters in rows are not significantly differed at 5%.

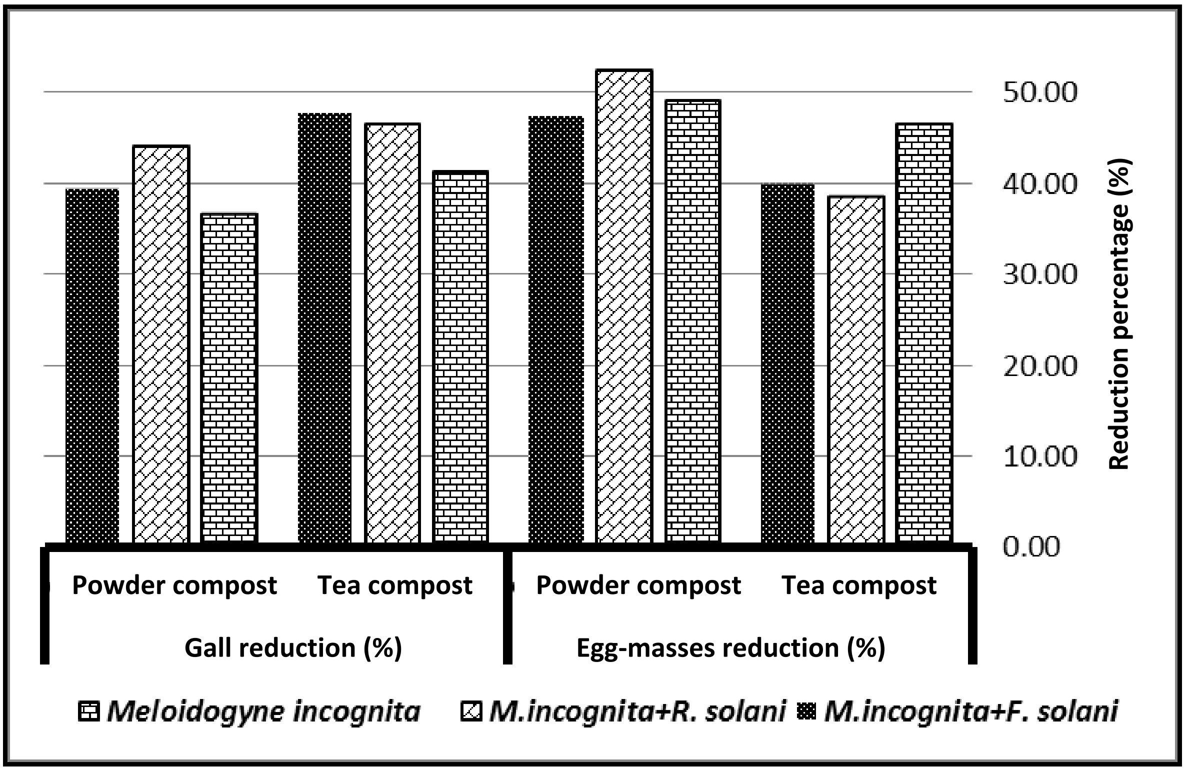

Fig. 2. Reduction percentage of galls and egg-masses formation as effected by powder compost and tea compost

The mechanisms by which composts suppress plant diseases and plant parasitic nematodes are still speculative but it may be due to increase competition from fungivorous and bacterivorous nematodes resulting from increased availability of food sources after compost applications **(Mostafa *et al.*, 2017; Silva *et al.*, 2018 b)**.

Effectiveness of Powder Compost and Tea Compost on Plant Growth Parameters

Improvement in plant growth parameters in terms of shoot and root length and weights was variable and proportioned with the compost (powder and tea extract) treatments (Table 5 and Figs. 3 and 4), while the powder compost offered the best averages in increment the plant height, fresh weight and dry weight (39.12 cm, 15.56 and 5.45 g, respectively) fallowed by tea compost (36.51 cm, 14.04 and 4.92 g, respectively) compared to control pathogenic treatment 35.02 cm, 11.61 and 4.06 g, respectively.

The beneficial effects of compost on treated plants rather than its role in controlling soil borne diseases were outlined by many authors (**Evanylo *et al.*, 2008; Rashad *et al.*, 2011; St. Martin and Brathwaite, 2012)**. They mentioned that compost improves soil structure, porosity; increases infiltration and permeability of heavy soils, increases water holding capacity, supplies variety of macro and micronutrients, supplies significant quantities of organic matter and improves cation exchange capacity. Also, compost stabilizes soil pH, provides humus, vitamins, hormones, and plant enzymes which are not supplied by chemical fertilizers field guide to compost use. In addition to the action of secondary compounds, mechanisms of action against pathogens associated with the incorporation of organic material into the soil are in some cases related to the improvement of the physical and chemical characteristics of the soil. These results are due to better development of the plant growth parameters, which became more tolerant to parasitism (**Xu *et al.*, 2012; Silva *et al.*, 2018a**).

Table 5. Effectiveness of powder compost and tea compost on pepper plant growth parameters

Treatment		Plant height (cm)	Fresh weight (g)	Dry weight (g)
Control	**Control treatments**	37.00 a	15.40 a	5.39a
	Fusarium solani	35.00 b	10.8 b	3.78b
	Rhizoctonia solani	34.60 c	11 b	3.85b
	Meloidogyne incognita	33.70 d	10.1 c	3.54c
	M. incognita and *R. solani*	35.00 b	10.63 b	3.72b
	M. incognita and *F. solani*	34.80 c	11.6 d	4.06d
	Average	35.02 C	11.61 C	4.06C
Powder compost	**Control compost**	39.00 a	18.07 a	6.32 a
	Fusarium solani	38.90 b	14.6 c	5.11 c
	Rhizoctonia solani	39.20 a	14.1 d	4.94 d
	Meloidogne incognita	39.70 a	14.8 c	5.18 c
	M.incognita and *F. solani*	38.50 b	14.50 c	5.08 c
	M. incognita and *R. solani*	39.40 a	15.5 b	5.43 b
	Average	39.12 A	15.56 A	5.45A
Tea compost	**Control tea compost**	38.30 a	15.83 a	5.54 a
	Fusarium solani	35.80 c	12.6 d	4.41 d
	Rhizoctonia solani	36.50 b	13.8 c	4.83c
	Meloidogyne incognita	35.54 c	12.6 d	4.41 d
	M. incognita and *F. solani*	36.00 c	13.00 c	4.55 c
	M. incognita and *R. solani*	36.90 b	14.6 b	5.11 b
	Average	36.51 B	14.04 B	4.92 B

Values followed by the same small letter in columns or capitals letter in rows are not significantly differed at 5%.

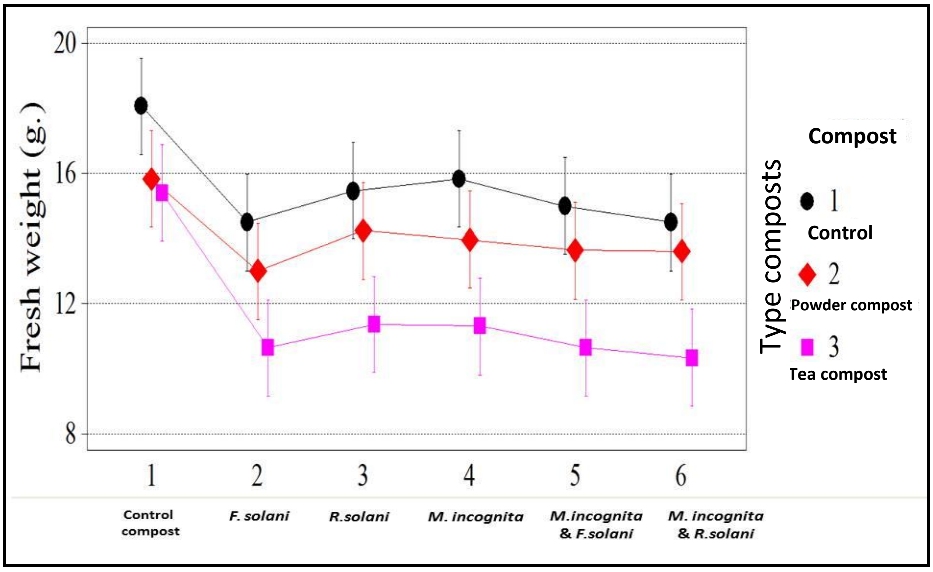

Fig. 3. Impact of powder compost and tea compost on fresh weight of pepper plant infected with disease complex

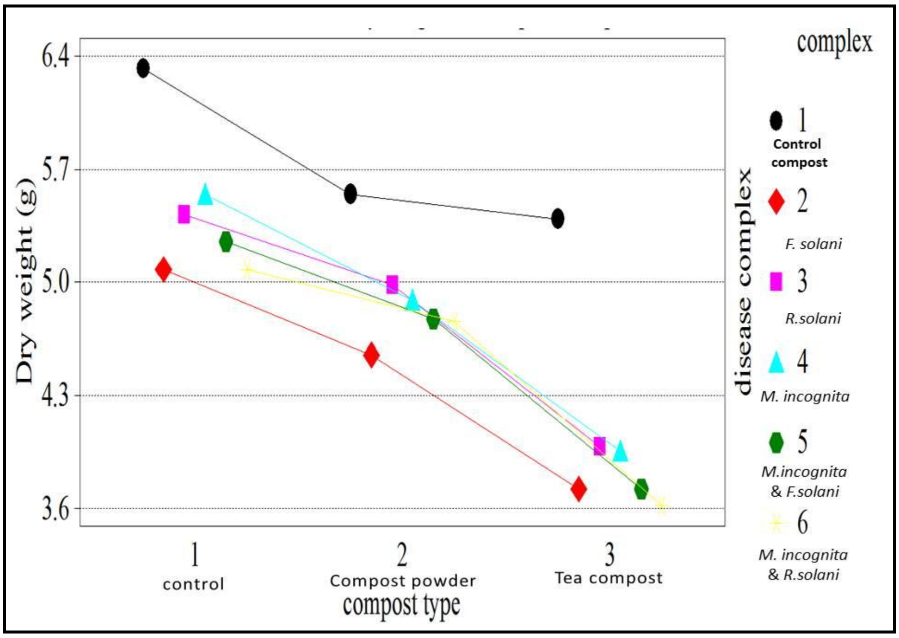

Fig. 4. Impact of powder compost and tea compost on dry weight of pepper plant infected with disease complex

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الإدارة الصديقة للبيئة لمرض نيماتودا تعقد الجذور وأعفان الجذور التي تصيب نباتات الفلفل باستخدام الكومبست وشاي الكومبست

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أجريت هذه الدراسة لتقييم فاعلية بودرة الكومبست ومستخلص شاي الكومبست في إدارة المعقد المرضي لعفن الجذور ونيماتودا تعقد الجذور النيماتودي علي نباتات الفلفل، معمليا تم تقييم التأثير التثبيطي لتركيزات مستخلص (شاي) الكومبست المختلفة (٢٥%، ٥٠%، ٧٥% و١٠٠%) علي فطري فيوزاريوم سولاني وريزوكتونيا سولاني المسببين لأعفان جذور الفلفل حيث أعطي الأخير حساسية عالية لمستخلص الكومبست عن فطر فيوزاريوم سولاني بنسبة ٨٨.٣٣% و ٨٢.٨٣% علي الترتيب عند تركيز ١٠٠%، وأوضحت النتائج أن التأثير التثبيطي لرواشح الكومبست غير المعقم (٦٥.٩٨% و٥٢.٣%) كانت أكثر معنوية عن المعقم (٥٤.٠٢% و٤٥.٩%) على معدل فقس بيض النيماتودا وموت اليرقات علي الترتيب في جميع التركيزات، وتحت ظروف الصوبة أوضحت النتائج إنخفاض نسبة الإصابة لأعفان الجذور في المعقد المرضي لكلا من بودرة الكومبست ومستخلص شاي الكومبست إلى ٢٢.١% و٢٠.١% مقارنته بالكنترول ٤٧.٤%، أدي استخدام الكومبست بالجرعة الموصي بها وكذا مستخلص شاي الكومبست إلى إنخفاض ملحوظ في أعداد العقد الجذرية بمتوسط (٦٤ و ٥٩ عقدة/جذر) مقارنة بالكنترول (١٠٨ عقدة/جذر) وهذه النتيجة صاحبها إنخفاض معنوي في عدد أكياس البيض المتكونة، على الجانب الآخر فقد دلت النتائج المتحصل عليها أن معايير نمو النبات (طول النبات والوزن الطازج والجاف) تحسنت بشكل معنوي نتيجة إضافة الكومبست ومستخلص شاي الكومبست، وبالتالي فان تطبيق استخدام الكومبست وراشح الكومبست يعتبر مصدر آمن وصديق للبيئة في الإدارة المستدامة لحل مشكلة الأمراض المركبة.

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