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Management of Wilt Disease Complex Caused by *Meloidogyne javanica* and *Fusarium Oxysporum* f.sp. *lycopersici* on Tomato Using Some Plant Extracts

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ABSTRACT

This work was conducted to study the effect of some ethanolic plant extracts i.e. lemon grass, *Cymbopogon citratus,* lantana, *Lantana indica,* camphor, *Cinnamomum camphora,* African marigold, *Tagetes erecta,* chrysanthemum , *Chrysanthemum indicum* and *Acacia senegal* at two concentrations (3 and 5%) on the control of wilt disease complex on tomato caused by root-knot nematode, *Meloidogyne javanica* and the fungus , *Fusarium oxysporum* f.sp *lycopersici* under greenhouse conditions at the Experimental Farm, Faculty of Agriculture, Menoufia University, Shibin El-Kom, Egypt. The results showed that application of plant extracts significantly reduced the disease severity, disease incidence, population of *M. javanica* / 100 g soil and root gall index. Furthermore, all treatments enhanced plant growth. Extract of *Cymbopogon citrates* 5% gave the best results in the control of target pests, followed by *Cinnamomum camphora* 5%. On the other hand, *Acacia sengegal* extract 3% showed the least effects on the tested pests.

Keywords: Fusarium wilt, root-knot nematode, medicinal plant, biocontrol.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops in the world, and grown in a wide range of temperature climate. Tomato is a high value crop because it contains carbohydrates, vitamins, sugars and proteins. Pests and diseases attack tomato led to huge losses in crop yield. Fusarium wilt caused by *Fusarium oxysporum* f.sp. *lycopersici* (Synder and Hansen) is one of the most prevalent and damaging disease of tomato. The yield losses caused by Fusarium wilt may reach 20 – 30% (Wibowo, 2005). Root-knot nematodes (*Meloidogyne* spp) are a major plant-parasitic nematode species cause significant damage by affecting the quantity and quality of fruits. Shady (2011) indicated that, one of the major obstacle facing the production of potato in Egypt is the damage caused by root-knot nematodes. Plant parasitic nematodes are uniquitous around the world which affect almost agricultural crops causing substantial yield loss to the farmers ((Manju and Sankari, 2015).

Fusarium wilt of tomato caused by fungus, *Fusarium oxysporum* f.sp. *lycopersici* causes great loss in warm climates and sandy soil of temperate regions (Mushtag, 2011). Disease complex involving nematodes and fugal pathogens significantly more crop losses than individually some resistant/ tolerant cultivars to fusarium wilt disease lose their characteristics and showed the symptoms of disease when parasitized by plant parasitic nematodes (McGawley, 2001). The increase of using various chemicals to management of plant diseases lead to huge environmental pollution such as contaminated ground and surface water, distributed the harmony existing among the soil and human disease. So, alternative method should be used to decrease the risk of using exterminators. Organic based materials have created worldwide interest in disease management which are eco-friendly and biodegradable in nature. Higher plants have fungi toxicity effect against spore germination and mycelial growth of phytopathogenic fungi (Verma and Dubey, 1999). According to Sinaga, 2006 the secondary metabolites produced by the higher plants may have anti-microbial effect against pathogens. These compounds include phenolic, cafeic acid, chlorogenic acid and alkaloids. Several studies have been done and showed that extracts of several tropical plants possess antifungal activities against plant pathogens (Suprapta *et al.,* 2008 and Asiti & Suprapta, 2012).

This study aimed to evaluate the antifungal and nematicidal activity of six ethanol plant extracts, Lemongrass (*Cymbopogon citrates* L.), Lantana (*Lantana indica* L.), Camphor (*Cinnamomum camphora*) , African marigold (*Tagetes erecta),* Acacia (*Acacia senegal* L.), and chrysanthemum (*Chrysanthemum indicum* .

MATERIALS AND METHODS

Preparation of *Fusarium oxysporum* culture:

Samples of tomato plant showing wilt disease symptoms were collected from vegetable experimental farm, Faculty of Agriculture, Shibin El-Kom. Samples were subjected to isolation trials for the organism according to the method devised by Sahi and Khalid (2007). The developed fungal colonies were purified onto Potato Dextrose Agar (PDA) medium by hyphal tip techniques. Purified isolated fungi were identified according to Nelson *et al.,* (1983). Subcultures of the obtained isolate were kept on PDA slants and stored at 5°C until used.

Nematode culture:

Second stage juveniles of the root knot nematode , *Meloidogyne javanica* were obtained from the pure culture reared on black nightshade , *Solanum nigrum* plants in the Nematode laboratory of the Entomology and Zoology Department of Faculty of Agriculture , Menoufia University.

Plant materials and preparation of solvent extracts:

Six aromatic and medicinal plants were collected from Floriculture and Ornamental Plants Farm, Faculty of Agriculture, Menoufia University . Leaves of Lemongrass, Lantana , Camphor , African marigold, fruits of Acacia and flowers of Chryanthemum were used in the study. The plant materials were washed with

clean water and chopped off into small pieces, then air dried for three days under room temperature and powdered using blender. One hundred gram of dried materials were soaked in one liter of ethanol (98%) and kept in it for 48 hours in the dark under room temperature for tissue maceration. After that, the extracts were filtered using two layers of cheese cloth followed by suing Whatman No. 1 filter paper. The final extracts were separately collected in other dark glass bottles and exposed to 60°C in a water bath for 30 min for ethanol evaporation. The collected extracts were then stored in a refrigerator at 5°C until used. This method was done according to El-Mougy and Mokhtar (2007) and Anak *et al.* (2015).

Effect of plant extracts on the disease complex on tomato under greenhouse conditions:

The effect of six ethanol plant extracts in the control of wilt disease complex (Fusarium and root-knot nematode) was carried out under greenhouse conditions at the Experimental Farm, Faculty of Agriculture, Menoufia University, Shebin Elkom, Egypt. Three seedlings (Five weeks old) were planted in plastic pot 25 cm in diameter filled with 4 kg sterilized clay-sand mixed soil (1:1, v/v) after one week for seedlings adaptation, plants extract were used at the concentration 3 and 5% by adding 10 ml / plant as soil drench around the roots, while Vydate was applied as 0.2 ml per pot as soil drench around the roots.

Three days later, 1000 J_2 of *M. javanica* were added by pipette into three holes around each seedling, at the same time *F. exysporum* (grown on sand wheat bran medium 1:1) was introduced to the soil at the rate of 3% soil weight. A randomized complete blocks design with four replicates was used. Pots were irrigated as needed and fertilized every four weeks. The experiment was terminated 60 days after planting.

At the end of the experiment, roots and shoots fresh weight, plant height were recorded. A scale of 0-4 was used to assess disease severity of Fusarium wilt, where 0= asymptomatic, 1= leaf wilted, 2= leaf with hemiplegic yellowing, 3= leaf with necrosis and 4= dead leaf.

The incidence of *F. oxysporum* was estimated 30, 45 and 60 days after planting via the index of leaf damage (ILD) following the formula of Beye and Lafay (1985).

Where: ILD = Σ notes / max Index of Leaf Damage Σ
Notes: Total notes.
Max: 4 time of developed-leave number.

Nematode Extraction and Numeration:

From each treatment, 250 ml soil was processed for nematode extraction. About 300-400 ml of water were added to the soil in a glass beaker (1000 ml) and the mixture was agitated by fingers, after few seconds the suspension was poured onto a 60 mesh-sieve and passing suspension was collected in another clean glass beaker. Materials caught on the 60 mesh-sieve were discarded, while the collected suspension was then poured onto a 200 mesh-sieve. Materials remain on the sieve were thoroughly washed by a gentle streamed of water into a 200 ml beaker. The resulting suspension containing nematodes was then transferred to a Modified Baermann pan fitted with soft tissue paper for the separation of active nematodes from debris and fine soil particles. After 72 hrs nematode water suspension was collected and concentrated to 20 ml in a vial by using a 350 mesh-sieve. An aliquant of 1 ml each of nematode suspensions were pipetted off, placed in a Hawksley counting slide and examined using a stereomicroscope. Roots were carefully washed, and the nematode galls were counted and rated as mentioned in Table (1) , as well as one gram per root was stained by acid fuchsin lactophenol to counted root knot nematode stages inside the roots with the aid of dissecting microscope.

Table. 1. Rating scale for the assessment of level of resistance or susceptible number of galls

Number of galls	Galling index	Resistance rating
0	0	Immune
1-2	1	Highly resistant
3-10	2	Resistant
11-30	3	Moderately resistant
31-70	4	Moderately susceptible
71-100	5	Susceptible
>100	6	Highly susceptible

Statistical analysis:

The obtained data were subjected to analysis of variance (ANOVA) using CoStat Software, Version 6.4 (2008). The mean differences were compared to Duncan's Multiple Range Test (DMRT).

Reduction percentages was computed according to Abbott formula (1925).

Increase or decrease % :Control – treatment/Control x 100

RESULTS AND DISSUSSION

As showed in Table (2) results on disease incidence of Fusarium wilt was more higher in the presence of root-knot nematode in comparison with Fusarium treatment only. Application of ethanol plant extracts were effective and significantly reduced index of leaf damage (ILD). In this respect, differences between these treatments and control are significant. *Cymbopogon citratus* (5% conc.) showed the superior inhibitory effect followed by *Cinnamomum camphora* (5% conc.) after 30, 45 and 90 days of treatments, respectively, while the lowest reduction in the fungus was attributed to *Acacia senegal* (3% conc.).

Results in Table (3) show the effect of medicinal plant extracts on the population density of root-knot nematode, *Meloidogyne javanica* infected tomato plants 30,60,and 90 days of treatment applications , under shield conditions.

The statistical analysis of the obtained data Table (3) indicate that all tested plant extracts significantly suppressed nematode population in the soil 30, 60, 90 days after treatment in comparison with control treatment .

As for the reduction percentages of the nematode percentages in the soil , the highest percentages was recorded at the treatments of Lemon grass, Camphor,

African marigold, and Lantana ranging between 81.0 - 89.4 % , while the least results was recorded with Chrysanthemum (*Chrysanthemum indicum*) giving 62.3 - 64.1 and Acacia (*Acacia senegal*) giving 58.1- 65.3 %.

Table 2. Wilt disease incidence as index of leaf damage (ILD) as influenced by different plant extracts after 30, 45, and 60 days of treatments

Treatments	conc. %	index of leaf damage (ILD) Days after planting								
		30 days			45 days			60 days		
		F	M	F+M	F	M	F+M	F	M	F+M
Lemon grass (*Cymbopogon citratus*)	3	0.072	0	0.090	0.156	0	0.174	0.193	0	0.205
	5	0.062	0	0.075	0.143	0	0.160	0.188	0	0.199
Lantana (*Lantana indica*)	3	0.212	0	0.224	0.280	0	0.301	0.460	0	0.481
	5	0.185	0	0.195	0.200	0	0.220	0.288	0	0.314
Camphor (*Cinnamomum camphora*)	3	0.130	0	0.142	0.394	0	0.412	0.566	0	0.590
	5	0.083	0	0.101	0.183	0	0.199	0.204	0	0.230
African marigold (*Tagetes erecta*)	3	0.088	0	0.099	0.187	0	0.201	0.204	0	0.219
	5	0.204	0	0.216	0.395	0	0.414	0.485	0	0.502
Acacia (*Acacia senegal*)	3	0.251	0	0.259	0.380	0	0.406	0.555	0	0.570
	5	0.222	0	0.226	0.340	0	0.371	0.540	0	0.560
Chrysanthemum (*Chrysanthemums indicum*)	3	0.158	0	0.168	0.412	0	0.429	0.590	0	0.604
	5	0.126	0	0.134	0.215	0	0.231	0.340	0	0.364
Fusarium+Meloidogyne	-	0.320			0.511			0.805		
Fusarium	-	0.268			0.443			0.670		
Meloidogyne	-	-			-			-		
Control	-	0			0			0		

Regarding to the effect of medicinal plant extracts on the population density of *Meloidogyne javanica* in the soil of tomato plants infected with nematode and Fusarium under shield plantation conditions , the statistical analysis of the results in Table (4) indicate that all tested plant extracts significantly suppressed nematode population in the soil 30, 60, 90 days after treatment in comparison with control treatment.

As for the reduction percentages of the nematode percentages in the presence of Fusarium , in the soil , the highest percentages was recorded at the treatments of Lemon grass, African marigold, Camphor, , and Lantana ranging between 76.0 - 89.2 % , while the least results was recorded with Chrysanthemum (*Chrysanthemum indicum*) giving 56.0 - 64.9 % and Acacia (*Acacia senegal*) giving 53.8 – 59.8 % .

Table. 3. Effect of medicinal plant extracts on the population density of root-knot nematode, *Meloidogyne javanica* infected tomato plants and reduction % ,under shield conditions

Treatments	Conc.	Aver. no. of *Meloidogyne javanica* juveniles/ 100 g soil				Reduction %			
		Days post-treatments							
		30 Days	60 Days	90 Days	Overall mean	30 Days	60 Days	90 Days	overall mean
Lemon grass (*Cymbonpogon citrates*)	3%	465.9 k	210.1 h	93.4 hi	256.5 i	72.1	89.4	96.0	85.8
	5%	405.0 l	132.7 k	20.1 j	185.9 l	75.8	93.3	99.1	89.4
Lantana (*Lantana indica*)	3%	603.6 f	300.0 f	135.4 g	346.3 f	63.9	84.9	94.2	81.0
	5%	512.0 i	280.9 g	97.4 h	296.8 h	69.4	85.8	95.9	83.7
Camphor (*Cinnamomum camphora*)	3%	572.8 g	204.6 h	176.5 f	317.9 g	65.7	89.7	92.9	82.5
	5%	502.4 j	143.8 j	16.0 j	220.7 j	70.0	92.8	99.3	87.4
African marigold (*Tagetes marigold*)	3%	532.8 h	178.0 i	67.8 i	259.5 i	68.1	91.0	97.1	85.4
	5%	460.2 k	113.4 l	18.0 j	197.2 k	72.5	94.3	99.2	88.7
Acacia (*Acacia senegal*)	3%	903.5 b	756.2 b	788.1 b	815.9 b	46.0	61.9	66.4	58.1
	5%	872.0 c	601.1 e	509.0 e	660.7 e	47.9	69.7	78.3	65.3
Chrysanthemum (*Chrysanthemum indicum*)	3%	861.4 d	632.9 d	700.6 c	731.6 c	48.5	68.1	70.1	62.3
	5%	793.2 e	688.3 c	598.0 d	693.2 d	52.6	65.3	74.5	64.1
Vydate 24% L	-	291.4 m	71.3 m	25.0 j	129.2 m	82.6	96.4	98.9	92.6
Control	-	1672.0 a	1982.2 a	2346.0 a	2000.1 a				
Check		0	0	0	0	0	0	0	0
LSD 5%	-	8.4	8.4	27.9	8.4				

Means in each column followed by the same letter (s) are not significantly different at 5% level.

Table. 4. Effect of medicinal plant extracts on the population density of *Meloidogyne javanica* in the soil of tomato plants infected with nematode and Fusarium under shield plantation conditions.

Treatments	Conc.	Aver. no. of *Meloidogyne javanica* juveniles/ 100 g soil				Reduction%			
		Days post-treatments							
		30 Days	60 Days	90 Days	Overall mean	30 Days	60 Days	90 Days	Overall mean
Lemon grass (*Cymbonpogon citrates*)	3%	463.0 f	129.9 i	33.4 gh	208.8 h	58.6	91.6	98.2	82.8
	5%	312.3 i	49.5 k	19.2 hi	127.0 j	72.1	96.8	98.9	89.2
Lantana (*Lantana indica*)	3%	479.2 f	300.6 f	101.0 e	293.6 f	57.2	80.6	94.6	77.5
	5%	483.7 g	160.9 h	59.0 f	234.5 g	56.9	89.6	96.9	81.0
Camphor (*Cinnamomum camphora*)	3%	538.4 e	288.0 f	98.1 e	308.2 f	51.9	81.4	94.8	76.0
	5%	388.2 h	80.1 j	13.5 i	160.6 i	65.3	94.8	99.3	86.5
African marigold (*Tagetes erecta*)	3%	422.1 g	178.3 g	40.8 g	213.7 h	62.3	88.5	97.8	82.9
	5%	390.3 h	92.5 j	11.8 i	164.9 i	65.1	94.0	99.4	86.2
Acacia (*Acacia senegal*)	3%	863.2 b	532.0 c	511.2b	635.5 b	22.9	65.6	72.8	53.8
	5%	801.7 c	434.8 e	389.9 c	542.1 d	28.4	71.9	79.2	59.8
Chrysanthemum (*Chrysanthemum indicum*)	3%	802.0 c	606.4 b	398.9 c	602.4 c	28.3	60.8	78.8	56.0
	5%	729.0 d	466.6 d	181.4 d	459.0 e	34.9	69.9	90.3	64.9
Vydate 24% L	-	197.5 j	49.9 k	9.0 i	85.5 k	82.4	96.8	99.5	92.9
Control (nematode + fungi)	-	1119.2 a	1548.5 a	1877.3 a	1515.0 a	-	-	-	-
Check		0	0	0	0	0	0	0	0
LSD 5%	-	17.6	14.6	15.5	14.8				

Means in each column followed by the same letter (s) are not significantly different at 5% level.

As for the effect of plant extracts on some vegetative characters and root gall index of tomato plants infested with root knot nematode , *M. javanica* and rot fungus , *F. oxysporum* , the statistical analysis of the obtained data in Table (5) indicated that there were significant differences in all tested measurements between control treatment and all other treatments.

Table. 5. Effect of leaf and flower extracts of certain plants on some tomato plant characters and root gall index.

Treatments	Conc.	plant height cm			shoot weight g			root weight g			root gall index	
		N	N+F	F	N	N+F	F	N	N+F	F	N	N+F
Lemon grass (*Cymbopogon citratus*)	3%	60.0 ab	58.1 ab	60.5 ab	67.4 bc	75.4 bc	74.4 bc	14.9cd	12.3 de	10.2 ab	2.0 cd	2.0 cd
	5%	60.5 ab	58.7 ab	61.4 ab	71.4 b	78.1 b	77.4 b	17.0 b	15.2 bc	11.1 a	1.0 d	1.0 d
Lantana (*Lantana indica*)	3%	53.9 bc	53.2 bc	57.4 b	66.0 bc	71.6 bc	69.1 bcd	13.0 e	14.0 c	10.0 ab	1.5 cd	2.5 bcd
	5%	54.0 bc	53.1 bc	58.3 b	67.4 bc	73.4 bc	72.0 bc	15.1cd	14.5 bc	10.6 ab	2.0 cd	1.0 d
Camphor (*Cinnamomum camphora*)	3%	59.0 ab	58.2 ab	59.6 b	65.8 bc	71.4 bc	70.1 bcd	10.0 f	11.2 ef	8.0 de	4.5 ab	4.0 ab
	5%	59.8 ab	58.6 ab	60.1 ab	70.5 b	75.3 bc	74.5 bc	16.3bc	16.0 b	9.3 bcd	5.0 a	3.5 abc
African marigold (*Tagetes erecta*)	3%	54.0 bc	56.1 b	57.6 b	64.2 bc	70.6 bc	68.6 cd	9.0 fg	8.1 h	9.7 abc	2.5 cd	2.0 cd
	5%	54.1 bc	56.3 b	58.4 b	70.0 b	74.4 bc	73.4 bc	9.5 fg	9.8 fg	8.0 de	2.0 cd	1.0 d
Acacia (*Acacia senegal*)	3%	52.4 bc	56.8 b	54.9bc	65.1 bc	71.3 bc	69.0 bcd	13.5de	7.9 h	7.6 e	3.0 bc	2.5 bcd
	5%	52.9 bc	56.9 b	56.0 b	67.9 bc	72.8 bc	72.5 bc	14.1de	8.2 gh	7.9 de	2.5 cd	1.0 d
Chrysanthemum (*Chrysanthemums indicum*)	3%	55.5 bc	56.4 b	56.4 b	65.2 bc	68.6 cd	68.4 cd	8.5 fg	7.8 h	7.8 de	5.0 a	4.5 a
	5%	56.4 bc	57.4 b	58.5 b	68.3 bc	69.5 c	69.8 bcd	8.5 fg	8.0 h	7.9 de	4.5 Ab	4.0 ab
Vydate 24% L	-	65.5 a	61.0 ab	60.8 ab	69.5 bc	70.0 bc	69.0 bcd	15.0 cd	13.9 cd	11.0 a	1.0 d	1.0 d
Control	-	48.6 c	45.6 c	46.6 c	61.2 c	60.2 d	62.2 d	8.0 g	7.5 h	7.1 e	6.0 a	5.0 a
Check	-	65 a	66 a	68 a	90 a	88 a	87 a	19 a	21 a	10.2ab	0	0
LSD 5%	-	8.3	8.3	8.3	8.3	8.7	8.4	1.7	1.7	1.7	1.7	1.6

It was clearly show that all treatments led to considerable increase of plant height, shoot weight and root weight and considerable decrease on root gall index (RGI) comparing to control (pathogenic treatment). The highest increase was obtained with *C. citratus* (5% conc.) followed by *C. camphora* (5% con.) while the least increase was observed by *A. senegal*.

As for the increase or decrease of tested characters Table (6) the obtained results indicated that all plant extracts increased plant height, shoot weight, root weight ,while it decreased root gall index.

Table. 6. Increase or decrease of some vegetative characters and gall index as influenced by plant extract application

Treatments	C.	plant height %			shoot weight %			root weight %			root gall index %	
		N	N+F	F	N	N+F	F	N	N+F	F	N	N+F
Lemon grass	3%	23.5	27.4	29.8	10.1	25.2	19.6	86.2	64.0	43.7	-66.7	-60.0
(*Cymbopogon citratus*)	5%	24.5	28.7	31.8	16.7	29.7	24.4	112.5	102.7	56.3	-83.3	-80.0
Lantana	3%	10.9	16.7	23.2	7.8	18.9	11.1	62.5	86.7	40.8	-78.3	-56.0
(*Lantana indica*)	5%	11.1	16.4	25.1	10.1	21.9	15.8	88.8	93.3	49.3	-66.7	-80.0
Camphor	3%	21.4	27.6	27.9	7.5	18.6	12.6	25.0	80.0	12.7	-25.0	-20.0
(*Cinnamomum camphora*)	5%	23.0	28.5	28.9	15.2	25.0	19.8	103.8	113.3	31.0	-16.7	-30.0
African marigold	3%	11.1	23.0	23.6	4.9	17.3	10.3	12.5	8.0	36.6	-58.3	-50.0
(*Tagetes marigold*)	5%	11.3	23.5	25.3	14.4	23.6	18.0	18.8	30.7	12.7	-66.7	-80.0
Acacia	3%	7.8	24.6	17.8	6.4	18.4	10.9	68.7	5.3	7.0	-50.0	-56.0
(*Acacia senegal*)	5%	8.8	24.9	20.2	10.9	20.9	16.6	76.2	9.3	11.3	-58.3	-80.0
Chrysanthemum	3%	14.1	23.7	21.0	6.5	13.9	10.0	6.2	4.0	9.9	-16.7	-10.0
(*Chrysanthemums indicum*)	5%	16.0	25.9	25.5	11.6	15.4	12.2	6.2	6.7	11.3	-25.0	-20.0
Vydate 24% L	-	34.7	33.8	30.5	13.6	16.3	10.9	87.5	85.3	55.0	-83.3	-80.0
Control	-	-	-	-	-	-	-	-	-	-	-	-
Check		33.7	44.7	45.9	47.1	46.2	39.9	137.5	180.0	43.7	0	0

- means decrease in root gall index

Disease complex situations in agricultural crop systems are very common in nature. The interaction between pathogenic fungi and plant parasitic nematodes leading to huge damage in plant production. Nagesh *et al.* (2006) demonstrated that, *Meloidogyne incognita* predisposed tomato to *Fusarium oxysporum* infection.

This study revealed that some ethanol plant extracts were highly toxic against *Fusarium oxysporum* and root-knot nematode *Meloidogyne javanica*.

The nematicidal effect of botanicals may attributed to their high contents of certain oxygenated compounds which enable them to dissolve the cytoplasmic membrane of nematode cells and their functional groups (Ghazalbash and Abdollahi, 2013). According to Korayem *et al.* (1993) exposure of *M. incognita* juveniles to water extract solution of *Thymus vulgaris* shoot powder and *Punica granatum* fruit powder for 72 hr reduced the number of active nematodes by 100%. Aqueous seed extract of *Lantana camara, Melothria purpusilla* and *Jatropha curcas* have inhibitory effect on egg hatching and juvenile mortality of *M. incognita* (Joymati *et al.,* 1998).

Anak *et al.* (2015) reported that, acetone leaf extract of *Cinnamomum burmanni* effectively suppressed the radial growth, biomass formation and spores formation of *F. oxysporum* f.sp. *lycopersici in vitro* condition on PDA and PDB media. Leaves alcoholic extracts of *Cinnamomum zeylanichum* and *Eucalyptus microtheca* possessed potential *in vitro* antifungal activity against *Penicillium digitatum* and *Aspergillus niger*. Phytochemical analysis of ethanol curd extract of cinnamon showed a wide variety of secondary metabolites; flavoroids, alkaloids, tannins, saporins, terpens, steroids and essential oils which have antimicrobial activity against pathogenic fungi (Sameer, 2012).

Alcoholic extracts enhanced the presence of nature bioactive compounds which have higher antifungal effect (Ghosh *et al.,* 2008). On the same trend, Ibekwe *et al.* (2001) found that, the high volatility of alcoholic, methanolic or ethanolic extracts trend to extract a wider range of antimicrobial compounds from the sample of the aqueous extract. Secondary metabolites of plant extracts showed inhibitory effect on fungal growth, disease development and disease incidence on some diseases of cucumber (Mohamed and El-Hadidy, 2008).

Furthermore, uses of plant extracts enhance the plant growth according to Kahkashan and Biswas (2013) who use plant extracts of some medicinal and aromatic plants including *Acacia Arabica* and *Cymbopogon floxosus* as seed treatment which significantly increased seed germination, shoot length and root length on tomato.

Medicinal plant extract have bio-efficacy in controlling the disease incidence of plants. So the present study demonstrated that application of these extracts is safe and low cost and reduce the risk of chemical pesticides.

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مكافحة مرض الذبول المركب في الطماطم المُتسبب عن فطر *Fusarium oxysporum* f.sp. *lycopersici* ونيماتودا *Meloidogyne javanica* باستخدام بعض المستخلصات النباتية

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تم إجراء هذا البحث في الصوبة بمزرعة التجارب بكلية الزراعة بشبين الكوم – جامعة المنوفية وذلك لدراسة تأثير المُستخلص الإيثانولي لبعض النباتات الطبيَّة وهي : اوراق كل من حشيشة الليمون – لانتانا – الكافور – القطيفة – بذورالسنط العربي وازهارالاقحوان على المُعقد المرضي المُتسبب عن فطر *Fusarium oxysporum* f.sp. *lycopersici* ونيماتوداتعقد الجذور *Meloidogyne javanica* على الطماطم بتركيزين ٣ و ٥٪.وقد أظهرت النتائج أن كل المُستخلصات كان لهم تأثير فعَّال على تثبيط نمو كل من الفطر و النيماتودا ، كما ادى تطبيق المستخلصات الى خفض نسبة الإصابة، الشدة المرضية، عدد يرقات النيماتودا في كل ١٠٠ جرام تربة، عدد العُقَد النيماتودية على النبات، بالإضافة إلى تحسين نمو النباتات. وكان أفضل المُستخلصات هو مُستخلص حشيشة الليمون بتركيز ٥٪ ، يليه مُستخلص الكافور بتركيز ٥٪ ، بينما كان أقل المُستخلصات فاعلية هو مُستخلص السنط العربي بتركيز ٣٪.