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Evaluation of some Plant Extracts in Control Damping-off and Mildew Diseases of Cucumber

M.R.A. Tohamy*; A.Z. Aly*; T.H. Abd-El-Moity; M.M. Atia* and Maisa L. Abed-El-Moneim****

* *Agric. Bot. Dept., Fac. Agric., Zagazig Univ., Zagazig, Egypt.*

** *Integrated Cont. Dept., Pl. Pathol. Res., Agric. Res. Centre, Giza, Egypt.*

Plant extracts of neem, camphor leaves and garlic bulb reduced linear growth of cucumber soil-borne pathogens. The most effective concentration in this regard was 5%. Plant preparations tested, either in the form of suspension or as a powder, significantly reduced disease incidence. On the other hand, neem and garlic plant extracts drastically reduced incidence of powdery and downy mildews disease. It is also clear that, garlic extract was more effective than neem extract. Four weeks cucumber plants responded positively to weekly sprays with neem and garlic extracts at all concentrations tested. These treatments reduced either powdery or downy mildew diseases and increased number as well as weight of fruits/plant compared with check treatment.

Key words: Cucumber, downy mildew, plant extract, powdery mildew and soil-borne diseases.

Garlic extract was used as seed treatment to depress *Pythium aphanidermatum* growth. Inhibition of plant pathogens is due to the effect of plant products used, which inhibit hydrolytic enzymes production in the pathogen by different degrees (Kurucheve and Padmavathi, 1997). Garlic gloves extract is very effective against *Fusarium solani, Rhizoctonia solani, Sclerotinia sclerotiorum* the causal organisms of watermelon and cantaloupe damping-off (Shalaby and Atia, 1996). Soil amendment with neem (*Azadirachta indica*) seed cake, significantly effective against *Fusarium solani, Macrophomina phaseolina* and *Rhizoctonia solani* (Ehteshamul *et al.*, 1998).

Qvarnstrom (1992) stated that, only 2-10% of the leaf areas were infected by *Erysiphe cichoracearum* in cucumber plants treated with 5% garlic extract compared with 83-85% in check treatment. While, neem products gave reasonable control against *Uncinula necator* ,the cause of powdery mildew in grapevine (Reh and Schlosser, 1994). Complete inhibition of conidial germination of *Erysiphe pisi* was observed when the active compound drived from garlic was used at the rate of 25 mg/liter. This active compound of garlic extract sprayed at 100 mg/liter controlled powdery mildew in growth chamber (Singh *et al.*, 1995). Treatment pea plants with neemazal (neem drived product) before inoculation with *Erysiphe pisi* gave more effective control than post inoculation. Neemazal led to increase in phenylalanine ammonialyase activities in pea leaves, compared with non-treated leaves (Singh and

Prithivira, 1997). Volf and Steinhouer (1997) showed that, neem methanol extract did not inhibit powdery mildew (*Sphaerotheca fuliginea*) of cucumber. Singh *et al.* (2000) found that, seed bacterization by *Pseudomonas fluorescens* and *Ps. aeruginosa* alone and/or in combination with aerial spray of their cell suspension or Neemazal at different concentration controlled powdery mildew of pea. Combinations of seed bacterization with either aerial sprays of bacterial cell suspensions or Neemazal were more effective in controlling the disease than seed bacterization alone. Bacterization by both bacteria and aerial spray of Neemazal increased the dry weight of aerial parts, number of nodules and pods as well as seed weight of pea plants.

This study was carried to determine the efficacy of most effective concentration and formula of some plant extracts to reduce linear growth of cucumber damping-off disease incidence. Also, their effect in controlling cucumber powdery and downy mildews disease.

Materials and Methods

1. Soil-borne diseases:

1.1. Effect of plant extracts on linear growth of soil-borne pathogens:

Tissue extracts of garlic bulbs, neem and camphor leaves were prepared by blending 10 g of frozen plant materials with 100 ml water for 5 minutes. The resultant was strained through a double cheesecloth fabric, and centrifuged for 10 minutes at 3000 rpm. Sterilization was made by 0.2 µm milipore filters. The extract was added (1.5 ml/plate) to the gliotoxin fermentation medium (GFM) as described by Brian and Hemming (1945). Inoculation was made with *Rhizoctonia solani*, *Fusarium solani* and *Sclerotium rolfsii* previously isolated in another work (Aly *et al.*, 2002). Control (check) plates- devoiding extracts were incubated under similar conditions at 28°C. Retardation in linear growth was determined according to the formula:

$X = [(G_2/G_1) \times 100] - 100$ where:

X = % of reduction.

G_1 = linear growth in check treatment.

G_2 = linear growth in treatment.

1.2. Cucumber damping-off control:

The cucumber greenhouse at Dokki, with a previous damping-off history, was used in this work. Conformation of the disease incidence was made by isolation from soil, identification and pathoginicity tests (Aly *et al.*, 2002). Three replicates were used for each treatment (1x2.5 ml infested plot). Ten seeds/treatment of variety Primo were planted in each plot. Efficacy of the treatment was assessed based on the determination of the percentage of pre- and post-emergence as well as the percentage of plant survivors.

1.2.1. Cucumber seed treatment with plant extracts:

Plant extracts of garlic, neem and camphor were prepared as mentioned before, to give 10 , 5 and 2.5 % of the actual extracts. Cucumber seeds were soaked in the prepared dilutions for 60 minutes and in pure water for check treatment. The seeds

were then sown in infested soil at the rate of 10 seeds/replicate under greenhouse conditions. Three replicates were used for each treatment.

1.2.2. Application of the extracted plant materials for damping-off control:

The plant extracts were evaluated for cucumber damping-off control by using two different methods of application. The wet method depends on soaking the cucumber seeds in the plant extract for one hour. The dry method depends on mixing the seed with talcum powder laden with the extract and Arabic gum. The dried preparation was produced by mixing 250 g of talcum with 250 ml of the extract and spread till drying. The dried preparation was used at the rate of 4 g/kg seed after being moisten with 5 % Arabic gum.

The seeds were sown after treatment at rate the of 10 seeds/replicate. Three replicates were considered for each treatment. Records were made on pre-emergence after 5,7 and 9 days of planting as well as post- emergence damping-off after 9, 11, 15 days. The percentages of survivals were determined one month after sowing:

2. Mildew diseases:

The plant extracts in concern were used in the control of powdery and downy mildew(s) disease under greenhouse conditions. Cucumber varieties Fares and Primo susceptible to powdery and downy mildew(s), respectively, were used.

2.1. Control of downy and powdery mildew diseases with garlic and neem extracts:

Four weeks-old Fares and Primo cucumber plants were used. Both cultivars received a weekly spray with the original garlic extract (10%). Another group of the same cultivars received the neem extract (10%) at the same intervals. Three replicates were considered for each treatment.

2.2. Effect of the number of sprays with garlic and neem extracts on mildews control:

Three groups of each of the cultivars in concern were used for either garlic or neem spraying. The first group received a weekly spray, whereas the second and the third groups received one spray every two or three weeks.

2.3. Effect of garlic and neem extracts dilutions on mildews control:

The original (10 %) garlic or neem extracts were diluted to give 5% and 2.5%. Three groups of four weeks-old cucumber plants of varieties Primo and Fares were used. Spraying was made weekly with different dilutions of garlic and neem extracts.

2.4. Plant age in relation to the efficacy of the spray:

Three groups of cucumber plants, varieties Primo and Fares 4, 5 and 6 weeks old were used. Garlic or neem extracts (100 ml/l) were sprayed. Three replicates (60 plants/rep.) were considered for each treatment. Check treatments were sprayed with water only.

2.5. Disease readings:

In the abovementioned experiments, results were mostly recorded on disease incidence, disease severity, average number of fruits/plant and average weight of fruits/plant. Statistical analysis was made according to Duncan (1954) and Gomez and Gomez (1984).

Results and Discussion

Data in Table (1) reveal that, garlic extract showed a high suppressive effect on linear growth of *Rhizoctonia solani* and *Fusarium solani*. This effect might be due to the presence of certain disulfide amino acids in the garlic extract as mentioned by Abd-EL-Moity (1981). Garlic extract contains as well special materials which inhibit the activity of hydrolytic enzymes produced by the pathogen (Kurucheve and Padmavath, 1997). Such inhibition results in unavailability of nutrients necessary for anabolism. The highest suppressive effect on *S. rolfsii* was obtained when neem was added to the medium, that might be attributed, however, to excretion of oxalic acid (Bateman and Beer, 1964), that increased the efficacy of the active component in the neem extract under such acidic conditions.

Table 1. Effect of plant extracts on the mycelial growth of the tested pathogenic soil-borne fungi

Plant extract	Reduction (%) in the linear growth of the pathogenic isolate			
	Rhizoctonia solani	*Fusarium solani*	*Sclerotium rolfsii*	Mean
Neem	30.000	48.800	77.633	52.144
Camphor	0.000	11.067	0000	3.6898
Garlic	54.400	77.633	61.100	64.377
Check	0.000	0.000	0.000	0.000
Mean	21.100	34.575	34.683	
LSD. at 5%	0.2382	0.1575	0.1031	

Three concentrations of different plant extracts were tested to determine the most effective concentration in controlling cucumber damping-off disease. Data in Table (2) indicate that, there was no linear correlation between plant extract concentrations and efficacy. Plant extracts at 10% concentration showed reduction in the percentage of survivals, compared with the other concentrations that might explain the direct effect of the high concentration of plant extracts on the treated plants. When plant extracts were used at lower concentrations (5 or 2.5%) better control results was recorded. The percentage of survival plants was increased, however, by increasing the concentration from 2.5 to 5%. This might be due to more active ingredient in plant extract at concentration of 5%. These results are in agreement with those obtained by Dik and Staay (1994) and Dwived and Singh (1998).

Food base or formula played an important role on efficacy of the treatment (Abd-El-Moity, 1981). Plant extracts behaved differently according to formula. Neem was more effective in controlling soil-borne pathogen when used as powder compared with that applied as a suspension (Table 3). This might be due to the effect of dilution following irrigation of plants of the latter treatment. No clear differences between the two forms used of garlic application that might be due to that garlic acts through the volatile oils (Abd-El-Moity, 1981). These volatile compounds are liberated from the carrier either it was in the form of suspension or powder. Camphor showed the least effect and no differences was noticed between the two forms (Table 3). The effect can be attributed to the volatile oils as well.

Table 2. Effect of cucumber seeds treatment in different concentrations of plant extracts on damping-off disease

Plant extract	Concentration of plant extract								
	10%			5%			2.5%		
	Pre *	Post	Survival	Pre	Post	Survival	Pre	Post	Survival
Neem	23.33	51.33	25.34	13.33	20.00	66.67	30.00	13.33	56.67
Garlic	23.33	33.33	43.34	16.67	20.00	63.33	26.67	16.66	56.67
Camphor	40.00	43.33	16.67	30.00	23.33	46.67	60.00	13.33	26.67
Check	43.33	56.67	0.00	43.33	56.67	0.00	43.33	56.67	0.00
LSD at 5%	7,303	8,324	7,797	9,926	7,209	6,752	6,324	14,42	13,50
at 1%	N.S	11,31	10,60	N.S	9,798	9,170	7,156	N.S	18,35

* Pre (Pre-emergence) Post (Post emergence)

Table 3. Effect of dressing cucumber seeds with plant preparation on the percentage of cucumber damping-off disease

Treatment	Formula tested					
	Suspension			Powder		
	Pre	Post	Survival	Pre	Post	Survival
Neem	13,33	20,00	66,67	6,67	16,67	76,66
Garlic	16,67	20,00	63,33	23,33	13,33	63,34
Camphor	30,00	23,33	46,67	50,00	6,67	43,33
Check	43.33	56.67	0.00	43.33	56.67	0.00
LSD at 5%	9,308	7,880	9,503	13,16	5,572	9,503
at 1%	12,92	10,94	13,19	N:S	N:S	13,190

* Pre (Pre-emergence) Post (Post emergence)

Using neem or garlic extracts on cucumber plants to reduce powdery or downy mildew disease was carried out at different spraying intervals. Data obtained in Table 4 show that, neem gave good control of both diseases when used at short intervals.

Table 4. Effect of spraying with plant extracts on cucumber powdery and downy mildews disease control

Treatment	Formula tested							
	Suspension				Powder			
	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits / plant	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits / plant
Neem	16.00	11.35	20.00	3.60	90.00	27.00	19.67	3.667
Garlic	10.00	10.00	21.00	3.72	80.00	16.33	21.33	3.833
Check	100.00	67.13	9.00	1.280	100.00	65.67	10.00	1.430
LSD at 5%	0.167	6.073	2.825	0.025	0.167	1.884	2.209	0.283
at 1%	0.253	9.201	4.281	0.383	0.253	2.854	3.346	0.428

Treatment at two weeks-interval resulted in an increase in mildew severity, contrary to the three weeks (Table 5). In this regard Singh and Prithivira (1997) reported that, neem application increased phenylalanine ammonialyase activity in leaves which inhibited disease development. Garlic acts on disease through certain volatile compounds (Abd-El-Moity, 1981). Therefore when the interval was increased from one to two weeks, considerable increase was noticed in either disease incidence or disease severity. Similar trend could be observed at 3 weeks interval that might be due to the removal of the active materials from the site of infection, making the court of infection suitable for the pathogen to attack cucumber plants.

Table 5. Effect of sprays number on the control of powdery and downy mildews disease of two varieties of cucumber

Treatment	Downy mildew on var. Primo				Powdery mildew on var. Fares			
	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits/ plant	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits / plant
Neem								
Spraying every week	16.00	11.317	20.000	3.60	90.00	27.00	19.667	3.667
Spraying every 2 weeks	16.00	25.290	15.000	2.40	100.00	29.67	16.333	3.267
Spraying every 3 weeks	84.00	25.600	10.000	1.65	100.00	35.67	13.000	2.067
Garlic								
Spraying every week	10.03	10.00	21.00	3.72	80.00	16.33	21.33	3.833
Spraying every 2 weeks	16.00	11.35	13.00	2.10	80.00	20.67	18.33	3.367
Spraying every 3 weeks	50.00	53.20	13.00	2.00	90.00	26.33	16.00	2.900
Check	100.00	67.13	9.00	1.28	100.00	65.67	10.00	1.430
L.S.D. for Plant extract (A)								
at 5%	0.073	2.194	1.579	0.048	0.630	1.332	0.953	0.133
1%	0.102	3.045	2.191	0.066	0.875	1.849	1.323	0.184
L.S.D. for Application (B)								
at 5%	0.104	3.103	N.S.	0.068	0.891	1.884	N.S.	0.188
1%	0.144	4.306	N.S.	0.094	1.237	2.615	N.S.	0.261
L.S.D. for A x B								
at 5%	0.146	4.388	7.232	0.095	1.260	2.664	1.348	0.266
1%	0.203	6.090	N.S.	0.133	1.749	3.698	1.871	0.368

To show if there exist any correlation between the efficacy and concentration of the plant extracts to control powdery and downy mildews disease at different concentrations of neem or garlic extracts were used. Table (6) indicates a negative correlation between concentration and either disease severity or disease incidence. The higher increase in concentration of the extract, the greater being in disease incidence. However, when garlic extract was changed from 5% to 2.5% considerable increase was noticed in disease severity. In this regard it is known that neem acts through the stimulation of certain enzymes such as phenylalanine ammonialyase (Singh and Prithivira, 1997), and garlic acts through presence of Alkyl cysteine sulphoxides (Abd-El-Moity, 1981), which is converted to theol that affects the pathogen. So a high concentration of garlic is an essential element in disease control. The number of fruits and yield of course were negatively correlated with severity of both powdery and downy mildews disease.

Table 6. Effect of the concentration of plant extract on the control of powdery and downy mildews disease of cucumber

Treatment	Downy mildew on var. Primo				Powdery mildew on var. Fares			
	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits/ plant	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits/ plant
Neem								
10%	16.00	11.35	20.00	3.60	90.00	27.00	19.67	3.67
5%	50.33	22.70	13.00	2.20	100.00	28.67	15.00	3.20
2.5%	84.00	26.35	10.00	1.40	100.00	31.33	13.00	1.93
Garlic								
10%	10.00	10.00	21.00	3.72	80.00	16.33	21.33	3.83
5%	50.00	27.60	11.00	1.64	90.00	22.67	19.00	3.07
2.5%	64.00	60.10	10.00	1.46	96.67	26.33	16.00	2.60
Check	100.00	67.13	9.00	1.28	100.00	65.67	10.00	1.43
L.S.D. for Plant extract (A)								
at 5%	1.103	0.724	1.743	0.009	0.338	0.623	0.919	0.111
1%	1.530	3.047	2.420	0.012	0.469	0.865	1.275	0.154
L.S.D. for concentrations (B)								
at 5%	1.559	3.105	N.S.	0.012	0.478	0.881	1.299	0.157
1%	2.164	4.309	N.S.	0.017	0.663	1.223	1.803	0.271
L.S.D. for A x B								
at 5%	2.205	4.391	N.S.	0.018	0.676	1.246	1.838	0.222
1%	3.061	6.094	N.S.	0.024	0.938	1.729	N.S.	0.307

Table 7 shows that the results of plant spray either with neem or garlic extract are being affected with the plant age. Four-weeks old plants showed better control results than those received the same treatment at six-weeks. The early sprays possibly enhances the early production of an anti-fungal materials before the initial development of the pathogen in the tissue. The mechanism of inhibition of the disease development following the application of neem preparations was previously discussed (Singh and Prithivira (1997), and the role of the volatile theol compounds from garlic was reported by Abd-El-Moity (1981).

Table 7. Effect of spraying time with plant extracts on controlling powdery and downy mildews disease of two cucumber varieties

Treatment	Downy mildew on var. Primo				Powdery mildew on var. Fares			
	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits/ plant	Disease (%)	Disease severity	No. of fruits / plant	W. of fruits/ plant
Neem								
Four weeks from sowing	16.00	11.35	20.00	3.60	90.00	27.00	19.00	3.67
Six weeks from sowing	84.00	22.70	10.00	1.56	100.00	34.33	11.00	1.70
Garlic								
Four weeks from sowing	10.00	10.00	21.00	3.72	80.00	16.33	21.33	3.83
Six weeks from sowing	50.00	53.20	15.00	2.40	100.00	30.67	15.67	2.47
Check	100.00	67.13	9.00	1.28	100.00	65.67	10.00	1.43
L.S.D. for Plant extract (A)								
at 5%	0.088	3.024	6.204	0.011	0.664	1.177	1.079	0.145
1%	0.125	4.302	N.S.	0.015	0.945	1.674	1.535	0.206
L.S.D. for Time (B)								
at 5%	0.108	3.704	N.S.	0.013	0.814	1.442	1.322	0.177
1%	0.153	5.268	N.S.	0.018	1.157	2.051	1.880	0.252
L.S.D. for A x B								
at 5%	0.152	5.238	N.S.	0.018	1.151	2.039	1.870	0.251
1%	0.217	7.451	N.S.	0.026	1.637	2.900	N.S.	0.357

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تقييم بعض المستخلصات النباتية لمكافحة موت البادرات وأمراض البياض فى الخيار

محمد رضا أحمد التهامى*، أحمد زكى على*، محمود محمد محمد عطية*،
توفيق حافظ عبد المعطى**، مايسة لطفى عبد المنعم**

* قسم النبات الزراعى-كلية الزراعة-جامعة الزقازيق.
** قسم المقاومة المتكاملة-معهد بحوث أمراض النبات-مركز البحوث الزراعية-الجيزة.

كانت مختلف المستخلصات النباتية تحت الأختبار (أوراق النيم والكافور وأوراق وأبصال البصل) ذات تأثير كبير على معدل نمو المسببات المرضية المحمولة بالتربة. وقد كان تركيز ٥% أكثر تركيزات المستخلصات النباتية تأثيرا على الفطريات المحمولة بالتربة. كما كانت جميع المستخلصات النباتية المختبرة بشكليها (معلق أو مسحوق) ذات تأثير معنوى على تقليل مرض موت البادرات. ومن ناحية أخرى كانت المستخلصات النباتية المختبرة ذات تأثير كبير على تقليل شدة الأصابة بمرضى البياض الدقيقى والزغبى فى الخيار. كما كان واضحا أيضا أن مستخلص البصل ذو تأثير أكبر من مستخلص النيم. وقد كانت نباتات الخيار عمر ٤ أسابيع والتى تم رشها أسبوعيا بأى من التركيزات المختبرة (٢,٥ ، ٥ ، ١٠) أكثر قوة وأقل عرضة للأصابة بمرضى البياض الدقيقى والزغبى كما كان عدد و وزن الثمار كبيرا بالمقارنة بالنباتات غير المعاملة (نباتات المقارنة).