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MANAGEMENT OF POTATO COMMON SCAB CAUSED BY *STREPTOMYCES SCABIES* USING COMPOST AND COMPOST TEA

Mohamed A. M Abdel-Hamid[1]; Emad A. Hassan[1]; Ali A. Elbana[2] and Anwar A. Galal [2]

[1] Central Lab of organic Agriculture, Agricultural Research Centre, Giza, Egypt.
[2] *Department of Plant Pathology, Fac. Agric., Minia Univ.-Egypt.*

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ABSTRACT

Four pathogenic bacterial isolates were isolated from naturally infected potato tubers showing typical potato scab symptoms and showed significant virulence values, since isolate CS1 was the most aggressive isolate (75.2% DI) and (32.12% DS) followed by CS2 (71.6% DI) and (31% DS) and CS4 (70.6% DI) and (30.27% DS).Isolate CS3 was the least pathogenic (65.2% DI) and (27.7% DS). Identification trial that based on the morphological, biochemical and physiological properties showed that all 4 bacterial isolates were similarly reacted as *Streptomyces scabies* (Thaxter). Two field experiments were conducted to study the efficacy of compost tea and compost on potato common scab incidence and severity. Treatment of potato plants cv. Berna with compost or compost tea significantly reduced the severity of common scab and number of scabbed tubers compared to the untreated control. However, compost was more suppressive to potato common scab as compared to compost tea. Moreover, Nile compost was more effective to reduce disease than Al obour compost.

Key words: Potato common scab, *Streptomyces scabies*, compost and compost tea.

INTRODUCTION

Common scab, caused by filamentous Gram-positive bacteria in the genus *Streptomyces*, is an important disease of potatoes (*Solanum tuberosum* L.) worldwide. The disease mainly affects the quality of potato by producing superficial, pitted, or raised lesions on the tuber surface. Common scab has been rated among the top five diseases by potato seed producers in the USA (Slack, 1991) .Yield may also be affected by delayed emergence and increase amounts of small tubers (Youssef, 2000; Galal *et al*. 1999; Hiltunen *et al*. 2005 and Bencheikh and Setti, 2007).They reported that the major common scab inducing organism is *Streptomyces scabies*. Furthermore, *Streptomyces scabies* isolates causing symptoms with aggressiveness of strains varying from mild to moderately severe (DSMZ, 2015).

Numerous organic soil amendments have been tried in efforts to decrease severity of common scab and other soil-borne diseases, to induce plant defenses responses and to improve soil quality (Lazarovits, 2010). Composts have been shown to enhance disease suppression against soil borne plant pathogens in peat or soil mixes. A factor constraining compost research is that repetition of experiments with the same batch of compost is difficult since during storage further decomposition of the organic material always occurs (Termorshuizen *et al.* 2006).

Application of either compost or compost teas in agriculture improve plant production as well as recycling wastes is increasing year by year (Paradelo *et al*., 2013).On the other hand, compost and/or compost teas are implicated to control several plant diseases (A1-Mughrabi *et al*., 2008 and Pane *et al*., 2011).

Compost tea is a highly concentrated microbial solution produced by extracting beneficial microbes from vermi-compost and /or compost. It is a source of foliar and organic nutrients, contains chelated micronutrients for easy plant absorption and the nutrients for both plant and microbial uptake. The most widely described benefit of compost teas is their ability to decrease plant disease when used as soil drenches or foliar sprays (Scheuerell and Mahaffee, 2004).

The present investigation was conducted to study; 1- Isolation the potato common scab causing pathogen(s). 2- Test the pathogenicity of the obtained isolates.3- Identify the potato common scab incitant bacteria and 4-Possible management of potato common scab disease by using compost or compost teas under field condition.

MATERIAL AND METHODS

Isolation of potato common scabe pathogen(s) .

Isolation trials were carried out from naturally infected potato tubers with well-developed deep and superficial scab symptoms. Potato tubers cv. Berna that showed severe natural infection of common scab were collected from 3 potato-growing

regions in El-Minia Governorate during summer season of 2013 as described by King *et al*., 1991. Four isolates listed CS1, CS2, CS3, CS4 were isolated during this study. Isolates were maintained-and routinely sub-cultured on Nutrient - glucose agar medium unless otherwise stated (Wanner, 2006).

Pathogenicity tests.

Under greenhouse conditions:

Potato tubers of cultivar Berna were tested for mortaring the virulence of bacterial isolates, CS1, CS2, CS3 and CS4. Pots (30 cm diameter) were sterilized by soaking in 5% formalin for 5 min, then left for 15 days before planting. Fresh Nile silt was sterilized in an autoclave at 121° for 30 min. Soil inocula were prepared using ten days old cultures of the isolated organisms grown on Potato Dextrose Agar (PDA) plates. Inocula were prepared as follow: the bacteria of 10 days old cultures were washed from the agar surface with 0.1% methylcellulose and the concentration was adjusted to about 10^7 colony forming unit (CFU) per milliliter by using Milton Roy Spectrophotometer at 600nm, OD 0.1(Goth and Webb, 1981). The bacterial suspension was thoroughly mixed with soil (to obtain10^6 CFU/g soil) in each pot. One week later, a single seed tuber of cv. Berna was planted in each pot. Non-infested pots (controls) were included in the experiment. A randomized complete block design with 3 replications (6 pots / treatment) was used. Plants were grown to maturity (approximately 12 weeks after planting) as described by (Keinath & Loria 1991 and Galal *et al*. 1999) and then disease incidence and disease severity were calculated.

Disease assessment:

The numbers of tubers with either superficial or deep scab symptoms were counted to give disease incidence as for (D1%) as follows .Also, the area of tuber surface that was covered with scab lesions was determined using a 0 to 5 scale as described by (Shihata, 1974).

Potato Disease incidence (D1):
common scab

Disease incidence (D1) and surface area infected index (SA1) induced by *Streptomyces* isolates on immature potato cultivars inoculated under laboratory conditions (Keinath and Loria, 1989).

$$D1\% = \frac{\text{infected potato}}{\text{all potato infected and none infected}} \times 100$$

Potato common scab disease Severity (DS).

The disease severity (DS) was determined by counting number of lesions of tuber surface in different treatments according to the scab proposed by (Shihata, 1974).

$$DS\% = \frac{0A+1B+2C+3D+4E+5F}{5T} \times 100$$

Where:

0=healthy tuber, 1 = trace – 10% tuber surface is scabbed, 2= 11 – 20 % tuber surface is scabbed, 3= 21 –30 % tuber surface is scabbed, 4 =31 – 40 % tuber surface is scabbed, 5 = more than 40 % tuber surface is scabbed.

A, B, C, D, E and F are the number of tubers corresponding to the numerical grades respectively.

T = is the total number of tubers, i.e. T = A+ B+ C+ D+ E+ F.

Identification of Pathogen:

Morphological, physiological and biochemical characteristics:

The isolated pathogenic bacterial isolates were identified using cultural, morphological, physiological and biochemical tests described by (King *et al*. 1991; Faucher et al. 1993 and Lorang *et al* .1995).

Possible management of potato common scab disease using compost :

Source of compost: Two types of compost, i .e residues Nile compost (100% of Plant) and Al obour compost Al a boor: Nile (70% Animal: 30% Plant).was composts obtained from the Egyptian Company to recycle agricultural waste in Minia Governorate, Egypt, which composed mainly a house hold biode gradable wastes, after sorting out plastic, glass and metals at the site of composting.

Table1: characters and chemical analysis of the used compost.Based on the company's analyses.

	compound	Item From To	
		Nile compost	Al obour compost
1	Weight per cubic meter	550 : 650	650:750
2	Humidity	20 : 30	25:30
3	PH	7.5 : 8.5	7.5:8.5
4	Degree electrical conductivity	4 : 6	3:4
5	Capacity water	200 : 300	150:200
6	O2 Over all	1.2:1.8 %	0.8:1.2
7	Organic matter	40 : 48%	25:30
8	Organic carbon	23 : 28%	14.5:17.5
9	The percentage of carbon / nitrogen	16 : 19%	14.5:18
10	phosphorus total	0.4 : 0.6%	0.4:0.6
11	Potassium Overall	0.7: 1.2 %	0.7:1
12	Iron part / million	1500 : 2000ppm	1000:1800
13	Part manganese million	100 : 150ppm	80:120
14	Copper portion million	160 : 240 ppm	100:160
15	Zinc portion million	40 : 80ppm	30:50
16	grass seeds	No grass seeds	No grass seeds
17	nematodes	No nematodes	No nematodes
18	There are parasites	No parasites	No parasites

Preparation of compost teas:

Compost teas were prepared according to the method of (Ingham, 2005) with some modifications.

Experimental design and treatments:

Two field experiments were carried out in the agriculture farm of

Plant Pathology Department, Faculty of Agriculture, Minia University, Egypt. Each experiment consisted of two treatments with three replications and experimental design was randomized complete block design. Experiments were conducted at fall season of 2014 and repeated at fall season of 2015.

The experiment:

Soil of experimental farm was individually amended by Nile or Al obour composts at two rat (1.25 and 2.5 Kg/M^2 soil).Non amended soil was served as control. Soil was amended by compost 5 days before planting. Un amended soil were divided to plots Each plot contained 3 raws of 2.5/m length and 30 cm wide .This potato seed tubers Berna cultivar, were distributed at 25 cm distance, each raw received 10 holes. Three plots were served as a replicate. Per each treatment. Soil was amended compost tea was drenched before infection at rate of 500 ml with two rat planting. Inoculation was carried out 45 days after planting, by inocula of *Streptomyces scabies* isolate CS1 prepared and applied as described in pathogenicity tests, except in each hole 100 ml of bacterial suspension (10^6 colony forming unit CFU/g soil) was added.

Statistical analysis

Analysis of variance was performed where SD tests were used to detect the significant of the observed differences between treatments means (Gomez and Gomez, 1984).

RESULTS

1.1. Isolation and Pathogenicity tests:

Four bacterial isolates , i.e. (CS1, CS2, CS3 and CS4) were isolated from naturally common scabbed potato tubers of Berna cv. During summer season of 2013 in Damarees, Minia and used for futher studies.

Data obtained (Table 2) showed that all bacterial isolates were able to infect potato tubers Berna cv. causing common scab symptoms. Isolate CS1caused highly disease incidence (75.2 % DI) and severity (32.1 % DS) followed by isolate CS2 that exhibited (71.6 % DI) and (31 % DS) and isolate CS4 (70.6 % DI) and (30.2 % DS). However lowest value of common scab incidence (65.2 %) and severity (27.7%) was expressed by isolate CS3.

Table 2: Infectivity of bacterial isolates to potato tubers cultivar Berna grown under artificial inoculation.

Bacterial isolate	common scab incidence (%)	common scab severity(%)
CS1	75.2 [a]	32.12 [a]
CS2	71.6 [b]	31 [b]
CS3	65.2 [d]	27.7 [d]
CS4	70.6 [bc]	30.27 [bc]

The means followed by the same letters are not significant different according to L.S.D 5%.

1.3. Identification of the pathogenic bacterial isolates :

All pathogenic isolates, i.e. CS1, CS2, and CS3and CS4 which provided infectivity to potato tubers that expressed common scab symptoms were subjected for Identification according to their morphological, biochemical and physiological characters (Table 3). Showed that all isolates had grey spores that formed in flexuous chains. Produced a melanin pigment on tyrosine agar as shown in (Table 3) These isolates were utilized D-fructose, D-glucose, maltose, D-mannitol , mannose, lactose, raffinose, rhamnose, sucrose, and meso - inositol. Only S2, isolate utilized L.arabinose, D-xylose, D-galactose and L. methionine, while S1 and S3 utilized these compounds weakly. All three of *Streptomyces* isolates produced Thaxtomin A. Data in Table (3) combined with those obtained in the pathogenicity tests when compared with earlier findings of (Faucher *et al*. 1993 and Lorang *et al* . 1995) whose indicated that all tested isolates are *Streptomyces scabies*.

2. Possible management of potato common scab:

2.1.Using composts as soil amendment:

Application of Nile compost or Al obour composts as soil amendment gave various effects towards potato common scab caused by *Streptomyces scabies* isolate CS1 (Table 4). In fall seasons of 2014 1st season, a significant was Al obour and Nile composts. Meanwhile, a significant difference recorded between concentrations of tested compost. Cutest significant potato common scab incidence (34.3%) and severity (15.8%) was expressed when potato plant cv. Berna grown in soil amendment by 2.5 Kg Nile compost /M^2 soil. Al obour compost above lasses effective to reduce potato common scab as compared with Nile compost. However highest percentage of protection was explored (53.8%protection) in fall season of 2014 by soil amendment by 2.5Kg Nile compost/M^2 soil followed by (47.1% protection) in the summer season and fall season 2015 by the same treatment.

2.2. Using compost tea as soil drenching:

Along growing fall seasons of 2014 and 2015, soil drenching with compost tea exhibited significant reduction in potato common scab incidence and severity as compared to compost. Was significant effective to reduce potato common scab incidence and severity as compared to composts heat number of scabbed tubers (32.2% DI) was concentration when potato cv. Berna growing in soil under drenching with Nile compost tea at rate (1Kg/M^{2}compost tea: 5 liter water). Similarly last potato common scab severity (15%) was expressed by drenching soil with Nile compost tea at rate Kg/M^2 Nile compost tea: 5 liter water. Al obour compost tea showed significant lowed protection as compared to Al obour compost tea.

Table 3: The reported Morphological, biochemical and physiological characters of *Streptomyces scabies* in comparison with those of the tested bacterial isolated from scabbed potato tubers.

Test	*S. scabies*		Potato common scab isolates			
	Faucher *et al.* (1993)	Lorang *et al.* (1995)	CS1	CS2	CS3	CS4
Chain morphology	S	S or RF	Flexuous	Flexuous	Flexuous	Flexuous
Spore color	Gray	ND	Gray	Gray	Gray	Gray
Colony color on Potato dextrose agar	ND	ND	White	White	White	White
Yeast malt extract	Tan to brown	ND	brown	brown	brown	brown
Growth on Nutrient agar	ND	ND	brown	brown	brown	brown
Arabinose	ND	ND	Aerobic	Aerobic	Aerobic	Aerobic
Melanin on Tyrosine agar	+	+	+	+	+	+
King B medium	ND	ND	+	+	+	+
Casein-nitrat tyrosine medium	ND	ND	+	+	+	+
Cazpeks - agar medium	ND	ND	+	+	+	+
Potato - Glucose agar medium (PDA)	ND	ND	+	+	+	+
Carbon usage: L-arabinose	+	+	+	+	+	+
D- fructose	+	+	+	+	+	+
D –glucose	+	+	+	+	+	+
D-Mannitol	+	+	+	+	+	+
Lactose	ND	ND	+	+	+	+
Raffinose	±	+	+	+	+	+
Sucrose	±	+	+	+	+	+
D- Xylose	+	+	±	+	±	±
Maltose	ND	ND	+	+	+	+
Mannose	ND	ND	+	+	+	+
Meso-insitol	+	+	+	+	+	+
D - Galactose	ND	+	+	+	+	+
Nitrogen usage: L - methionine	+	+	+	+	+	+

ND Not done + Positive reaction ±delayed or weak positive reaction - Negative reaction

Table 4: Potato common scab incidence (DI) and severity (DS) on potato Berna cv. inoculated by *Streptomyces scabies* isolate CS1 as influenced by soil amendment with Nile or Al obour composts during fall seasons of 2014 and 2015.

Soil amendment with,	Compost concentration or rate(kg/M^2)	DI	DS	%Protection
Fall season of 2014 (1st season)				
Nile compost	1.25	45.2±2.9	18.9 ± 1.2	44.7
	2.5	34.3±6	15.8± 1.6	53.8
Al obour compost	1.25	49.3±3.4	28.9±3. 9	15.9
	2.5	41.9±2.6	21.3± 1.9	37.7
None	0.0	61.2±3.2	34.2 ± 3.8	0.0
Fall season of 2015 (2nd season)				
Nile compost	1.25	41.5±3.5	20.3±2.2	32.8
	2.5	28.7±4.3	16± 2.4	47.1
Al obour compost	1.25	48±3.5	24.4 ± 4.6	19.2
	2.5	45 ±4.5	20.9±2.2	30.8
None	0.0	64.8±6.2	30.2±2.6	0.0

Table 5: Potato common scab incidence (DI) and severity (DS) on potato Berna cv. inculcated by *Streptomyces scabies* isolate CS1 as influenced by drenching soil amendment with composts tea of Nile or Al obour composts at rate 1Kg/M^2 : 5 liter water and 1 Kg/ M^2 :7 liter water during fall growing seasons of 2014 and 2015.

Soil drenching with compost tea,	Compost concentration or rate(kg/ M^2)	DI	DS	%Protection
Fall season of 2014 (1st season)				
Nile compost	1:7	49.6± 4.1	21.2 ± 3.7	40.1
	1:5	32.2 ± 3.6	15.1±2.5	57.4
Al obour compost	1:7	55.6 ±4.1	22.8± 3.6	35.5
	1:5	43.7 ± 6.5	20 ± 2.2	43.5
None	0.0	64.2±4.3	35.4 ± 3.7	0.0
Fall season of 2015 (2nd season)				
Nile compost	1:7	46.5±5.5	22.1±1.3	42.2
	1:5	34.7±3.4	20±3.2	47.9
Al obour compost	1:7	47.2±4.4	28.1± 2.4	13.3
	1:5	44±1.8	28.8±1.7	11.1
None	0.0	60.8 ± 3.6	32.4 ± 2.3	0.0

DISCUUSSION

Four bacterial isolates were isolated from scabbed potato tubers of Berna cultivar. Pathogenicity test showed that all isolates are pathogenic to potato tubers of Berna cv. A significant variances in the virulence of isolates the tested. Isolate CS1. Lee significant virulence values proved by isolate CS2 with CS4. Contrary isolate gave least DI (65.2%) and DS (30.27%). Results are in line with those obtained by several researches (Shihata, 1974; Faucher *et al*. 1993; Lorang *et al* .1995; Galal *et al*. 1999; El-Sheikh, 2010 and Ali *et al*. 2011).

Identification of the pathogenic bacterial isolates was applied through detecting these morphological, biochemical and physiological characters, almost the tested isolates are similar in their properties to potato tubers that expressed common scab symptoms. The obtained data was combined with those obtained in the pathogenicity tests and compared with earlier findings of Faucher et al. (1993); Lorang *et al* .1995; Galal *et al*. (1999) and Wanner, (2004). Data indicated that all tested isolates are *Streptomyces scabies*. On the light of above mentioned properties, all isolates could be identified as *Streptomyces scabies* to be mentioned, bacterial isolates are similarly to those isolated since 2 decades before (Youssef, 1996) indicating no biodiversity happened to the soil inhabitant *Streptomyces scabies*.

Potato common scab which caused by soil born bacterium *Streptomyces scabies* considered as epidemic disease with no effective control tool established yet (Chater, 2006). Nowadays organic cultures tool a great attention due to clean cultivation to avoid soil and air pollution for human health (Avis, 2007). Composts from different sources are used widely to improve plant yields (Nakkeeran *et al*. 2005) and to suppress various plant diseases such as fungal diseases i.e., *Pythium ultimum, Rhizoctonia solani* (Scheuerell and Mahaffee, 2004 and Dionne´ *et al*. 2012). Fusarium dry rot, black scurf and silver scurf (A1-Mughrabi *et al*. 2008) *Pythium* and *Phytophthora* spp (Liebman and Epstein, 1992). *Alternaria solani*, *Botrytis cinerea*, and *Phytophthora infestans* (Kone *et al*. 2010). Bacterial disease e.g., soil borne (Larkin, 2008 and Lazarovits, 2010) common scab (A1-Mughrabi *et al*. 2008 and Larkin *et al*. 2010).

First experiment was carried out to find methods for possible manage potato common scab through soil amendment with Nile or Al obour composts. Results indicate a significant suppresses of potato common scab using Nile or Al obour composts as soil amendment. Nile compost amended soil showed more suppressive tuber common scab thus Al obour compost amended soil. Increasing Nile compost significantly reduced potato common scab incidence and severity. Generally, Nile compost amended soil was suppressed to suppress potato common scab infection. Results are agree with those

obtained by A1-Mughrabi *et al*. (2008) and Larkin *et al.* (2010).

Soil drenching with compost tea of plants resulted in significant reduction of potato common scab infection. Al obour compost tea scab drenching significantly reduced potato common scab infection as compared to non-drenched soil (control).

However, Nile compost tea application as soil drenching more significantly suppressive as compared to Al obour compost tea drenched. Nile compost is benefits to suppress potato common scab as compared to Al obour compost tea. Similar findings are explored else values (Siddiqui *et al*. 2008; Anna Ghorbani *et al. 2008*; Siddiqui *et al.* 2009; Siddiqui *et al*. 2013 and On *et al*. 2015).

REFERANCES

Ali, M. A., Keera, A. A., Helmy, M. S., Abd El-Nasser, H. N., Ahmed, K. A. and El Hennawi, H. M. (2011). Selection of pigment (melanin) production in *Streptomyces* and their applications in printing and dyeing of wool fabrics, Res. J. Chem. Sci., 1: 22-28.

Al-Mughrabi, K. I. C., Berthélémé, T., Livingston, A ., Burgoyne, R. and Poirierand, A. Vikram. (2008). Aerobic compost tea, compost and a combination of both reduce the severity of common scab (*Streptomyces scabies*) on potato tubers. J. Plant Sci., 3: 168–175.

Avis, T. J. (2007). Antifungal compounds that target fungal membranes: applications in plant disease control. Can. J. Plant Pathol. 29: 323–329.

Bencheikh, M . and Setti , B. (2007). Characterization of *Streptomyces scabies* isolated from common scab lesions on potato tubers by morphological, biochemical and pathogenicity tests in chief region in Western Algeria. Science and Technologie 16-67.

Chater, K. F. (2006) . *Streptomyces* inside-out: a new perspective on the bacteria that provide us with antibiotics. Philos Trans Biol Sci 361(1469):761–768.

Dionne´, A., Tweddell, R. J., Antoun, H. and Avis, T. J. (2012). Effect of non-aerated compost teas on damping-off pathogens of tomato. Can. J. Plant Pathol. 34: 51–57.

DSMZ,(2015). Leibniz institute dsmz-german collection of microorganisms and cell cultures, germany,prokaryotic nomenclature up-to-date.http://www.dsmz.de/bacterial-diversity/prokaryotic nomenclature-up-to-date. [Accessed: March 13, 2015].

El-Sheikh, M. A.(2010). Common scab of potato as affected by soil mineral elements and tuber chemical constituents. J. Agric and Envi. Sci. Alex. Uni, Egypt.9 (2):1-24.

Faucher , E., Otrysko , B., Paradis , E., Hodge , N. C., Stall, R, E. and Beaulieu, C. (1993) . Characterization of *Streptomyces* causing russet scab in quebec. Plant Dis.77:1217-1220.

Galal, A. A., S. H. Gad El-Hak .,Y. T. Abd El-Mageed. and Youssef , N. S. (1999) . Some Studies on Potato Common Scab Disease of pathological Studies. Egypt.J.Microbiol.34 (1).181-199.

Ghorbani, R ., Koocheki , A ., Gahan, M . and Asadi ,A. G. (2008). Impact of organic amendments and compost extracts on tomato production and storability in agroecological systems. Agron. Sustain. Dev. 28 :307–311.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures of Agricultural Research .Jorin Wily and Sons. New York, U. S. A. PP. 680.pp.

Goth,R. A. and R. E.Webb. (1981). Resistance of commercial watermelon (*Citrullus lanatus*) to *Pseudomonas pseudocolaligenes* subsp.citrulli. Plant Disease,65:671-672.

Hiltunen, L. H , Weckman, A ., Ylhainen , A., Rita, H., Richter, E. and Valkonen, J. P. T. (2005). Responses of potato cultivars to the common scab pathogens, *Streptomyces scabies* and *S.turgidiscabies*. Annals of applied Biology 146: 395-403.

Ingham, E. R. (2005). The compost tea brewing manual 5th edition. Soil Food web, Incorporated. Corvallis, OR Jain RC., 2003. Effect of farmyard manure and sugar press mud on yield, symbiotic traits and quality of soybean (*Glycine max L. Merr*.). Indian J Appl Pure Biol. 18(1):47–51.

Keinath, A. P. and Loria, R. (1989). Population dynamics *Streptomyces scabies* and other actinomycetes as relate to common scab of potato. Phytopathology, 79:681-687.

Keinath, A . P . and Loria, R . (1991). Effects of inoculum density and cultivar resistance on common scab of potato and population dynamics of *Streptomyces scabies*. Am. Potato J. 68: 515-524.

King, R. R.; Lawrence, C. H. and Clark, M.C. (1991). Correlation of phytotoxin production with pathogenicity of *Streptomyces scabies* isolates from scab infected potato tubers Am. Potato J.68: 675-680.

Koné, S. B ., Dionne, A ., Tweddell ,R. J., Antoun, H. and Avis , T . J. (2010). Suppressive effect of non-aerated compost teas on foliar fungal pathogens of tomato. Biol. Control 52:167–173.

Larkin, R. P. (2008). Relative effects of biological amendments and crop rotations on soil microbial communities and soil-borne diseases of potato. Soil Biol Biochem 40:1341–1351. doi:10.1016/j.soilbio.2007.03.005

Larkin, R. P., Griffin,T. S. and Honeycutt, C. W. (2010). Rotation and cover crop effects on soil-borne potato diseases, tuber yield, and soil microbial communities. Plant Dis 94:1491–

1502. doi:10.1094/PDIS-03-10-0172

Lazarovits, G. (2010). Managing soil borne disease of potatoes using ecologically based approaches. Am. J. Potato Res. 87: 401–411.

Liebman, J. A., Epstein , L . (1992). Activity of fungistatic compounds from soil. Phytopathology 82: 147-153.

Lorang, J. M., Liu, D., Anderson , N. A. and Schottel, J. L. (1995). Identification of potato scab inducing and suppressive species of *Streptomyces*. Phytopathology 85(3):261–268.

Nakkeeran , S., Fernando ,W. G. D. and Siddiqui,Z. A. (2005). Plant growth promoting rhizobacteria formulations and its scope in commercialization for the management of pests and disease. In Siddqui, Z.A. (Ed.), PGPR: Biocontrol and Biofertiization. Springer, Dordrecht, The Netherlands,pp. 257-296.

On Anna. Francis Wong., Queenie, K. O., Russell, J. Tweddell., Hani, Antoun. and Tyler, J. Avis. (2015). Antifungal effects of compost tea microorganisms on tomato pathogens, Biological Control 80 : 63–69.

Pane, C., Spaccini, R., Piccolo, A., Scala, F. and Bonanomi, G. (2011). Compost amendments enhance peat suppressiveness to Pythium ultimum, *Rhizoctonia solani* and *Sclerotinia minor*. Biol. Contr, 56: 115 - 124.

Paradelo, R ., Moldes ,A. B. and Barral ,M. T. (2013). Evolution of organic matter during the mesophilic composting of lignocellulosic winery wastes. J. Environ. Manage,116: 18-26.

Scheuerell, S. J. and Mahaffee, W. F. (2004). Compost tea as a container medium drench for suppressing seedling damping-off caused by *Pythium ultimum*. Phytopathology 94:1156-1163.

Shihata, Z. A. (1974). Studies on common scab disease of potato M.SC.Thesis 108, Fac.Agric., Assiut Univ., Egypt.

Siddiqui, Y., Meon, S., Ismail,M. R. and Ali, A. (2008). *Trichoderma-fortified* compost extracts for the control of choanephora wet rot in okra production. Crop Protection 27: 385–390.

Siddiqui, Y ., Sariah , M., Razi , I. and Mawardi,R. (2009). Bio-potential of compost tea fromagro-waste to suppress *Choanephora cucurbitarum L*. the causal pathogen of wet rot of okra. Biol. Control 49: 38–44.

Siddiqui, Y., Meon,S. and Yuvarani,Naidu .(2013) . Foliar Application of microbial-enriched compost tea enhances growth, yield and quality of muskmelon (*Cucumis Melo L*.) Cultivated under fertigation system. Scientia Horticulturae, 159: 33–40.

Slack, S . A . (1991). A look at potato leaf roll virus and potato virus Y: past, present, future. Badger Common Tater 43:16–21.

Termorshuizen , A. J., van Rijn, E., vander Gaag, D. J ., Alabouvette , C., Chen , Y., Lagerlof , J., Malandrakis ,A. A ., Paplomatas, E. J., Ramert,B., Ryckeboer, J., Steinberg , C. and Zmora-Nahum, S. (2006). Suppressiveness of 18 composts against 7 pathsystems: variability in pathogen response. Soil Biology and Biochemistry, 38: 2461–2477.

Wanner, L. A. (2004). Field isolates of *Streptomyces* differ in pathogenicity and virulence on radish. Plant Dis 88(8):785–796.

Wanner, L . A. (2006). A survey of genetic variation in *Streptomyces* isolates causing potato common scab in the United States. Phytopathology, 96: 1363-1371.

Youssef, N. S. (1996). Studies on common scab disease of potato. M. Sc. Thesis 97, Faculty of Agriculture, Minia University.

Youssef,N. S. (2000). Response of potato plants grown conventionally and in tissue culture to some antioxidant treatments. Ph.D. Thesis 123, Faculty of Agriculture, Minia University.

الملخص العربي

إمكانيه مكافحه مرض الجرب العادي في البطاطس المتسبب عن البكتريا *Streptomyces scabies* باستخدام الكمبوست وشاي الكمبوست

محمد عبدالرازق محمد عبدالحميد[1]، عماد عبدالقادر حسن[1]، علي عبدالمنعم البنا[2]، أنور عبدالعزيز جلال[2]

[1] المعمل المركزي للزراعه العضويه – مركز البحوث الزراعية بالجيزة– مصر
[2] قسم أمراض النبات – كلية الزراعة – جامعة المنيا

تم عزل أربعة عزلات بكتيرية ممرضة من درنات مصابة إصابة طبيعية بمرض الجرب العادي وإختلفت قدرتها المرضيه حيث كانت العزلة الأولي أكثر العزلات فاعلية كانت نسبة الإصابة (75.2%) وشدة الإصابة (32.2%) بينما العزلة الثانية كانت نسبة الإصابة (71.6%) وشدة الإصابة (31%) والعزلة الرابعة كانت نسبة الإصابة (70.6%) وشدة الإصابة (30.27%) بينما كانت العزلة الثالثة أقلهم حيث كانت نسبة الإصابة (65.2%) وشدة الإصابة (27.7%).

عرفت العزلات البكتيرية الممرضه عن طريق الخصائص المورفولوجية والفسيولوجية والبيوكميائية وتشابهت جميع العزلات في إستجابتها مع بكتريا *Streptomyces scabies* .

أجريت تجربتين حقليتين لدراسة فاعلية إستخدام الكمبوست أو شاي الكمبوست بنوعيهما النيل والعبور في إمكانية خفض الإصابة بمرض الجرب العادي علي درنات البطاطس وأظهرت النتائج أن إستخدام الكمبوست مضافآ للتربة أو شاي الكمبوست ري ذات فاعلية في خفض الإصابة بالجرب وبينت الدراسة أن إضافة النوع الأول من الكمبوست أكثر فاعلية في خفض نسبه الإصابة من النوع الثاني .