

الاختلافات المرضية و الفسيولوجية و الجزيئية بين عزلات
الفطر الترناريا سولانى مسبب مرض اللفحة المبكرة على
الطماطم

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تحريراً في 6 / 6 / 2006م

**PATHOLOGICAL, PHYSIOLOGICAL, AND MOLECULAR
VARIATIONS AMONG ISOLATES OF *Alternaria*
solani THE CAUSAL OF TOMATO EARLY**

BLIGHT DISEASE

BY

MICHAEL HANNA FARAG ABDEL-SAYED

B.Sc. (Agirc.), Assiut University (1988)

M.Sc. (Plant Pathol.) , Cairo University (2000)

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CNTENTES

INTRODUCTION.....	1
REVIEW OF LITERATURE.....	4
1. Globally distribution of tomato early blight disease.....	4
2. The causal organism.....	5
3. Variation among <i>A. solani</i> isolates.....	6
4. Physiological studies.....	7
4.1. Factors affecting <i>in vitro</i> Sporulation of <i>A. solani</i>	7
4.2. Ability of <i>Alternaria</i> sp. to produce mycotoxin(S).....	13
5. Pathological studies.....	14
5.1. Inoculum potential.....	14
5.2. Hybrids and varietals reaction.....	15
5.3. Effect of plant age on disease incidence.....	17
6. Effect of agricultural practices on disease incidence.....	18
6.1. Effect of fertilization.....	18
6.2. Effect of intercropping.....	21
7. Disease control.....	22
7.1. Chemical Control.....	22
7.1.1. Effect of fungicides.....	22
7.1.2. Effect of some chemicals on inducing tomato plant resistance against early blight disease.....	27
7.2. Biological control.....	29
7.2.1. Antagonistic microorganisms.....	29
7.3. Plant extracts.....	32
MATERIALS AND METHODS.....	37
1. Isolation, purification, identification and maintenance of the causal fungi.....	37
1.1. Isolation of the causal fungus from different locations....	37
1.2. Purification and identification of the fungal isolates.....	37
1.3. Maintenance and storing of stock cultures.....	38
2. Media composition.....	38
2.1. Preparation of media.....	38
2.1.1. Czapek's broth (Cz broth).....	38
2.1.2. Czapek's agar (Cz agar).....	38
2.1.3. Nutrient agar (NA).....	38
2.1.4. Potato dextrose agar (PDA).....	38
2.1.5. Potato dextrose broth (PDB).....	38
2.1.6. Potato agar (PA).....	39
2.1.7. SMKY broth.....	39
2.1.8. SMKY agar.....	39
2.1.9. Talboys and Burch medium.....	39

II

2.1.10. Tomato juice agar (TA).....	39
2.1.11. Tomato- potato agar (TPA).....	39
2.1.12. Tryptone yeast glucose agar (TYG agar).....	40
2.1.13. Tryptone yeast glucose broth (TYG broth).....	40
2.1.14. V-8 agar.....	40
2.1.15. V-88 agar	40
2.2. Sterilization of media.....	40
2.3. Inoculation of media.....	40
3. Physiological studies	41
3.1. Comparative studies among the causal fungal isolates.....	41
3.1.1 Determination of mycelial growth on different media.....	41
3.1. 2. Fungal sporulation.....	41
3.2. Toxicological experiments.....	42
3.2.1. Extraction of mycotoxin(s).....	42
3.2.1.1. Extraction from synthetic Media.....	42
3.2.1.2. Extraction from tomato fruits.....	42
3.2.1.3. Mycotoxin(s) bioassay (bacterial inhibition) technique.....	43
4. Pathological Studies	44
4.1. Inoculum preparation.....	44
4.1.1. Mycelial fragment preparation.....	44
4.1.2. Preparation of spore suspension:.....	44
4.1.3. Disease Assessment	45
4.2. Pathogenecity test:.....	45
4.3. Host range.....	46
4.4. Effect of different tomato plant ages on disease incidence.....	46
4.5. Effect of ripening stages of tomato fruit on disease incidence under Lab. conditions.....	47
4.6. Comparative studies on <i>A. solani</i> isolates causing early blight and/or collar rot diseases on tomato plants.....	48
4.6.1. Capability of collar rot isolates to cause early blight disease on tomato plants.....	48
4.6.2. Capability of early blight isolates to cause collar rot disease on tomato seedlings:.....	48
4.6.3. Disease development on collar rot infected tomato seedlings.....	48
4.7. Tomato hybrids and varieties reactions.....	49
4.7.1. Greenhouse experiment.....	49
4.7.2. Laboratory experiment.....	49
4.7.3. Field experiment.....	50
5. Effect of agricultural practices on disease incidence	51

III

5.1. Effect of fertilization.....	51
5.1.1. Effect of different rates of fertilization on disease intensity and fruits yield of natural infection under field conditions.....	51
5.2. Effect of intercropping.....	52
5.2.1. Effect of intercropping on disease intensity and tomato yield (fruits number and weight) under natural Infection.....	52
6. Molecular studies	53
6.1. RAPD-PCR analysis of genetic variations among isolates of <i>A. solani</i>	53
6.1.1. DNA extraction.....	54
6.1.2. Random Amplified Polymorphism DNA technique (RAPD).....	54
6.1.3. Amplified product analysis.....	55
6.1.4. Gel analysis.....	55
6.1.5. Statistical analyses.....	55
6.1.6. Electrophoresis.....	55
7. Disease control	56
7.1. Chemical control.....	56
7.1.1. Fungicides used.....	56
7.1.1.1. <i>In vitro</i> effect of tested fungicides on <i>A. solani</i> linear growth.....	56
7.1.1.2. <i>In vivo</i> effect of tested fungicides on tomato early blight disease.....	57
7.1.2. Determination of the capability of some chemicals to induce tomato plant resistant against early blight disease.....	59
7.1.2.1. Greenhouse experiment.....	59
7.1.2.2. Field experiment.....	59
7.1.2.3. Genetic variation among of tomato plants treated and untreated with tested inducer resistance materials.....	60
7.2. Biological control.....	61
7.2.1. Isolation and identification of the bioagents.....	61
7.2.1.1. <i>In vitro</i> experiment.....	61
7.2.1.2. <i>In vivo</i> experiment.....	62
7. 3. Plant extracts.....	63
7. 3.1. Extraction by water.....	63
7. 3.2. Extraction by hexane.....	64
7.3.3. <i>In vitro</i> experiment.....	64
7. 3.4. <i>In vivo</i> experiment.....	64

8. Statistical analysis	65
EXPERIMENTAL RESULTS	66
1. Isolation and identification of the causal fungi	66
2. Physiological studies	68
2.1. Determination of mycelial growth on different media.....	68
2.2. Fungul sporulation.....	70
2.2.1. Sporulation of <i>A. solani</i> isolates the causal of tomato early blight disease:.....	70
2.2.2. Sporulation of <i>A. solani</i> isolates the causal of tomato collar rot disease.....	73
2.2. Determination of the ability of <i>A. solani</i> to produce mycotoxin(s).....	75
3. Pathological studies	76
3.1. Aggressiveness of <i>A. solani</i> Isolates.....	76
3.2. Host Range.....	79
3.3. Effect of tomato plant age on disease incidence.....	79
3.4. Effect of ripening stage of tomato fruits on disease incidence under Lab. conditions:.....	82
3.5. Comparative studies on <i>A. solani</i> isolates causing early blight and/or collar rot diseases on tomato plants.....	83
3.5.1. Capability of collar rot isolates to cause early blight disease on tomato plants.....	83
3.5.2. Capability of early blight isolates to cause collar rot disease on tomato seedlings.....	85
3.5.3. Disease development of collar rot on the infected tomato seedlings.....	86
3.6. Tomato hybrids and varieties reactions.....	86
3.6.1. Greenhouse experiment.....	87
3.6.2. Laboratory experiment.....	90
3.6.2. Field experiment.....	90
4. Effect of agricultural practices on disease incidence	95
4.1. Effect of fertilization.....	95
4.1.1. Effect of different rates of fertilizers on disease intensity of natural infection under field conditions.....	95
4.1.2. Effect of fertilizers on tomato fruits (number and weight) under natural infection with <i>A. solani</i>	95
4.2. Effect of intercropping.....	99
4.2.1. Effect of intercropping of tomato and other plants on disease intensity under natural infection with <i>A. solani</i>	99
4.2.2. Effect of intercropping on tomato yield (fruits number and weight) under natural infection	101

5. Molecular studies	104
5.1. RAPD-PCR analysis of genetic variations among isolates of <i>A. solani</i>	
6. Disease control	105
6.1. Chemical control.....	105
6.1.1. <i>In vitro</i> effect of tested fungicides on <i>A. solani</i> linear growth.....	105
6.1.2. <i>In vivo</i> effect of tested fungicides on tomato early blight disease	105
6.2. Capability of some chemicals to induce tomato plant resistant against early blight disease.....	108
6.2.1. Greenhouse experiments.....	108
6.2.2. Field experiments.....	111
6.2.3. Genetic variation among tomato plants treated with tested resistance inducer materials	117
6.3. Biological control.....	121
6.3.1. <i>In vitro</i> experiment.....	121
6.3.2. <i>In vivo</i> experiments.....	122
6.4. Plant extracts.....	124
6.4.1. <i>In vitro</i> experiment.....	124
6.4.2. <i>In vivo</i> experiment.....	124
DISCUSSION	128
SUMMARY	151
REFERENCES	155
ARABIC SUMMARY	

INTRODUCTION

In Egypt tomato (*Lycopersicon esculentum* Mill.), ranked as the number one vegetable cash crop with total planting area 459,283 feddan which yielded about 7,140,198 ton of fruits (Department of Agricultural Economic Statistical, Ministry of Agriculture and Land Reclamation, March 2005). This area is about 31.5% of the total vegetable cultivated area in Egypt. Globally, Egypt ranked in the fifth position in growing tomato crop. Egyptian consumption per capita is almost equal to the American one. Egyptian climate is favourable for tomato production as well as incidence of early blight disease most of the year.

Tomato is considered as one of the highest nutritional crops because of its high contents of vitamin C as well as many chemical compounds and elements which are not found in the other Solanaceae crops. Tomato plants are vulnerable to attack by many destructive pathogens. Several fungal diseases are affecting tomato plants in all growing stages causing a considerable reduction in fruit yield per feddan.

Alternaria solani (Ellis and Martin) Jones and Grout, is known to be the causal agent of two distinct phases on tomato plants, *i.e.* early blight and collar rot (Pritchard and Porte, 1921). Early blight disease is responsible of most serious problem on tomato than collar rot. Collar rot is mainly a seedbed disease that carried to the field on tomato transplants and has been associated with the southern production of tomato seedlings in open fields. Meanwhile, early blight disease occurs wherever tomatoes are grown, under humid or semiarid climates, with dew or water irrigation, which providing good conditions for disease development (Tsrer and Bieche, 1999). The causal agent is an airborne fungus, whose dark multicellular conidia are dispersed by wind and water splash (Jones,

1991). It is well known that sporulation of *A. solani* is very scarce, either on synthetic or on semi-synthetic media, using the conventional methods Benliglu and Delen (1996). The pathogen penetrates wounded leaves, causing typical symptoms of concentric rings that severely damage the foliage, resulting in considerable reduce yield (number of fruits and size)

Because of increasing the importance of early blight disease all over the world, studies for its control are continually applied in different countries such as Brazil (Romeiro *et al.*, 2000 and Tofoli *et al.*, 2003), Canada (Lynch *et al.*, 1991 and Jong *et al.*, 2001), Cuba (Sueiro-Pelegrin *et al.*, 2003), Egypt (El-Abyad *et al.*, 1996; Ismail, 1999 and Ghoma, 2000), Greece (Vloutoglou *et al.*, 2000), Israel (Tsrer and Bieche, 1999), Nigeria (Gwary and Nahunnaro, 1998), Romania (Tomescu *et al.*, 2002), SriLanka (Wickramaarachchi *et al.*, 2003), Turkey (Ozcan and Boyraz, 2000) and USA (Gardner and Shoemaker, 1999 and Tietjen *et al.*, 2001).

The present investigation was conducted to address some important issues concerning the nature of the causal pathogen of tomato early blight and/or collar rot diseases as well as different approaches for its control. The first objective was to explore the host/pathogen interaction especially pathogenicity of different *A. solani* isolates and susceptibility of different commercial tomato cultivars to both early blight and collar rot infection. Also, the influence of plant age and ripping stage on the development of tomato early blight disease was investigated. The second objective was to determine the combined effect of different semi-synthetic media and different incubation conditions on the induction of conidial spores of *A. solani*. Also, the capability of the tested isolates to produce *in vitro* mycotoxin substances was studied. Moreover, molecular characteristics,

using random amplified polymorphic DNA (RAPD) analysis, polymerase chain reaction (PCR) technique was followed to define genetic variations Among the tested *A. solani* isolates. Third objective of this investigation was to explore different *in vitro* and *in vivo* approaches for early blight disease control, *i.e.* chemical and biological control. In this concern, different fungicides and/or simple chemical substrates, such as phosphate salts and potassium nitrate, as well as salicylic acid and gibberellic acid, were evaluated for their inhibitory effect against the causal fungus and disease intensity. Also, the capability of different antagonistic fungi and bacteria were evaluated for their effects as biocontrol agents against the causal fungus of tomato early blight disease.

REVIEW OF LITERATURE

1. Globally distribution of tomato early blight disease:

Early blight disease, caused by *Alternaria solani* (Ellis and Martin) Jones and Grout, occurs wherever tomatoes are grown in humid or semiarid climates, with dew or irrigation water providing conditions for disease development (Jones, 1991). The disease was recorded in most of the world countries, *i.e.* Argentina (Monaco *et al.*, 1999), Brazil (Romeiro *et al.*, 2000; Leite *et al.*, 2003 and Tofoli *et al.*, 2003), Bulgaria (Stancheva and Stamova, 1990), Cameroon (Fontem *et al.*, 1999 and Fontem, 2003), Canada (Holley *et al.*, 1985; Tolman *et al.*, 1986; Srivastava *et al.*, 1989; Fry and Shtieberg, 1990; Lynch *et al.*, 1991 and Jong *et al.*, 2001), China (Zhang-GuoQiang *et al.*, 2002; Xu-XiangYang *et al.*, 2002; Fang-Ling *et al.*, 2002 and Zhang-JianGuo *et al.*, 2003)), Cuba (Castellanos *et al.*, 1989; Andreu-Rodriguez and Cupull-Santana, 1993; Castellanos *et al.*, 1995; Salgado *et al.*, 1999; Gonzalez-Chavez *et al.*, 2003 and Sueiro-Pelegrin *et al.*, 2003), Egypt (Saad and Stino, 1982; Ahmed and Saleh, 1987; El-Abyad *et al.*, 1993; Abou-Zeid, 1995; El-Abyad *et al.*, 1996 and Ismail, 1999), Greece (Vakalouakis, 1991 and Vloutoglou *et al.*, 2000), India (Sharma *et al.*, 1997; Krishna-Swamy *et al.*, 1998; Sawant *et al.*, 1999; Babu *et al.*, 2000a; Chhabra *et al.*, 2000; Singh *et al.*, 2000; Suryavanshi *et al.*, 2000; Sawant and Desai, 2001 and Prasad and Naik, 2003), Israel (Shtienberg *et al.*, 1996 and Tsrer and Bieche, 1999), Japan (Langsdorf *et al.*, 1991; Okamura *et al.*, 1996 and Ichihara and Oikawa, 1997), Korea Republic (Lee-HyangBurm *et al.*, 1995) Lithuania (Surviliene *et al.*, 2003) Mexico (Gomez-Rodriguez *et al.*, 2003), Nigeria (Gwary and Nahunnaro, 1998), Romania (Tomescu *et al.*, 2002), Republic of Macedonia (Jovancev, 1998), Russia (Kozlovskii

and Kvasnyuk, 1984), SriLanka (Wickramaarachchi *et al.*, 2003), Taiwan (Liu-ChienHui *et al.*, 1996 and Liu-ChienHui *et al.*, 1997), Turkey (Benlioglu and Delen, 1996; Delen *et al.*, 1996; Ozcelik and Ozcelik, 1997 and Ozcan and Boyraz, 2000), USA (Christ, 1991; Edwards *et al.*, 1996; Louws *et al.*, 1996; Goth and Keane, 1997; Krohn *et al.*, 1998; Gardner and Shoemaker, 1999 and Tietjen *et al.*, 2001) and Zambia (Andersson, 1987).

2. The Causal organism:

Many investigators reported that early blight disease, caused by *Alternaria solani*, is considered as the most important foliar disease on tomato (Saad and Stino, 1982; Ahmed and Saleh, 1987; Maiero *et al.*, 1990; Vakalounkis, 1991; Abou-Zeid., 1995; Moretto and Barreto, 1995; El-Abyad *et al.*, 1996; Keinath *et al.*, 1996; Krishna-Swamy *et al.*, 1998; Weir *et al.*, 1998; Fontem *et al.*, 1999; Ismail, 1999; Tsrer and Bieche, 1999 1999; Babu *et al.*, 2000a; Foolad *et al.*, 2000; Vloutoglou *et al.*, 2000; and Christ and Haynes, 2001).

Madden *et al.* (1978) reported that the principal foliar disease of tomato in North Eastern USA is early blight, caused by *Alternaria solani*. The disease characterized by dark lesions with concentric rings, first evident on the lower leaves. Eventually, defoliation becomes pronounced as the diseases progress.

Langsdorf *et al.* (1990) reported that avirulent isolate of *A. solani* was obtained from potato leaves infected by early blight. The fungus was maintained on V-8 juice agar slants and stored at 4°C.