

**INDUCED RESISTANCE IN WATERMELON (CITRULLUS
VULGARIS), AGAINST WILT DISEASE CAUSED
BY FUSARIUM OXYSPORUM F.SP. NIVEUM.**

By

FARID ABD-EL-KAREEM IBRAHIM

632.352
C. A

A thesis submitted in partial fulfillment

of

the requirements for the degree, of

Master of Science

in

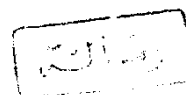
Agriculture
(Plant Pathology)

Department of Plant Pathology

Faculty of Agriculture

Ain Shams University

1993



Approval Sheet

INDUCED RESISTANCE IN WATERMELON (CITRULLUS VULGARIS), AGAINST WILT DISEASE CAUSED BY FUSARIUM OXYSPORUM F.SP. NIVEUM.

By

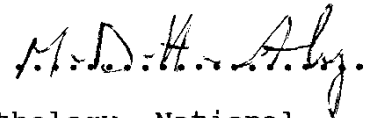
FARID ABD-EL-KAREEM IBRAHIM

B. Sc. in Agric. (Plant Pathology) Fac. of Agric.
Assuit University, 1984.

This thesis for **M.Sc.** degree has been :

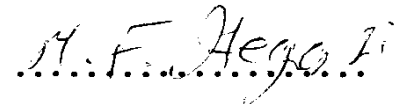
Approved by:

Prof. Dr. M.D.H. Aly



Prof. of Plant Pathology, National
Research Centre.

Prof. Dr. M.F. Hegazi



Prof. and Head of Plant Pathology Dept.
Fac. of Agric. Ain Shams University.

Prof. Dr. M.M. Aly



Prof. of Plant Pathology. Fac. of
Agric., Ain Shams University.

Date of Examination : 17/4 / 1993.



**INDUCED RESISTANCE IN WATERMELON (CITRULLUS
VULGARIS), AGAINST WILT DISEASE CAUSED
BY FUSARIUM OXYSPORUM F.SP. NIVEUM.**

By

FARID ABD-EL-KAREEM IBRAHIM

B. Sc. Agric. (Plant Pathology Dept.) Assuit
Univ., (1984)

Under the supervision of :

Prof. Dr. W.E. Ashour

Prof. of Plant Pathology, Ain Shams University.

Prof. Dr. M.M. Aly

Prof. of Plant Pathology, Ain Shams University.

Prof. Dr. M.M. Diab

Prof. of Plant Pathology, National Research
Centre.

ABSTRACT

Induction of resistance in watermelon plants against fusarium wilt caused by Fusarium oxysporum f.sp. niveum was studied. Inoculation of germinating seeds with 10^6 cfu/ml of biotic inducers i.e. air-borne fungi and non-pathogenic formae speciales of Fusarium oxysporum were tested. In other treatments resistance was induced by seed soaking in solutions of Cobalt as CoSO_4 , and ethephon.

The most effective treatments in reducing the percentage of wilted plants in pot experiments, were F.o. niveum race 0, F.o. cucumerinum and Stemphylium sp., in addition to Co^{++} 0.5 ppm, ethephon 600 and 800 ppm, on Giza 1 cv. Two field experiments were carried out during 1991 and 1992 growing seasons in naturally infested soil, on Giza 1 cv. The most promising treatments in pot experiments were applied, in addition to the Benlate treatment as a comparison. Results showed that all the tested inducers effectively controlled the disease. Their effectiveness withstood till the end of growing season. Remarkable reductions in disease incidence were obtained with treatments of ethephon 600, 800 ppm and Co^{++} 0.5 ppm, followed by F.o. cucumerinum and F.o. niveum race 0. Chemical inducers increased fruit weight/plant about 10 times of the untreated and more than 3 times of the Benlate treatment. Meanwhile, treatment of Stemphylium sp. was similar in its effect to the Benlate treatment. As for Gorma cv. The most effective treatments in reducing the percentage of wilted plants in pot experiments were F.o. cucumerinum; F.o. melonis, Stemphylium sp., Co^{++} 0.5 ppm ethephon 600 and 800 ppm. The most promising treatments in addition to Benlate as a comparison were applied under field conditions. Two field experiments were carried out during 1992 growing season. Results showed that all the inductive treatments were effective in controlling fusarium wilt, increasing number of fruits/plant, seed-yield/feddan and weight of 100

seeds. The most effective treatments were chemical inducers and F.o. cucumerinum. Meanwhile, treatment of F.o. melonis and Stemphylium sp., were similar in their effect to the Benlate treatment. An additional foliar application with Co^{++} 0.25 ppm was applied after 60 days in one experiment. Statistical analysis indicated that this treatment had no significant effect. All inductive treatments stimulated chitinase activity before challenge. The most effective treatments were ethephon 800 ppm and F.o. niveum race 0. Challenging with the pathogen increased chitinase activity of the abiotic treatments, as determined after 24, 48 and 72 h.

Results of this investigation conclude that induction of resistance could be considered a practical and effective method for controlling wilt disease of watermelon. Large scale experiments on other cultivars is needed to recommend this method for controlling the disease at the commercial level.

ACKNOWLEDGMENT

The author would like to express his deep sense of gratitude, and appreciation to Prof. Dr. Wally, E. Ashour Professor of Plant Pathology; Prof. Dr. Madih, M. Aly, Professor of Plant Pathology, Ain Shams University, and Prof. Dr. Mohamed, M. Diab Professor of Plant Pathology, National research Centre, for their supervision and valuable guidance during the research work and preparation of the manuscript.

Many thanks are also due to Prof. Dr. Ahmed, A. Morsy, Professor and Head of Plant Pathology Department, N.R.C., and Prof Dr. Saied, I. Amin Professor of Plant Pathology, N.R.C.

Many thanks are also due to Prof. Dr. Mohamed, A. Rasheid Head of the Agricultural and Biological Division N.R.C.

Thanks and appreciation to Mr. Sabry Y. Mohamed, Mr T. Saad and Miss Fattma Hassan for their kind permission to carrying out the experiments in their fields.

Thanks and appreciation to all staff-members at the Department of Plant Pathology, Fac. of Agric. Ain Shams University, and Department of Plant Pathology, National Research Centre.

CONTENTS

	Page
INTRODUCTION	1
REVIEW OF LITERATURE	3
1- Causal organism and economic importance	3
2- Induction of resistance in plants	5
2:1 Biotic inducers	5
2:2 Chemical inducers	10
3- Biochemical response of the host to stress agents	12
MATERIAL AND METHODS	15
1- Isolation of the causal fungus	15
2- Pathogenicity tests	15
3- Disease assessment	16
4- Pot experiments	16
4:1 Tests of biotic inducers	16
4:2 Tests of chemical inducers	18
4:3 Evaluation of selected inductive treatments.....	19
4:4 Effect of inductive treatments on chitinase activity .	21
5- Field experiments	22
RESULTS	26
1: Pathogenicity tests	26
1:1: Identification and characterization of fungi	26
2: Pot experiments	29
2:1: Biotic inducers	29
2:1:1 Induction of resistance using different air- borne fungi	29

	Page
2:1:2 Induction of resistance using non-pathogenic formae speciales of <u>Fusarium oxysporum</u>	29
2:2: Chemical inducers	36
2:2:1 Induction of resistance using ethephon treatment.	36
2:2:2 Induction of resistance using low cobalt ions ...	40
2:3: Effect of interval between induction and challenge on the induction of resistance	44
2:4: Effect of conidial concentrations of <u>F.o. cucumerinum</u> on the induction of resistance	44
2:5: Effect of selected inductive treatments on:-	
2:5:1: Disease incidence	45
2:5:2: Some vegetative characters	45
2:5:3: Leaf pigments	45
2:6: Effect of inductive treatments on chitinase activity...	48
3: Field experiments	50
3:1: Application of selected biotic and chemical inducers on Giza 1 cultivar	50
3:1:1 Disease incidence	50
3:1:2 Vegetative characters	54
3:1:3 Fruit yield	56
3:2: Application of selected seed treatment on Gorma cultivar	58
3:2:1 Disease incidence	58
3:2:2 Vegetative characters	58
3:2:3 Seed-yield	61

	Page
3:3: Application of selected seed treatment on Gorma	
cultivar and foliar application with cobalt.....	64
3:3:1 Disease incidence	64
3:3:2 Vegetative characters	67
3:3:3 Seed-yield	67
DISCUSSION	71
SUMMARY	82
REFERENCES	85
ARABIC SUMMARY	

LIST OF TABLES

	Page
1- Effect of different isolates of <u>Fusarium oxysporum</u> f.sp. <u>niveum</u> on disease incidence in watermelon plants Giza 1 and Gorma cultivars	27
2- Percentage of wilted watermelon plants as affected by presowing seed treatment with different air-borne fungi	30
3- Percentage of wilted watermelon plants as affected by presowing seed treatment with non-pathogenic formae speciales of <u>Fusarium oxysporum</u>	33
4- Percentage of wilted watermelon plants as affected by presowing seed treatment with different concentrations of ethephon	37
5- Percentage of wilted watermelon plants as affected by presowing seed treatment with low concentrations of cobalt	41
6- Evaluation of selected inductive treatments for their effect on disease incidence and some vegetative characters of watermelon plants, Giza 1 cv...	46
7- Leaf pigments of watermelon Giza 1 cv. as affected by inductive treatment	47
8- Chitinase activity of watermelon plants as affected by different inducers and the subsequent challenge with <u>Fusarium oxysporum</u> f.sp. <u>niveum</u>	49

	Page
9- Fusarium wilt incidence in watermelon plant Giza 1 cultivar induced for resistance with various prior sowing seed treatment during 1991 and 1992 growing seasons	51
10- Influence of different resistance inducers on vegetative characters of watermelon plants Giza 1 cultivar during 1991 and 1992 growing seasons	55
11- Influence of different resistance inducers on fruit yield of Giza 1 cultivar during 1992 growing season....	57
12- Fusarium wilt incidence, vegetative characters, and seed yield in watermelon plants Gorma cultivar induced for resistance with various prior sowing seed treatment during 1992 growing season	59
13- Fusarium wilt incidence in watermelon plants Gorma cultivar induced for resistance with various prior sowing seed treatment and foliar application with cobalt during 1992 growing season	65
14- Influence of inductive treatments on vegetative characters of watermelon plants Gorma cultivar during 1992 growing season	68
15- Influence of different seed treatment with different inducers and foliar treatment with cobalt on seed-yield of watermelon plants, Gorma cultivar, during 1992 growing season	69

LIST OF FIGURES

	Page
Fig (1) Fusarium wilt progression in the watermelon plants, Giza 1 cv., as affected by presowing seed treatment with different air-borne fungi	31
Fig (2) Fusarium wilt progression in the watermelon plants, Gorma cv., as affected by presowing seed treatment with different air-borne fungi	32
Fig (3) Fusarium wilt progression in the watermelon plants, Giza 1 cv., as affected by presowing seed treatment with non-pathogenic formae speciales of <u>Fusarium</u> <u>oxysporum</u>	34
Fig (4) Fusarium wilt progression in the watermelon plants, Gorma cv., as affected by presowing seed treatment with non-pathogenic formae speciales of <u>Fusarium</u> <u>oxysporum</u>	35
Fig (5) Fusarium wilt progression in the watermelon plants, Giza 1 cv., as affected by presowing seed treatment with different concentrations of ethephon	38
Fig (6) Fusarium wilt progression in the watermelon plants, Gorma cv., as affected by presowing seed treatment with different concentrations of ethephon	39
Fig (7) Fusarium wilt progression in the watermelon plants, Giza 1 cv., as affected by presowing seed treatment with low concentrations of cobalt	42
Fig (8) Fusarium wilt progression in the watermelon plants, Gorma cv., as affected by presowing seed treatment with low concentrations of cobalt	43

	Page
Fig (9) Fusarium wilt progression in the watermelon cultivar Giza 1 induced for resistance with various prior sowing seed treatments during 1991 growing season	52
Fig (10) Fusarium wilt progression in the watermelon cultivar Giza 1 induced for resistance with various prior sowing seed treatments during 1992 growing season	53
Fig (11) Fusarium wilt progression in the watermelon cultivar Gorma induced for resistance with various prior sowing seed treatment. (Experiment 1)	60
Fig (12) Fusarium wilt progression in the watermelon cultivar Gorma induced for resistance with various prior sowing seed treatments (A) and foliar application with cobalt after 60 days (B). (Experiment 2)	66

LIST OF PLATE

	Page
Plate (1): Field photographs of watermelon plants Gorma cv. (60 days old) induced for resistance using biotic inducers	62
Plate (2): Field photographs of watermelon plants Gorma cv. (60 days old) induced for resistance using chemical inducers	63