J. Agric. Sci. Mansoura Univ., 25 (11): 7097 - 7106, 2000.

CONTROLLING OF DOWNY MILDEW AND IMPROVING GROWTH AND YIELD OF CUCUMBER BY USING NEW LOCAL ANTI-FUNGUS (TS-3, S1), MICROELEMENTS AND BIO-AGENT.

Farid,S.*;El-S.L.El-S.Fathy*;Z.M.A.Khedr and A.A.EL-Kafrawy *****

***   Vegt. Dept., Hort. Inst., Agric. Res. Center, Cairo, Egypt.**

****   Dept. of Agric. Botany, Fac. of Agric., Moshtohor, Zagazig Univ.**

***** Plant Pathology Res. Inst., Agric. Res. Center, Giza, Egypt.**

ABSTRACT

Several pots and field experiments were conducted during 1997 (fall season, 1998 and 1999 (summer seasons) to study the possibility of using some safety combinations (prepared in Mansoura Research Laboratory), some microelements and biological agents in controlling downy mildew, improving growth and yield of cucumber plants,

Results of pot experiments could be summarized as follows; the best treatments of the highest suppresive effect on downy mildew disease (lowest disease severity %) were TS-3 (0.02 and 0.04%), S1 (5 and 10 ml/L), $MnSO_4$ (0.5 an d1 gm/L) those which recorded the lowest disease severity % between 1.0 and 5.4%, whereas control plants were strongly infected (their disease severity was 95.3 and 96.7% at the two seasons, respectively. Also, plant guard (bio-agent) (2, 4 ml/L) had an considerable suppresive effect.

For field experiment, the selected best treatments from pots experiment were used herein. The best treatments of the lowest disease severity and the highest growth and yield parameters were: TS-3 (0.02%), which reduced the severity of disease by 82.8%, increased dry weight by 143.7% and fruit yield by 166.6% relative to the control. These values were 77.6, 111.0 and 158.3%, respectively for S1 (5 ml/L); 70.8, 93.0 and 125.0% for $MnSO_4$ (0.5 gm/L); 40.8, 85.1 and 116.0%, respectively for plant guard (4 ml/L).

The results also indicated that some safety agents (nutritive micro- and macro-elements) alone or in combinations as ($MnSO_4$, KOH and H_2SO_4) could be efficiently used in safety and economic concentrations in controlling the pathogenic fungus (down mildew) paralleled with improving growth and yield of plants. Meanwhile, the results of statistical correlation between disease severity % and some characters confirming the present findings.

INTRODUCTION

Under Egyptian conditions cucumber (*Cucumis sativus*) is infected by many fungal diseases. However, cucumber downy mildew (incited by *Pseudoperonospora cubensis*) is the most serious ones that cause great reduction in cucumber growth and yield.

Up till now, synthetic fungicides considered as the main control method for this disease. Such method impose various undesirable side effects as residual toxicity, environmental pollution and degradation, development of fungicides resistance (Edwards, 1973).

Considerable attention has been given to use safety alternatives of less or no side effects in controlling or inducing resistance to some serious fungal diseases.

Such alternatives as nutrient elements (Attia *et al*., 1982; Monged *et al*., 1986; Biddle, 1987; Ali *et al*., 1994 and Fahim *et al*., 1994) regarding the use of microelements, i.e. Mn, Zn, Cu, B and Ni. Also, potassium (K) in different forms, i.e. $KMnO_4$, KOH and KCl was involved (Nironenko, 1965 and Wicks *et al*., 1990). Welch (1995) indicated that Mn, Zn and Cu had a major functions in fungal diseases resistance.

On the other hand, antibiotics and salicylic acid were tested in narrow scale in reducing severity of some diseases and/or inducing plant resistance (Shoeib and Hassanein, 1994; Shengquan *et al*., 1995 and Farid *et al*., 2000) dealing with the use of antibiotics in controlling mildew diseases; Rahway (1983), Malamy *et al*. (1990), Samac and Shah (1991); Yung-Xing *et al*. (1997), Kassemeyer *et al*. (1998) and Farid *et al*. (2000) dealing with the use of salicylic acid.

Bio-control is the other safe and promising method, based on using non-pathogenic micro-organisms, i.e. Trichoderma, Penicillium, Pseudomonas and etc. to control other pathogenic ones (Fedosseva *et al*., 1983; Mikolaeva *et al*., 1989; Saeed *et al*., 1994; Kassemyer *et al*., 1998; Rahman *et al*., 1998 and Farid *et al*., 2000).

Present work aimed to study the effect of $MnSO_4$, $ZnSO_4$, H_3BO_4 (micro-elements), combination of KOH and phosphonic acid, combination of tetracyclin and salicylic acid as well as plant guard (bio-agent) in suppressing the severity of downy mildew disease of cucumber plant to improve its growth and yield.

MATERIALS AND METHODS

Several pots and field experiments were conducted at Mansoura Research Station during 1997 (fall), 1998 and 1999 (summer) seasons to study the effect of micro-elements, new promising anti-fungus combinations (TS-3 and S1) and plant guard (biological anti-fungus) in reducing the severity of downy mildew disease of cucumber to improve its growth and yield.

1. Pots experiment:

Cucumber (*Cucumis sativus*) seeds of Medina cv. were sown on 25 September 1997 and 25 March 1998, in 35 cm diameter polyethylene pots filled with clay and sand 1:1 (v/v) medium. Two weeks after sowing; plants thinned to one plant / pot and fertilized with 5 gm/pot of NPK-Mg (20-20-20-1) and the same (5 gm/pot) after one month.

Pots were arranged in randomized complete block design (RCBD) with three replicates, the experimental unit was consisted of ten pots.

Experimental procedure:

After sowing (30 day) cucumber plants were sprayed with solution of treatments (first application). Ten days later, an artificial inoculation with cucumber downy mildew spores was carried out by gently rubbing with heavily infected cucumber leaves (those had been taken from adjacent infected cucumber field), according to method of Fahim *et al*. (1994) and Farid *et al*. (2000). Second application was done ten days after inoculation.

Disease severity percentage was calculated 65 days after sowing on all plants of each experimental unit (10 plants), according to the devised scale of Large and Doling (1962) modified by Ghobrial *et al*. (1977).

Experimental treatments:

Pot plants were treated as follows:-

1, 2. $ZnSO_4$ (0.5 and 1 gm/L).
3, 4. H_3BO_4 (boric acid) (0.5 and 1 gm/L).
5, 6. $MnSO_4$ (0.5 and 1 gm/L).
7, 8. S1 (5 and 10 ml/L).
9, 10. TS-3 (0.02 and 0.04%).
11, 12. Plant guard (bio-agent) (2 and 4 ml/L).
13. Control (distilled water).

TS-3 combination:

TS-3 a new anti-fungal combination prepared by mixing different promising agents (in Mansoura Res. Lab. by Dr. Fathy and Dr. Farid). Oxytetracycline, sulfathiazole and salicylic acid were the used agents according to Farid *et al*. (2000). TS-3 used at two concentration 0.02 and 0.04%.

S1 combination:

Aliquot formulation contained KOH, H_2PO_4, oleic acid (C_{18} : 1) and acetone, those were mixed on chemical basis, also emuls. agents used. S1 prepared in Mansoura Res. Lab. by Dr. Farid and Dr. Fathy as a safety anti-fungus combinations and used at two concentrations (5 and 10 ml/L).

Plant guard:

The commercial biological anti-fungus (*Trichoderma harzianum*) used at two concentrations (2 and 4 ml/L).

2. Field experiments:

On March 25 of 1998 and 1999 (summer seasons) cucumber seeds of Medina cv. were sown in the field at 30 cm apart on one side ridge 5 m long and 1 m wide (3 ridges per plot) in RCB design with 3 replicates. All cultural practices were done as recommended with no control of any fungal diseases. Plants were treated (sprayed) 30, 45 and 60 days after sowing. The most effective land economically concentrations of different treatments in pot experiment (based on reducing the percentage of downy mildew severity), were detected and used in field experiment.

So, the treatments were as follows:- 1. $ZnSO_4$ (0.5 gm/L), 2. H_3BO_4 (0.5 gm/L), 3. $MnSO_4$ (0.5 gm/L), 4. S1 (5 ml/L), 5. TS-3 (0.2%), 6. Plant guard (2 ml/L), 7. Plant guard (4 ml/L), and 8. Control (distilled water).

Experimental parameters:

Disease severity:

It was recorded on all plants of each plot (ten days after the last spray) and calculated as a pot experiment.

Vegetative growth:

A representative five plants were taken from each plot 70 days after sowing, then fresh, dry weight (gm) plant and leaf area (cm^2) per plant were determined.

$$\text{Leaf area (cm}^2\text{) / plant} = \frac{\text{Leaves dry wt. x 10 leaf disk area}}{\text{Average dry wt. of 10 leaf disks}}$$

Fruit yield:

In term of number and weight (kg) of fruits per 1 m^2 yield was calculated as number and weight of all harvested fruits per each plot and divided by the area (m^2) of plot.

Also, the % of increase in dry matter yield* and fruit yield** ,ore than control and the controlling degree*** (%) of decrease in disease severity relative to control were calculated based on the mean values of two seasons.

$$* = \frac{\text{D.W. gm/plant of each treatment x 100}}{\text{D.W. gm/plant of control}} - 100$$

$$** = \frac{\text{Fruit wt. kg/m}^2\text{ of each treatment x 100}}{\text{Fruit wt. kg/m}^2\text{ of control}} - 100$$

$$*** = \frac{\text{Disease severity \% of each treatment x 100}}{\text{Disease severity \% of control}} - 100$$

All the obtained data on plot basis were subjected to computer statistical analysis as well as correlation between disease severity % and some important parameters was done.

RESULTS AND DISCUSSION

I. Pots experiment:

Data in Table (1) showed the effect of treatments ($ZnSO_4$, H_3BO_4, $MnSO_4$, Si, TS-3, plant guard and the control on the percentage of downy mildew disease severity of cucumber plants during fall season of 1997 and summer season of 1998. Such data cleared that all treatments were significantly reduced the severity of this disease relative to the control, which scored the highest percentage (severe infection) 95.3 and 96.7 at the two seasons, respectively.

The same data indicated that TS-3, 0.04 and 0.02%), S_1 (10 and 5 ml/L) and $MnSO_4$ (1 and 0.5 gm/L) were significantly the most superior treatments in reducing the severity of cucumber downy mildew at the two seasons. Also, these treatments respectively could be arranged in decreased order. Plant guard (4 and 2 ml/L), $ZnSO_4$ (0.5 and 1.0 gm/L), H_3BO_4 (0.5 and 1.0 gm/L) were respectively in decreased order (dealing with their suppressive effect) and they followed the above superior treatments.

It is also evident that there was no considerable difference between the low and high concentrations of each treatment except that of plant guard at both seasons. Herein, it could be suggested that the most potent treatment, in controlling cucumber downy mildew were TS-3 (combination of tetracycline, salicylic acid and sulfathiazole), S1 (combination of KOH, H_2PO_4, oleic acid and acetone) and $MnSO_4$ (among the used microelements).

Table 1: Disease severity of cucumber in pots (after artificial inoculation) as affected by micro-elements, S1, TS-3 and plant guard during 1997 (fall season) and 1998 (Summer season).

Treatments	1997	1998
$ZnSO_4$ (0.5 gm/L)	28.8 c	30.3 c
$ZnSO_4$ (1.0 gm/L)	28.5 c	29.9 c
H_3BO_4 (0.5 gm/L)	33.2 b	37.0 b
H_3BO_4 (1.0 gm/L)	33.3 b	36.3 b
$MnSO_4$ (0.5 gm/L)	4.3 f	5.8 f
$MnSO_4$ (1.0 gm/L)	3.9 f	5.4 fg
S1 comb. (5 ml/L)	2.5 g	4.2 fg
S1 comb. (10 ml/L)	2.2 gh	3.2 g
TS-3 comb. (0.02%)	1.5 gh	3.9 fg
TS-3 comb. (0.04%)	1.0 h	1.1 h
Plant guard (2 ml/L)	16.3 d	19.7 d
Plant guard (4 ml/L)	14.0 e	16.0 e
Control	95.3 a	96.7 a

These results were coincided by the results of Attia *et al*. (1982), Monged *et al*. (1986), Biddle (1987), Ali *et al*. (1994) and Fahim *et al*. (1994) dealing with micro-elements. Shoeib and Hassanein (1994), Shengquan *et al*. (1995) and Farid *et al*. (2000) (antibiotics), Yung-Xing *et al*. (1997) and Kassemyer *et al*. (1998) (salicylic acid) (TS-3 components).

Concerning the use of bio-agent similar finding were obtained by Fedoseeva *et al*. (1983), Mikolaeva *et al*. (1989), Saeed *et al*. (1994), Kasemyer *et al*. (1998) and Farid *et al*. (2000).

The superiority of TS-3 combination in controlling downy mildew might be due to the direct inhibitional (anti-microbial) effect of its components (tetracycline, sulfathiazole and salicylic acid) besides to indirect role via the inducable role of salicylic acid in disease resistance by plants due to its function in signal transduction system and gene expression ulteration (Shettym and Kumar, 1999).

Shengquan *et al*. (1995) provided 93.5-94.3% control of downy mildew by using antibiotics. Yung-Xing *et al*. (1997) in cucumber and Kassemeyer *et al*. (1998) in grape vine, they induced resistance to downy mildew by salicylic acid. Meanwhile, S1 due to its KOH, phosphoric acid and the other contents were of potent fungicidal effect, those might be by contact decomposing the fungus components (mycelium and spores) (Wicks *et al*., 1990 and Yung-Xing *et al*., 1997), also this potent effect might be in part related to the effect of K in the development of thicker outer walls in epidermal cells of plant, thereby preventing fungus attack (Trolldenier and Zehler, 1976).

On the other hand, the considerable suppressive effect of Mn ($MnSO_4$) and somewhat other micro-elements might be due to their inhibitional effect on the growth, sporulation and phytotoxins production and the physiological processes of the fungus (Sharma *et al*., 1976; Fahim *et al*., 1994 and Welch, 1995).

II. Field experiment:

II.1. Disease severity %, growth and yield parameters:

Tables (2 and 3) showed the effect of the selected treatments from experiment I, i.e. $ZnSO_4$, H_3BO_4, $MnSO_4$ all (0.5 gm/L), S1 (5 ml/L), TS-3

(0.02%), plant guard (2 and 4 ml/L) and the control on disease severity percentage as well as growth and yield parameters of cucumber plants cultivated in field under natural infection case during summer seasons of 1998 and 1999.

Table 2: Effect of some micro-elements, S1, TS-3 and plant guard on growth, yield and disease severity, growth and yield of cucumber plant grown in field during 1998 (summer season).

Treatments	Fresh weight (gm) / plant	Dry weight (gm) / plant	Leaf area (cm^2) / plant	Yield		Disease severity (%)
				No. of fruits / m^2	Weight of fruits (kg)/m^2	
$ZnSO_4$ (0.5 gm/L)	170.6e	31.9d	2641d	32.6e	2.3e	65.0b
H_3BO_4 (0.5 gm/L)	148.8f	29.1e	2402e	30.3f	1.9f	68.6b
$MnSO_4$ (0.5 gm/L)	210.3c	40.5c	3281b	39.0c	2.8c	25.0d
S1 comb. (5 ml/L)	239.4b	45.1b	3799a	41.0b	3.3b	18.6de
TS-3 comb. (0.02%)	246.6a	51.3a	3862a	45.3a	3.4a	13.7e
Plant guard (2 ml/L)	126.2g	26.6f	2088f	29.6f	1.6g	69.3b
Plant guard (4 ml/L)	194.7d	38.8c	3022c	36.6d	2.6d	46.6c
Control	98.7d	21.3g	1528g	16.7g	1.2h	88.0a

Such results cleared that, TS-3, S1 and $MnSO_4$, respectively in descending order were of the significant lowest disease severity %, at the same time of the highest fresh and dry weight gm/plant, leaf area, number and weight of fruit (kg)/m^2. With considerable difference among them in most cases and relative to other ones in all cases at the two seasons.

Table 3: Effect of some micro-elements, S1, TS-3 and plant guard on growth, yield and disease severity of cucumber grown in field during 1999 (summer season).

Treatments	Fresh weight (gm) / plant	Dry weight (gm) / plant	Leaf area (cm^2) / plant	Yield		Disease severity (%)
				No. of fruits/ m^2	Weight of fruits (kg)/m^2	
$ZnSO_4$ (0.5 gm/L)	162.7e	30.0d	2554d	31.3d	2.16c	67.6b
H_3BO_4 (0.5 gm/L)	139.6f	26.4e	1824e	29.6e	1.8d	69.0b
$MnSO_4$ (0.5 gm/L)	197.0d	38.7c	3247b	37.0b	2.6b	26.6d
S1 comb. (5 ml/L)	232.4b	42.7b	3712a	38.0b	2.9a	21.0de
TS-3 comb. (0.02%)	243.8a	50.1a	3887a	42.3a	3.0a	16.7e
Plant guard (2 ml/L)	118.5g	24.7e	1766ef	27.6f	1.5e	71.3b
Plant guard (4 ml/L)	209.8c	38.1c	3067c	35.3c	2.6b	58.3c
Control	107.5h	20.4f	163.4f	17.3g	1.32f	89.0a

Such superiority of these treatments could be expected under present work condition, since the same treatments gave the greatest reduction in disease severity % under artificial inoculation case (Table 1), also the data of correlation (Table 4) coincided this results. So, this low infection case resulted in healthy leaves of greatest extension surfaces (leaf area) and hence normal physiological and metabolical functions thereby increasing the accumulation of dry matter and fruit yield.

In addition to the beneficial anti-fungal effect of TS-3, S1 and $MnSO_4$, they might be of stimulatory and regulatory role on the physiological and metabolical processes thereby growth and yield due to their content of salicylic acid (Ts-3 component) (Malamy *et al*., 1990 and Samac and Shah, 1991), kund P (S1-components) (Mengel and Kirkby, 1982) and Mn (welch, 1995).

Once again, the data in Tables (2 and 3) indicated that plant guard of higher concentration (4 ml/L) gave medium suppressive effect on disease severity, this also accompanied by similar effect on growth and yield parameters.

On the other hand, $ZnSO_4$, H_3BO_4 (boric acid) and plant guard of low concentration (2 ml/L) were of weak anti-fungus effects relative to other treatment, but not to control with no significant difference among them in disease severity at both seasons. They were affected growth and yield parameters in similar fashion.

In contrary, untreated control plants were severly infected by downy mildew, since they scored the highest severity percentage 88.0 and 89.0% at both seasons, respectively as they did under artificial inoculation case (Table 1). These plants reflected such adverse case on their growth and yield (they were significantly of the lowest growth and yield parameters).

The illustrated positive correlation of disease severity vrs. growth and yield parameters in Table (4) coincided this result.

Similar results about using antibiotics K-compounds and micro-elements in reducing powdery mildew severity was of Nironeko (1965), Biddle (1987) about using $MnSO_4$ in controlling downy mildew in peas, Wicks *et al*. (1990) about using KOH and H_2PO_4 in controlling downy mildew of some vegetable crops; Shengquan *et al*. (1995); Yung-Xing *et al*. (1997) and Kassemeyer *et al*. (1998) about using salicylic acid and antibiotics in controlling downy mildew of cucumber and other plants.

Also, Kassemyer *et al*. (1998) and Rahman *et al*. (1998) in controlling downy mildew and other fungus diseases by using the microbial agents.

II.2. Correlation studies:

Data of Table (4) illustrated correlation coefficient values of disease severity (%) vrs. growth and yield characteristics as affected by different treatments during 1998 and 1999 seasons.

Such data revealed that all the studied characteristics were negatively correlated with disease severity percentage at the two seasons. This indicated that as the treatment reduced the severity percentage, the growth and yield parameters were considerably increased.

Table 4: Correlation coefficient of disease severity percentage vrs. some growth and yield characters during 1998 and 1999 seasons.

Characters vrs.	Disease severity (%)	
	1998 season	1999 season
Fresh weight (gm) / plant	-0.963**	-0.899**
Dry weight (gm) / plant	-0.961**	-0.929**
Leaf area cm^2 / plant	-0.964**	-0.919**
Yield (No. of fruits / m^2)	-0.930**	-0.899**
Yield (weight of fruits kg / m^2)	-0.964**	-0.912**

Meanwhile, these correlation could be coincided the previous results in Tables (2 and 3).

II.3. Relations of dry matter yield, fruit yield and disease severity of treatments relative to control:

Data of Table (5) illustrated the percentage of decrease in disease severity and the increase in dry weight and fruit yield of cucumber plant (mean of the two seasons of different treatments relative to mean of control. Such data indicated that all treatments were greatly reduced the severity of downy mildew disease.

This was accompanied by great increase in dry matter accumulation and fruit yield of different treatments particularly T-3 (143.7 and 166.6%), S1 (111.0 and 158.3%), $MnSO_4$ (93.0 and 125.0%) and plant guard (4 ml/L) (85.1 and 116.0%) of dry matter and fruit yield, respectively to those of control one. Herein, treatments could be arranged based on their efficiency (in decreased order) as follows:- TS-3 > S1 > $MnSO_4$ > plant guard (4 ml/L) > $ZnSO_4$ > H_3BO_3 > plant guard (2 ml/L) > control.

Table 5: Percentages of increase in dry matter and fruit yield and decrease in disease severity of different treatments relative to control.

Treatments	Increase in dry matter of treatments more than control (%)	Increase in fruit yield of treatments more than control (%)	Decrease in disease severity of treatments relative to control (%)
$ZnSO_4$ (0.5 gm/L)	48.5*	85.5	25.1
H_3BO_4 (0.5 gm/L)	33.4	54.2	22.2
$MnSO_4$ (0.5 gm/L)	93.0	125.0	70.8
S1 comb. (5 ml/L)	111.0	158.3	77.6
TS-3 comb. (0.02%)	143.7	166.6	82.8
Plant guard (2 ml/L)	23.3	25.0	20.5
Plant guard (4 ml/L)	85.1	116.0	40.8

***. The tabulated values calculated as mean of two seasons.**

The order was the same for disease severity % (reduction), dry matter and fruit yield (increase).

To far extent, this order reflected the harmony state of treatments effect on disease severity and growth and fruit yield and reflected of the potentially of some treatments, i.e. S1 and $MnSO_4$ in controlling the most common and serious cucumber disease (downy mildew) for improving cucumber growth and yield.

REFERENCES

Ali, A.A.; A.A. Hanafi; T.H.M. Abd El-Rahman; A.M. Zahra and M.B.M. Hassan (1994). Effect of some micro-nutrients and growth regulators combined with fungicides on the incidence of white rot of onion. The Seventh Cong. of Phytopathology, Giza:302-308.

Attia, M.F.; F.A. Khalil; M. Nazim and Y.H. El-Daoudi (1982). Increasing resistance to stem rust of wheat under the effect of some micro-elements and phenolic compounds. Minufyia J. Agric. Res., 5:77-96.

Biddle, A. (1987). Summer pest and disease control in peas. Vegetable Grower Summer, 8-9.

Edwards, C.A. (1973). Environmental Pollution by Pesticides. Plenum Press, London, P. 1-9.

Fahim, M.M.; K.A. Abada and A.M. Nabila (1994). Application of micro-elements on barley plants and their role in suppressing powdry mildew disease. Proc. 7th Cong. of Phytopathol., Egypt, PP. 285-291.

Farid, S. ; El-S.L. El-S. Fathy; M.A.A. El-Maghrabi and H.A.E. El-Shazly (2000). Controlling of powdery mildew and improving growth, sex ratio and yield of squash plant by using some natural essential oils, phytoextracts and biological agents. J. Agric. Sci. Mansoura Univ., 25(7):3869-3887.

Fedoseeva, Z.N.; V.E. Pereveizeva and S.M. Ranumenjanahari (1983). Development of the pathogen of maize blister smut under the influence of antibiotic-producing fungi. Plant Pathol. Rev., 63:12.

Ghobrial, E.; A.M. Hammouda; R. Abd El-Khalik and E.E. Moustafa (1977). Studies on the control of powdry mildew of barley in ARE. Agric. Res. Rev. Min. Agric., 55(2):31-38.

Kassemeyer, H.H.; G. Busam and P. Blaise (1998). Induce resistance of grapevine prespectives of biological control of grapevines disease. Integrated Control in Viticulture Proc. of the Meeting at Godollo Hungary, Bulletin Ollbsrop, 21(2):43-45.

Large, E.C. and D.A. Doling (1962). The measurement of cerale mildew and its effect on yield. Plant Pathol., 11:47-57.

Malamy, J.; J.P. Carr; D.F. Klessing and I. Raskin (1990). Salicylic acid: A likely endogenous signal in the resistance response of tobaco viral infection. Science, 250:10020.

Mengel, K. and E.A. Kirkby (1982). Principles of Plant Nutrition. 3rd Ed. Inter. Potash Inst., Bern, Switzerland, 402-422.

Mikolaeva, S.I.; M.E. Shte Inberg; I.A. Zavelishko; M.V. Kharbur and L.S. Andronaki (1989). Antagonistic and antibiotic activity of *Trichoderma viride*. Pres. Fr. and Gliocladium virens Miller, Giddens & Foster with respect to *Sclerotinia sclerotiorum* (Lib). D by Mikolegiyi Fitopathologia, 32:167-172 (C.F. Hassan, M.H., 1992). Biological Control of Certain Plant Disease Caused by Sclerotia Producing Fungi. Ph.D. Thesis, Fac. of Agric., Assiut Univ., Egypt.

Monged, Nadia, O.; Y.M. El-Daoudi and A.A. Aggez (1986). Effect of micro-nutrients and the fungicide (INDAR) on yield and leaf rust infection in wheat plants. J. Agric. Sci. Mansoura Univ., 11(3):985-990.

Nironenko, P. (1965). Micro-elements and antibiotics against powdry mildew. Kartofel Ovashchi, 4:49-50. (Abest. in Ref. Zhur. Rasten, 1965, 18:488). (C.F. Rev. Appl. Mycol., 45:1607).

Rahman, T.M.A.; G.A. Zayed and H.E. Asfour (1998). Interrelationship between garlic cultivars and the biological control of white rot disease. Assiut J. Agric. Sci., 29(4):1-13.

Rahway, N.J. (1983). The Merck Index. 10th ed., Indent 2821, Merck & Co. Inc.

Saeed, F.A.; A.M. El-Zawahry; A.D. Allam and M.R. Asran (1994). Studies on the biocontrol of common smut of maize. Proc. of the 7th Cong. of Phytopathol., Egypt, 353-360.

Samac, D.A. and D.M. Shah (1991). Development and pathogen induced activation of arabidopsis acidic chitinase promoter. Plant Cell, 3:1063.

Sharma, Y.R.; B.M. Singh and H.L. Khatrl (1976). Chemical control of seed and soil-borne infection by *Corticium rolfsii* Curzi in maize. Phytopathol. Medit., 15(2/3):234-236. (C.F. Rev. Pl. Pathol., 57(1):1978).

Shengquan, Y.; F. Lixin; T. Wenqing; L. Jianfeng and J.F. Liu (1995). Technology of controlling major pests on litchi trees. China Guangdong Agric. Sci., 3:38-40.

Shettym H.S. and V.U. Kumar (1999). Signalling in plants during induction of resistance against pathogens. Current Sci., 76(5):640-646.

Shoeib, A.A. and F.M. Hassanein (1994). Effect of streptomycin sprays on the existence of Erwinia herbicola like bacteria in epiphytic populations of *E. amylovora* in pear prchards in Egypt. Proc. of the 7th Cong. of Phytopathol., Egypt, PP. 235-240.

Trolldenier, G. and E. Zehler (1976). Relationship between nutrition and rice diseases. Fertilizer Use and Plant Health Inst., 85-93. Proc. 12th Colloq. Int. Potash Inst., Bern.

Welch, R.M. (1995). Micro-nutrient nutrition of plants. Critical Reviews in Plant Sciences, 14(1):49-52.

Wicks, T.J.; P.A. Magarey; R.E. Boer and K.G. Pegg (1990). Evaluation of phosphoric acid as a fungicide in Australia. Brighton Crop Protection Conf., Pests and Diseases, 1:97-102.

Yung-Xing, F.U.; L. Rongxi; M. Liguo; H. Xiuwen; X.F. Yun; R.X. Li; L.G. Ma and X.W. Hou (1997). Induce resistance to downy mildew in cucumber by chemicals. Acta phytophylacica Sinica, 24(2):159-163.

مقاومة مرض البياض الزغبى وتحسين نمو ومحصول نبات الخيار بإستخدام بعض المركبات الآمنة والعناصر الصغرى والمواد البيولوجية0

سيف فريد* - السعيد لطفى* - زكريا خضر -أحمد أبوريا الكفراوى*****

*** قسم الخضر - معهد بحوث البساتين - مركز البحوث الزراعية0**

**** قسم النبات الزراعى - كلية الزراعة بمشتهر - جامعة الزقازيق0**

**** مركز البحوث الزراعية - معهد أمراض النبات - الجيزة - مصر0**

أجريت عدة تجارب فى الأصص والحقل فى الأعوام 1997 ، 1998 ، 1999 لدراسة إمكانية إستخدام بعض المركبات الآمنة (مجهزة معملياً بمعمل البحوث بالمنصورة) وبعض العناصر الصغرى والمواد البيولوجية فى مقاومة مرض البياض الزغبى وتحسين نمو ومحصول نباتات الخيار0

وتتلخص نتائج تجارب الأصص فيما يلى:-

كانت أفضل المعاملات ذات التأثير المثبط العالى للمرض (أقل نسبه مئويه لشدة الإصابة) هى مركب تى أس-3 بتركيزيه المستعملين (0.02 ، 0.04%) وأس-1 بتركيزيه (5 ، 10 مل/لتر) وسلفات المنجنيز بتركيزيها (0.5 ، 1.0 جم/لتر) حيث سجلت هذه المعاملات نسبة مئوية لشدة الإصابة تراوحت بين 1.0 و 5.4% فى حين أصيبت النباتات غير المعاملة بشدة وسجلت أعلى شدة إصابه (95.3 ، 96.7%) فى موسمى التجربة على التوالى0 وكان للمضاد الفطرى (بلانت جارد) بتركيزيه (2 ، 4 مل/لتر) تأثير مثبط ملحوظ للمرض وكذلك باقى العناصر المستخدمة (الزنك والبورون)0

بالنسبة لنتائج تجارب الحقل0

أختيرت أفضل المعاملات فى تجارب الأصص لدراسة تأثيرها على شدة الإصابة والنمو والمحصول لنباتات الخيار المزروعة بالحقل ، وكانت أفضل المعاملات فى تقليل شدة الإصابة وتحسين النمو وزيادة المحصول هى مركب تى أس-3 (0.02%) والذى أحدث نقص فى شدة الإصابة مقداره 82.8% وزيادة فى الوزن الجاف مقدارها 143.7% وزيادة فى محصول الثمار مقدارها 166.6% نسبة إلى معاملة المقارنه ، وكانت تلك القيم على التوالى لمعاملة أس-1 (5 مل/لتر) هى 77.6 ، 111.0 ، 158.3% ولسلفات المنجنيز (0.5 جم/لتر) هى 70.8 ، 93.0 ، 125.0% ولمعاملة بلانت جارد (4 مل/لتر) هى 40.8 ، 85.1 ، 116.0%0

أيضا توضح النتائج إمكانية إستخدام مواد آمنه (عناصر مغذية صغرى وكبرى) بمفردها أو فى تركيبات معينه مثل سلفات المنجنيز وهيدروكسيد البوتاسيوم وحمض الفوسفوريك بتركيزات إقتصادية وبكفاءة عالية فى مقاومة المسببات الفطرية المرضية (البياض الزغبى) وفى تحسين النمو وزيادة المحصول. وجاءت نتائج الإرتباط الإحصائى (بين شدة الإصابة وبعض الصفات) مؤكدة لذلك0