INTRODUCTION

Background of the research

Vesicular-arbuscular (VA) mycorrhizal fungi are beneficial soil microorganisms that form symbiotic associations (mycorrhizae) with the fine roots of plants. The fungi colonize root cortical tissues and extend their hyphae into surrounding soil forming an important linkage between the plant and its below-ground environment. The fungus obtains photosynthate and other growth factors from its host. In turn it extends and increases the absorbing surface area of the root system allowing the plant to more fully tap soils for nutrients and water.

Arbuscular mycorrhizas (AM) the most common of mycorrhizal forms, involve fungi classified as Zygomycetes. The aseptate hyphae enter root cells of nearly all cultivated plants and of many forest and shade trees, shrubs, and wild herbaceous species. No discernible root or outside structural changes are noticaeable. On some species, such as onion, there is a slight yellowing of the roots, but most other plants have to be examined under the microscope to determine the presence of AM. The arbuscular name is derived from the internal structure in the root cortex is the arbuscule. This consists of finely branched hyphae similar to the haustoria of plant pathogens.The arbuscules persist within individual plant cells for a 4- to 10- day period. After this time they are digested by the plant cell, and new ones are formed in other cells. Nutrient transfer is thought to occur between the finely branched fungal mycelium and highly invaginated plant cell membranes, It has been observed that the weight of plant cytoplasmic material within an arbuscular plant cell is 20 times that of an uninfected cell.

Importance of the topic

Tomato is the second most important crop in Libya with a production area of over 5000 ha, yielding 50 000 t/year. It is grown in the field as fresh-market and processing crops and in greenhouses for the same purpose. The best cultivated area is the coast of North Libya. There are several verieties of tomatoes such as:

a) varieties for open area (in the field) as Roma, Rio Grande, Alwadi (national speciality),
b) varieties for close area (greenhouse) as Falcato, Monte Carlo, Michigan Ohio, Dombo, Dombito, Divista.

During the past decade, our knowledge of various aspects of micorrhizae has expanded significantly. Valuable data on induced suppression of soilborne

pathogens have opened up the prospects for their practical application. This subject has been reviewed by many "mycorrhizasts" who have attempted to focus attention on the biocontrol potentialities of this microbial model system and thereby "raised their study to the level of a reputable pursuit"

The objectives of the thesis

The objectives of this study were to examine and understand impact of mycorrhizal fungi and other symbiotic microbes as biocontrol agents on soil borne pathogens and some ecophysiological changes in tomato roots.

Thus, the **objectives** were the following:

1. Examine the characteristics of tomato rhizobacterial populations.
2. Clear up the diversity of arbuscular mycorrhiza fungal communities in different soil types .
3. Determine the effect of AM and rhizobacteria on the growth of tomato plant.
4. Examine the effect of AM and rhizobacteria on the soil-borne pathogen *Pseudomonas syringae* pv. *tomato.*
5. Develop our knowledge of the effect of different systemic fungicides on AM of tomato plant. The investigations of the effect of bensimidazol, chloro-alkylthio-phalimide, phosphyte, dimethylamino-alkyl-carbamate and their combinations on AM of tomato plant were planned.

MATERIALS AND METHODS

Culturing and isolation of the rhizoplan bacterial populations

Intact tomato plants were taken from their habitat. Rhizosphere soil was removed with a repeated gentle rinse in sterile water. After this cleaning the appropriate root samples were washed with a strong shaking across seven steps in sterile physiological NaCl solution. From the last suspension a raw of 10x rate dilution was made. An aliquot of 0.1-0.1 ml from every stage of dilution was plated on the general nutrient agar and, for selective isolation of fluorescent pseudomonads, on ACC agar (Simon and Ridge, 1974). After a 2 days long incubation at 26 °C the developed colonies were transferred on King's B agar for maintaining and a preliminary typisation.

Pot experiments

The experiments were carried out in a greenhouse with controlled environmental conditions. The day/night temperature cycle was 26/15 °C, with 70-80 % relative humidity. Five week-old seedlings (cultivar Coral B) were planted in natural calcarous loamy soil in greenhouse experiments at the Kecskemét Experimental Station of the Hungarian National Cultivar Qualifying Institute.

Measurement of the AM colonisation

Samples were taken 2, 5, 10 and 15 weeks after the planlting. The roots were stained with the trypan blue, according to the method of Kormanik et al. (1980). Frecqvency (F%) and intensity (M) of the mycorrhizal infection, arbusculum content in the root system (A) and in the colonised cells were calculated after a trypan blue staining (Trouvelot et al. 1995).

Statistical analysis

Treatment effects were tested by three-way analysis of varience and means compared by the Newman-Keul test, the F-test or presented with standard error of mean (SE).

RESULTS AND DISCUSSION

Characteristics of tomato rhizobacteria

It is well known in the special literature that the rhizosphere bacterial populations consist in majority of *Pseudomonas* species. As we isolated our strains from the rhizoplan of tomato roots it is not surprising that only a single Gram positive isolate appeared investigating the cultural the microscopic morphological and physiological biochemical characteristics of the Gram negative isolates we could concluded that six of them belonged to the species *Pseudomonas fluorescens* and two of them is to be ordered to *Pseudomonas putida*. On the bases of the distribution of *P. fluorescens* isolates in point of view of denitrification and pigment production two biotypes could be differentiated. From their physiological, biochemical features they are supposed to become a useful agent of rhizosphere inoculants.

We could estimate differences in some characteristics: two of the tested strains (BTO 154, BTO 226) did not grow at 4 °C, two of them (BTO 079, BTO 180) could not reduce nitrate ions, one of them (BTO 226) did not changed the color

into red (arginine hydrolysis), three of them could not liquefy gelatin-agar (gelatine hydrolysis). We had three strains (BTO 021, BTO 036, 148) which did not utilise the carbon sorce glycolate.

On the basis of their physiological-biochemical characteristics they proved to belong to species *Pseudomonas fluorescens*. This fact also was proved by the results of a detailed test for their ability of utilisation of different carbon sources.

Diversity of arbuscular mycorrhiza fungal communities in different soil types

Five AMF species as different spore-types were identified: three of them proved to belong to the genus *Glomus* one to belong to *Gigaspora* and one to the genus *Sclerocystis.*

Effect of AM and rhizobacteria on the growth of tomato plant

Our experiments on the effect of soil inoculations resulted that both AM fungus *Glomus intraradices* and the rhizobacterium (RB) *Pseudomonas fluorescens* significantly stimulated the growth of tomato plants.

During the first two weeks no effect could be experienced because the fungal inoculant colonized the roots not so fast as the bacterial one, because the period infection of mycorrhizal hyphae are longer than the bacteria. The bacterial inoculant, on the other hand, with its fast colonization caused an initial stress for the roots. From the fifth week after the inoculation the stimulatory effect markedly occurred in plant growth.

The combined inoculation with AM and rhizobacteria resulted an expressed stimulation of the experimental plants. The second effect on root dry weight (g) could be estimated also from the fifth week, the results of the inoculation with *Glomus intraradices* are increase of (40 %) of control, and we resulted the optimum level in fifteenth week as (15 %) of control. The combined inoculation with AM fungi and rhizobacteria we estimated also after five weeks from variation of treatment, and resulted as (195 %) of control. And a final result after 15 weeks we stimulated as (177 %) of control.

The third effect on root length (cm) by treated with *Glomus intraradices* and estimated from the five week after all variation of the treatment and we accept the result of increase as (17 cm) of control, we measure the length of the root from the combination of AM fungi and rhizobacteria as (38.1 cm) of control. And in 15^{th} week we resulted the length of the root treated by *Glomus intraradices* as (125.8 cm) of control, and combined treatment with AM fungi and rhizobacteria we measured the result as (742.5 cm) of control.

Effect of AM and rhizobacteria on the soil-borne pathogen Pseudomonas syringae pv. tomato

Both the AM fungus *Glomus intraradices* and the rhizobacterium (RB) *Pseudomonas fluorescens* significantly inhibited the development of the disease tomato leaf–specks. When the seedlings were planted and inoculated with AM and rhizobacteria in their age of two-leafs, so the preventive effect hardly appeared in the second leafs. The increasing surfaces of the third, fourth, fifth leafs more and more specks could developed in the uninoculated controls. The inoculation with AM as a single treatment significantly increased the resistance of tomato plants. The appropriate treatment with rhizobacteria resulted a bigger resistance shown in every generation of leafs. The combined inoculation with AM and rhizobacteria resulted a very strong resistance in all parts of each experimental plants. In addition the resistance maintained even in the further generation of the leafs. It is concluded that a highly effected biological control of the soil-born pathogen *Pseudomonas syringae* pv. *tomato* can be realized only with the combined application of arbuscular mycorhiza and rhizobacterium inoculants.

Effect of a bensimidazol-type fungicide on AM of tomato plant

The bensimidazol-type fungicide benomyl significantly inhibited the vegetative growth of AM. The frequency of mycorrhiza infection (F%) remained 0 % two weeks after inoculation while F% was 4.9% in control plants at that time. Appressoria could be observed after 5 weeks: F% was 6.1% in the presence of benomyl and 36.3% in control. Ten weeks after the inoculation the frequency of mycorrhiza infection did not change significantly in the presence of benomyl, it was 7.5%. In contrast, the mycorrhiza infection permanently grew in control roots (74.5%). The frequency of mycorrhiza infection changed somewhat after 15 weeks, it was 13.0% while the frequency in control plants grew further to 83.6%. Thus, the inhibitory effect of benomyl was apparent in the infection kinetics: the infection of the roots was delayed for three weeks by benomyl treatment and remained very low (10.2 %) up to the end of the 10^{th} week. It was only after this that a slight increase (15%) was found.

In addition, five weeks after the inoculation the intensity of mycorrhiza colonization (M%) remained 0% in the presence of benomyl while rose to 12 and 22% in the untreated control roots. After 10 weeks few coenocitic hyphae could be observed, the intensity of colonization was 7.4% as opposed to the 57.5% in control. 15 weeks after the inoculation the intensity did not change: it showed 7.7% while it grew to 80% in control roots. The intramatricular hyphae began to grow after only 5 weeks and the intensity of mycorrhiza colonization was also decreased (13%) and remained more restricted (7.9%) during the whole examination period.

At the beginning of the inoculation period arbuscules developed very slowly: they did not appear even in the control roots until the 3rd week. After 5 weeks, the arbuscularity (A%) of mycorrhiza colonization remained 0 % while that increased to 22% in control plants. Ten weeks after the inoculation the arbuscularity reached 2.9% while it was 41% in control. After 15 weeks no change could be observed: the arbuscularity was 2.9% in the presence of benomyl and 39% in control.

In summary, the inhibition of arbusculum formation by benomyl was found to be especially pronounced. No arbuscules could be observed even at the 5th week after inoculation. Arbuscularity reached only 7.0% of the control by the end of the15-week examination period.

The benomyl also inhibited the spore formation of AM: at the end of the experiment the quantity of *Azygospores* was only 39% of that of spores in the control.

The bensimidazol-type fungicide benomyl, which inhibits all higher fungi except for the members of *Basidiomycota*, completely inhibits the members of *Glomales* of extraordinary taxonomic relation. Knowing that this mode of action is in the obstacling formation of microtubuli in cell division, we can conclude that *Glomales* take a special taxonomic place among the fungi. (The plant-relating *Peronosporales* also are resistant to benomyl!)

Effect of chloro-alkylthio-phtalimide type fungicides on AM of tomato plant

The chloro-alkylthio-phtalimide-type fungicide captan significantly inhibited the vegetative growth of AM. Two weeks after inoculation, the frequency of mycorrhiza infection (F%) remained 0% while it was 4.9% in control plants. After 5 weeks several appressoria could be observed: the frequency was 7.5% in treated and 36.3% in control. Ten weeks after the inoculation the frequency of mycorrhiza infection changed slightly to 9.5% while it markedly increased in control roots (74.5%). After 15 weeks the frequency of mycorrhiza infection changed to a small degree: it was 13.8% while that in control plants grew further (83.6%). Thus, the inhibitory effect of captan was apparent in the infection kinetics: the infection of the roots was delayed for three weeks by captan treatment and remained very low (13 %) up to the end of the 10th week. It was only after this that a slight increase (16%) occured.

Two weeks after the inoculation the intensity of mycorrhiza colonization (M%) remained 0% while that of mycorrhiza colonization was 12% in the untreated control roots. After 5 weeks few coenocitic hyphae could be observed: intensity of colonization was 7.2% while it was 22% in control. At the 10th week more coenocytic hyphae could be observed: intensity of colonization was 12% while that was 57% in control. 15 weeks after the inoculation the intensity did not change significantly: it was 14.5% while it grew to 80% in control roots. The intramatricular hyphae began to grow after only 5 weeks and the intensity of mycorrhiza

colonization was also decreased (20%) and remained more restricted (18%) during the whole examination period.

At the beginning of the inoculation period the arbuscules developed very slowly: they did not appear even in the control roots in the 3th weeks. After 5 weeks the arbuscularity (A%) of mycorrhiza colonization remained 0 % while it increased to 22% in control plants. Ten weeks after the inoculation the arbuscularity reached 2.9% while it was 41% in control. After 15 weeks no change could be observed: the arbuscularity seemed to be 2.9% in treated and 39% in control. Thus, the inhibition of arbusculum formation by benomyl was especially pronounced. No arbuscule could be observed even at 5th week after inoculation and arbuscularity reached only 70% of the control by the end of the examination period.

The folpet which was also applied in our experience had the same effect on the intensity, the colonization and the arbuscularity of AM as the captan did.

Both the captan and the folpet also inhibit the spore formation of AM: the rate of *Azygospores* was 40 and 37% respectively.

The chloro-alkylthio-phtalimide-type fungicides captan and folpet which also inhibit all higher fungi, including the members of *Basidiomycota* but not for *Erisiphales,* completely inhibit the members of *Glomales* of extraordinary taxonomic relation. Knowing that this mode of action is in the reacting whith different fungal proteins, we can also conclude that *Glomales* take a special taxonomic place among the fungi.

Effect of phosphite-type fungicide on AM of tomato plant

The phosphite-type fungicide ephosite significantly stimulated the vegetative growth of AM. The frequency of mycorrhiza infection (F%) achieved 3% two weeks after inoculation while F% was only 4.9% in control plants at that time. Appressoria permanently developed after 5 weeks: F% was 30% in the presence of ephosite and 36% in control. Ten weeks after the inoculation the frequency of mycorrhiza infection further grew in the presence of the ephosite, it was 77%. The frequency of mycorrhiza infection changed somewhat after 15 weeks, it was 80% while the frequency of control plants grew further to 83.6%. Thus, the indifferent effect of ephosite was apparent in the infection kinetics: the infection of the roots was at the same level for two weeks of ephosite treatment and remained same up to the end of the experiment.

In addition 2 weeks after the inoculation the intensity of mycorrhiza colonization (M%) grew to 17% in the presence of ephosite while rose to 12% in the untreated control roots. Coenocitic hyphae permanently grew and intensity reached 37% in the presence of ephosite and 22% in control. After 10 weeks still more coenocitic hyphae could be observed, the intensity of colonization reached 54% as opposed to the 57.1% in control. 15 weeks after the inoculation the intensity did not change it showed 78.6% while it grew to 80% in control roots. The intramatricular

hyphae began to grow even in the second week (139%) and the intensity of mycorrhiza colonization permanently increased (166%) in 5th week and remained at high level up to the 10th week (95%) and the 15th week (98%) respectively.

At the beginning of the inoculation period arbuscules developed very slowly: they did not appear even in the control roots until the 3rd week. After 5 weeks the arbuscularity (A%) changed to 29.1% while that increased to 22% in control plants. 10 weeks after the inoculation the arbuscularity reached 49% while it was only 41% in control. After 15 weeks a complete desorganization of the arbuscules could be observed: so arbuscularity decreased to 0.5% in the presence of ephosite and 39% in control.

In summary, the influence of arbusculum formation by ephosite was found to be especially surpriceable. No arbuscules could be observed at the beginning, than at the 5th and 10th week arbuscularity by ephosite significantly exceeded (132 and 120%) that of the control roots. The rate of arbuscularity at the 15th week (1.3%) can be explained with the processe of senility.

The phosphite-type fungicid ephosite which inhibits the members of especially *Peronosporales,* significantly stimulates the members of *Glomales*. Knowing that this mode of action is in indirect process we can conclude that *Glomales* are not closely related to the members of *Peronosporales.*

Effect of dimethylamino-alkyl-carbamate type fungicide on AM of tomato plant

The dimethylamino-alkyl-carbamate type fungicide propamocarb significantly stimulated the vegetative growth of AM. The frequency of mycorrhiza infection (F%) achieved 3.2% two weeks after inoculation while F% was only 4.9% in control plants at that time. Appressoria permanently developed after 5 weeks: F% was 30.1% in the presence of propamocarb and 36% in control. Ten weeks after the inoculation the frequency of mycorrhiza infection further grew in the presence of the propamocarb, it was 78%. The frequency of mycorrhiza infection changed somewhat after 15 weeks, it was 820% while the frequency of control plants grew further to 83.6%. Thus, the indifferent effect of propamocarb was apparent in the infection kinetics: the infection of the roots was at the same level for two weeks of propamocarb treatment and remained same up to the end of the experiment.

In addition 2 weeks after the inoculation the intensity of mycorrhiza colonization (M%) grew to 17.2% in the presence of propamocarb while rose to 12% in the untreated control roots. Coenocitic hyphae permanently grew and intensity reached 37.4% in the presence of propamocarb and 22% in control. After 10 weeks still more coenocytic hyphae could be observed, the intensity of colonization reached 55.2% as opposed to the 57.1% in control. 15 weeks after the inoculation the intensity did not change it showed 81.6% while it grew to 80% in control roots. The intramatricular hyphae began to grow even in the second week (140%) and the intensity of mycorrhiza colonization permanently increased (168%)

in 5th week and remained at high level up to the 10th week (96%) and the 15th week (102%) respectively.

At the beginning of the inoculation period arbuscules developed very slowly: they did not appear even in the control roots until the 3th week. After 5 weeks the arbuscularity (A%) changed to 35.4% while that increased to 22% in control plants. 10 weeks after the inoculation the arbuscularity reached 47.2% while it was only 41% in control. After 15 weeks a complete desorganization of the arbuscules could be observed: so arbuscularity decreased to 42.8% in the presence of propamocarb and 39% in control.

In summary, the influence of arbusculum formation by propamocarb was found to be especially pronounced. No arbuscules could be observed at the beginning, than at the 5th and 10th week arbuscularity by propamocarb significantly exceeded (132 and 120%) that of the control roots. The rate of arbuscularity remained at the same level (110%) even at the 15th week.

The dimethylamino-alkyl-carbamate-type fungicide propamocarb which inhibits the members of especially *Peronosporales,* significantly stimulates the members of *Glomales*. Knowing that this mode of action is in indirect process we can conclude that *Glomales* are not closely related to the members of *Peronosporales.*

Effect of fungicide combinations on AM of tomato plant

The combination of benomyl and captan totally inhibited each vegetative form of arbuscular AM. Even up to the end of the experiment no appressoria, no coenocitic hyphae in the roots and no arbuscules could be observed.

The combination of the phosphyte-type ephosite and chloro-alkylthio-phalimide-type folpet inhibited the vegetative growth very much. Only several appressoria could be experienced at the 10th and 15th week, coenocitic hyphae and arbuscules did not develope during the whole experiment.

The combination of bensimidazol-type fungicide the benomyl and dimethylamino-alkyl-carbamate-type fungicide propamocarb inhibited the vegetative growth very much. Only several appressoria and some coenocitic hyphae developed at the 10th and the15th week, no arbuscule could be observed during the experiment.

SUMMARY OF NEW FINDINGS

1. We could conclude that six of them belonged to the species *Pseudomonas fluorescens* and two of them is to be ordered to *Pseudomonas putida*. On the bases of the distribution of *P. fluorescens* isolates in point of view of denitrification and pigment production two biotypes could be differentiated. From their physiological, biochemical features they are supposed to become a useful agent of rhizosphere inoculants.
2. Five AMF species as different spore-types were identified: three of them proved to belong to the genus *Glomus* one to belong to *Gigaspora* and one to the genus *Sclerocystis*.
3. The combined inoculation with AM and rhizobacteria resulted an expressed stimulation of the experimental plants. The second effect on root dry weight (g) could be estimated also from the fifth week, the results of the inoculation with *Glomus intraradices* are increase of (40 %) of control, and we resulted the optimum level in fifteenth week as (15 %) of control. The combined inoculation with AM fungi and rhizobacteria we estimated also after five weeks from variation of treatment, and resulted as (195 %) of control.
4. The inoculation with AM as a single treatment significantly increased the resistance of tomato plants. The appropriate treatment with rhizobacteria resulted a bigger resistance shown in every generation of leafs. The combined inoculation with AM and rhizobacteria resulted a very strong resistance in all parts of each experimental plants. In addition the resistance maintained even in the further generation of the leafs. It is concluded that a highly effected biological control of the soil-born pathogen *Pseudomonas syringae* pv. *tomato* can be realized only with the combined application of arbuscular mycorhiza and rhizobacterium inoculants
5. The inhibitory effect of benomyl was apparent in the infection kinetics: the infection of the roots was delayed for three weeks by benomyl treatment and remained very low up to the end of the 10^{th} week. It was only after this that a slight increase was found.
6. The inhibitory effect of captan and folpet was apparent in the infection kinetics: the infection of the roots was delayed for three weeks by captan treatment and remained very low up to the end of the 10^{th} week. It was only after this that a slight increase occured, the intensity of mycorrhiza colonization was also decreased and remained more restricted during the whole examination period.
7. The indifferent effect of ephosite was apparent in the infection kinetics: the infection of the roots was at the same level for two weeks of ephosite treatment and remained same up to the end of the experiment, and the intensity of mycorrhiza colonization permanently increased in 5^{th} week and remained at high level up to the 10^{th} week and the 15^{th} week respectively.

8. The indifferent effect of propamocarb was apparent in the infection kinetics: the infection of the roots was at the same level for two weeks of propamocarb treatment and remained same up to the end of the experiment. and the intensity of mycorrhiza colonization permanently increased in 5th week and remained at high level up to the 10th week and the 15th week. Arbuscularity by propamocarb significantly exceeded that of the control roots and remained at the same level even at the 15th week.

SUGGESTIONS

1. Based on our results of the effect of rhizosphere organisms on the growth of tomato plant the use of their preparates is suggested in tomato production.
2. Rhizosphere bacterial population should be capitalised in the biological control of soil-borne pathogens in tomato production.
3. On the base of the experiences in our experiments tomato plant is suggested to use as standard macrosymbiont in the isolation, the maintainance and the scaleup of arbuscular mycorrhizal fungi.
4. It was found that the influence of different fungicides used in tomato production is extremely different. The side-effect of different fungicides should be considered in tomato production of ecological interest even in future.

PUBLICATIONS RELATED TO THE TOPIC

Rewied articles:

1. Salem, S. F., Helyes, L., Pék, Z., Dimény, J., Dobolyi, C. (2003) Side-effect of benomyl and captan on arbuscular mycorrhiza formation in tomato plant. *Acta Horticulturae* (accepted)

2. Salem, S. F., Barna, Sz., Dobolyi, Cs. (2003) Use of the arbuscular mycorrhiza of tomato plant in ecotoxicological qualification. *Acta Alimentaria* 32 (accepted)

Papers in local periodicals:

1. Salem, S. F., Dobolyi, Cs. (2002) Biological control effects of rhizosphere microorganisms on pathogenic bacteria *Pseudomonas syringae* pv. *tomato* and *Xanthomonas campestris* pv. *vesicatoria* in tomato plant. *Bulletin of the Szent István University* 21 (accepted)

Conference abstracts:

1. Salem, S. F., Helyes, L., Pék, Z., Dimény, J., Dobolyi, Cs. (2002) Side-effect of benomyl and captan on arbuscular mycorrhiza formation in tomato plant. *8th ISHS Symposium on Processing Tomato, Istambul,* 8-10 June 2002

2. Salem, S. F., Dobolyi, C. (2002) Possible side-effect of bensimidazol- and chloro-alkylthio-ftalimide type fungicides on the action of AM-inoculants on tomato plants. *Meeting of the COST Action 830 Second-generation Microbial Inocula, Budapest,* 21-22 June 2002

Conference presentations:

1. Dobolyi, Cs., Salem, S. F. (2002) Development of arbuscular mycorrhiza symbiosis affected by the fungicides folpet and efozit in tomato plant. *2nd Hungarian Conference of Mycology, Szeged,* 29-31 May 2002

2. Salem, S. F., Helyes, L., Pék, Z., Dimény, J., Dobolyi, Cs. (2002) Side-effect of benomyl and captan on arbuscular mycorrhiza formation in tomato plant. *8th ISHS Symposium on Processing Tomato, Istambul,* 8-10 June 2002

3. Salem, S. F., Dobolyi, C. (2002) Possible side-effect of bensimidazol- and chloro-alkylthio-ftalimide type fungicides on the action of AM-inoculants on tomato plants. *Meeting of the COST Action 830 Second-generation Microbial Inocula, Budapest,* 21-22 June 2002

4. Dobolyi, Cs., Salem, S. F. (2003) Élesztőközösségek rendszertani diverzitása és antibakteriális aktivitása paradicsomnövény filloszférájában. EU-konform mezőgazdaság és élelmiszerbiztonság. A Szent István Egyetem Mezőgazdaság- és Környezettudományi Kara és a Debreceni Egyetem Agrártudományi Centrum Mezőgazdaságtudományi Kara Nemzetközi Tudományos Konferenciája, Gödöllő, 2003. jun. 5-6.