진균병학(방제)

C-01. Effect of Phosphorous Acid on Control of Tomato Late Blight Caused by *Phytophthora infestans*. Hyeong-Jin Jee[1], In-Hee Park[2], Weon-Dae Cho[1] and Yong-Chul Choi[1]. [1]Plant Pathology Div. National Institute of Agricultural Science and Technology, RDA, Suwon 441-707, Korea. [2]Puyeo Tomato Experiment Station, Chungnam Agricultural Research and Extension Service.

Phosphorous acid (H_3PO_3) was highly effective on control of late blight of tomato caused by *Phytophthora infestans* in a field trial. The field application was conducted under a naturally infested plastic film-house in Puyeo, Chungnam, from Mar. 4 to Apr. 8 of 1999 with 3 replications. Phosphorous acid 2,000ppm was adjusted to pH 5.5～5.8 by potassium hydroxide and sprayed on foliage for 3 times at 7-days interval. On the first application, averaged incidence of the infected plant were 4.1～8.3%. However, the disease increased drastically to 41.6%, 95.0% and 98.3% after 7, 14 and 21 days in untreated control plots, while, it reached to 13.3%, 19.2% and 22.5% in the treated plots with phosphorous acid 2,000ppm. Control efficacy of the chemical on the incidence of infected plant and leaf was about 78% and 86%, respectively. In a greenhouse test, tomato growth was not affected and no chemical injury was observed at the concentration below 4,000ppm at pH 5.0～8.0. While, the plant showed chemical injuries on leaves at the concentration at over 4,000ppm and below pH 3.0. Combination of phosphorous acid and other chemicals as metalaxyl copper oxychloride or cartap hydrochloride was not desirable since the plant showed strong chemical injuries as leaf burn or blight.

C-02. The Fungus *Acremonium strictum* BCP as a Hyperparasite of the Gray Mold Pathogen, *Botrytis cinerea*. Gyung Ja Choi, Heung Tae Kim, Jin-Cheol Kim, Yong Ho Choi and Kwang Yun Cho. Screening Division, Korea Research Institute of Chemical Technology, Yusung P.O. Box 107, Taejon 305-600, Korea

A fungal isolate BCP parasiting gray mold pathogen, *Botrytis cinerea,* was obtained in laboratory. The isolate was classified as *Acremonium strictum* W. Gams by using light and electron microscopes. Its conidia are small [$2.1 \pm (0.16) \times 0.9 \pm (0.07)$ ㎛], cylindrical, aseptate and hyaline in slimy heads. The phialides are simple, not verticillate and their bases are hardly chromophilic and granulose. *A. strictum* BCP severely parasitized *B. cinerea* isolate *in vitro*. It overgrew the colonies of *B. cinerea* and caused severe lysis of the host hyphae. Frequent penetration and hyphal growth of *A. strictum* BCP inside the mycelia of *B. cinerea* were observed under light microscope. In addition, some morphological abnormalities such as granulation and vacuolation of the cytoplasm were observed in mycelia of *B. cinerea*. However, appressoria were not found. The parasitic activity of *A. strictum* BCP against *B. cinerea* in 96-well microtiter plates was dependent on the spore concentration of BCP isolate. These results indicate the possibility of *A. strictum* BCP as a biological control agent for gray mold disease.

C-03. The Physiology of *Acremonium strictum* BCP, a Hyperparasite of *Botrytis cinerea*. Gyung Ja Choi, Heung Tae Kim, Jin-Cheol Kim and Kwang Yun Cho. Screening Division, Korea Research Institute of Chemical Technology, Taejon 305-600, Korea

Acremonium strictum BCP isolated from the mycelia of gray mold pathogen, *Botrytis cinerea,* severely parasitizes *B. cinerea* isolate. In order to use the hyperparasite as a biocontrol agent against gray mold disease, factors affecting sporulation, mycelial growth and spore germination of *A. strictum* BCP were investigated. Among seven solid media tested, lima bean agar, oat meal agar, and potato dextrose agar (PDA) were good solid media for mycelial growth of the fungus. The optimum temperature of the hyperparasite was near 23℃. The fungus grew faster in potato dextrose broth than on PDA. Its spores germinated very fast over a large range of temperature with an optimum near 26℃. When the fungus was inoculated with spore suspension onto PDA plates, it produced a large number of spores at 15~26℃ in 3 days, but its sporulation was inhibited at 28~30℃. The advantages and disadvantages of this hyperparasite as a biological control agent are discussed. Further investigations on *A. strictum* BCP will clarify its potential as a biocontrol agent for gray mold disease.

C-04. The Effect of Composts and Cover Crops on Population of *Phytophthora cactorum* in Soil. Magdalena Szczech[1] and Jae Youl Uhm[2]. [1]Researche Institute of Vegetable Crops, Department of Plant Protection, ul. Konstytucji 3-Maja 1/3, 96-100 Skierniewice, Poland. [2]Department of Agricultural Biolgy, College of Agriculture, Kyungpook National University, Taegu 702-701, Korea

Phytophthora cactorum (Lebert and Cohn) J. Schrot. caused root, crown and collar rots of apple trees in all apple growing regions. The aim of the work was the use of composts or cover crops to reduce population of *P. cactorum* in soil. Seven commercial composts and six kind of grasses were tested for their suppressiveness against pathogen.

In greenhouse experiments soil was mixed with composts in concentration 0, 10, 20 or 30% and inoculated with propagules of *P. cactorum*. Then the apple seedlings were planted and disease incidence was monitored. The roots of infected plants were examined for incidence of *P. cactorum* and the population of the pathogen in soil-compost mixtures was determined. All composts decreased the infection of apple seedlings by *P. cactorum*, but only one significantly reduced the density of pathogen in the soil.

Experiment with cover crops was carried out in microplots. The infested with *P. cactorum* soil was sown with different grasses and analysed for the density of active propagules and dormant spores of the pathogen at monthly intervals. Two of the tested grasses (kentucky bluegrass, tall fescue) significantly decreased the population of *P. cactorum* in the soil.

The most effective compost and three grasses (kentucky bluegrass, tall fescue, orchardgrass) were chosen for experiment, in which the synergistic effect of compost and cover crop was studied. In this experiment soil was mixed with compost (10% vol/vol), infected with *P. cactorum* and sown with grasses. The soil without compost but sown with grasses served as a control. The number of active propagules and dormant spores of the pathogen was determined at monthly intervals. The combination of compost and grasses significantly decreased population of *P. cactorum*. This effect was stronger than activity of cover crop alone.

C-05. Antimicrobial Fungi Isolated from the Lichens Distributed in the Southern Regions of Korea. Jae-Seoun Hur[1], Geon-Seoun Han[1] and Jin Won Kim[2]. [1]Sunchon National University, 315 Maegok Dong, Sunchon, chonnam, Korea, 540-742 [2]The University of Seoul, 90 Jeonnong Dong, Seoul 130-173, Korea

Lichen-forming(LFF) or lichenicolous fungi(LCF) isolated from the lichens distributed in the southern regions of Korea were screened for antagonistic efficacy against several plant-pathogenic fungi. Symbiotic algae-free LFF and LCF were isolated by the following methods: I) discharged spore (ascospores), II) macerated thalli suspension and III) direct use of thalli fragment. Eight fungal isolates from 35 lichens collected at 'Backwoon' mountain area, 'Chiri' mountain area and 'Solok' island showed antifungal activity against plant-pathogenic fungi. Antifungal activities of the greatest antagonistic isolate(LB9810) of *Parmelia quercina* lichen were evaluated against 16 plant-pathogenic fungi such as *Collectotrichum gloeosporioides, Fusarium oxysporum, Magneporthe grisea, Phomopsis soje, Phythium graminicola* and *Rhizoctonia solani.* When crude methanol extract of the LB9810 isolate incubated in PDB at 20℃ for 10 days was employed at the rate of 0.5%(V/W), fungal growth of *Magneporthe grisea* and *Rhizoctonia solani* was severely inhibited as much as approximately 60% relative to control. Growth of various food-borne bacterial pathogens was also severely inhibited by the same extract. The extract was separated by different solvents such as hexane, ethyl acetate, butanol and methanol. As a result, hexane fraction displayed the greatest antimicrobial activities against *R. solani.* The LB9810 isolate was finally identified as *Fusarium equiseti* (Corda) Sacc. which is already reported to produce a broad spectrum antifungal substance. Antimicrobial activities of two more isolates of LFF and LCF are still under investigation.

C-06. Biocontrol of *Phytophthora* Blight of Pepper by *Enterobacter aerogenes* A21-4. Shun Shan Shen, Ok Hee Choi, Jin Woo Kim, Dong Soo Kim and Chang Seuk Park. Division of Plant Resources and Environment, Gyeongsang National University # 900 Gazwa-Dong, Chinju 660-701, Korea. E-mail : changpk@nongae.gsnu.ac.kr

A promising biocontrol strain A21-4 was isolated from 565 bacterial isolates which were collected from the rhizosphere of onion (*Allium cepa* L.) that showed strong inhibitory effects on *Phytophthora capsici*, the causal agent of pepper blight. The isolate readily colonized on the pepper root system via seed and root inoculation. The isolate A21-4 was identified as *Enterobacter aerogenes* based on its bacteriological properties. A21-4 showed somewhat narrow spectrum of antifungal activity. It inhibits strongly the growth of the *Pythium* and *Phytophthora* species but cannot inhibit the growth of *Fusarium* species neither *Rhizoctonia solani* groups. Seed inoculation of A21-4 to pepper plant was not effective to suppress the phytophthora blight but root inoculation of pepper seedlings was successfully control the disease in pot tests.

C-07. Effects of Soluble Silicate Treatment on Growth of Cucumber and Occurrence of Powdery Mildew(*Sphaerotheca fuliginea*). Jung Sup Lee, Seon kyu Kim[1], Myeong Sun Yiem and Kyeong Suk Han. Div. of Horticultural Environment, NHRI, [1]Department of Horticulture, Chungbuk National University

The objective of this study was to determine the Si distribution and the extent of control on powdery mildew diseases of cucumber(*Cucumis sativus* L.). Cucumberplants, cv. 'Eunsungbackdadagi',were grown in recirculating nutrient solutions containing SiO2 which was the level present in the water supply or providing an additional SiO2. Silicate concentration in nutrient solutions was decreased as the cucumber plants grow up, which indicated that the cucumber plants selectively absorbed silicate. The silicate absorbed from nutrient solutions translocated into the 6th node above cotyledons of cucumber plants was as much as 3 times higher than in 6th node below apex. The accumulated silicate enhanced the rigidity of mature leaves, and prevented leaf senescence as much as 4 times than in the leaves of under part compared to the leaves of non-treated cucumber plants. High silicate concentration treatment induced production of darker green leaves, and enhanced photosynthesis capacity of leaves and resulted in shorter petioles, increased amount of fresh weight, higher chlorophyll content, higher RuBPcarboxylase activity, and higher soluble protein content. the P contents in leaves of cucumber plants cultivated in silicate-containing medium were 0.78% and 1.15% at 1.7mM and 3.4mM concentrations of silicate, respectively, while the content was 0.46% in cucumber leaves of non-treated. A pronounced effect of Si addition was the increased resistance to the powdery mildew fungus *Sphaerotheca fuliginea*. The contents of N, K, Ca, Mg, Cu, Fe, Mn, and Zn were not different according to silicate treatment.

C-08. Characterization of Extracellular Protease Production by *Colletotrichum gloeosporioides* A1/5. Soon-Sub Hwang[1], Sang Ho Park[2], Myung Yong Shim[3] and Chang Won Choi[1]. [1]Department of Biology and [2]Research Center for Bio-medicinal Resources, Pai Chai University, Taejon, Korea 302-735. [3]Chungnam Agricultural Research & Extension Services, Taejon,305-313, Korea

Several isolates of *Colletotrichum gloeosporioides* were found to produce extracellular proteases with wide spectrum. Inclusion of gelatin in SDS polyacrylamide gel electrophoresis provides a sensitive way of detecting multiple proteolytic activities in several culturing media. The effect of medium components on the quantitative and qualitative composition of extracellular proteases was studied. The activity of extracellular proteases was dependent on the kind of proteins added to the medium as well as fungal growth. Among isolates tested, a strain designated as A1/5 having strong protease activity was selected to identify and characterize the enzyme. We also examined the dependence of the protease activity on the buffer conditions, temperature, pH, and the presence of detergents. Sensitivity of this fungal protease to protease inhibitors was screened by PMSF, leupeptin, antipain, E64, HEC, AEBSF, SBTI. pepstatin, TLCK, EDTA, and bestain.

C-09. Biological Control of Blue Stain Fungi in Wood Chips and Logs. Eun Sung Oh and Jong Kyu Lee. Division of Forest Resources, Kangwon National University, Chunchon 200-701, Korea

Biological control of blue stain fungi, such as *Ophiostoma* and *Leptographium* spp., that reduce the quality of logs and cause economic losses in wood product industry, was carried out in laboratory and field trials by a colorless strain of *Ophiostoma quercus*, BSFcs-1. Inoculation of pine wood chips with the colorless strain 1 wk before inoculating with wild type strain demonstrated that BSFcs-1 colonized wood chips and excluded blue stain fungi from being established. Efficacy of BSFcs-1 was compared with a colorless strain of *O. piliferum*, which is commercially available under the trade name Cartapip. Inoculation of pine wood logs with the colorless strain 1 wk before inoculating with wild type strain of blue stain fungi resulted in 50% colonization for the colorless strain in isolated wood chips, while *O. quercus* and *O. floccosum* colonized 0 and 22%, respectively. Simultaneous inoculation of logs with the colorless strain and wild type strain resulted in decreased colonization(27.5%) by BSFcs-1, but increased colonization by *O. quercus*(22%) and *O. floccosum*(31%). In the meanwhile, BSFcs-1 and wild type strain alone colonized 75 and 71%, respectively. Treatment of the surface of log ends with mycelial suspension of BSFcs-1 after cutting also showed excellent control of blue stain fungi in a pine forest.

C-10. Biological Control of *Botrytis cinerea* on Perilla with *Bacillus* spp. Byung Ju Moon, Jae Pil Lee, Young Jun Son, Chul Sung Kim, Su Hee Lee, Ji Hee Son. Division of Natural Resources and Life Science, College of Natural Resources and Life Science, Dong-A University, Pusan 604-714, Korea

Antagonistic bacteria obtained from perilla leaves and the rhizosphere soil were evaluated for their potential as biological control agent of gray mold rot of perilla, a serious diseases of greenhouse-grown perilla. 2 bacteria, N-1 and N-2 with the ability to inhibition of mycelial growth and conidial germination of *Botrytis cinerea in vitro*, were identified as *B. megaterium* and *B. licheniformis*, respectively by morphological, physiological characteristics and API systems. Gray mold rot was controlled effectively in greenhouse tests by the application of *B. megaterium* N-1 and *B. licheniformis* N-2 with control values of 86.9% and 84.1%, respectively.

C-11. Sterilization of Pathogens by Using Advanced Oxidation Process. Young-Tae Kim, Moon-Sik Yang and Dae-Hyuk Kim.

Advanced oxidation process(AOP) using hydroxy radical was conducted to sterilze *Escherichia coli, Ralstonia solanacearum* and *Fusarium oxysporum* f. sp. *lycopersici*. Ozone producer (0.5 g/hr) was applied to generate hydroxy radical under the presence of U.V.(,253.9nm, 39W). A total of 1,000 liter containing bacterial suspension (1.0 x 107/ml) was made in the PVC tank and samples were obtained to count colony forming unit at different time intervals. Ten minute treatment was able to sterilize 50% CFU and thirty minute treatment were enough to eradicate both bacteria. Spore suspension (1.0 x 104/ml) of *F. oxysporum* f. sp. *lycopersici* were also tested and twenty minute treatment resulted in no germination of spore on the selective media. Although it further needs field trial, it suggest that AOP can be applied to control bacterial as well as fungal pathogens.

C-12. **Ecology and Chemical Control of Yuzu Melanose in Coastal Regions of Chonnam Province.** Kil Hyun Hur[1], Duck Soo Choi[1], Dong Kwan Kim[1], Ki Beum Park[2] and Seur Kee Park[2]. [1]Subtropical Fruit Crops Experiment Station, Chonnam ARES, Koheung, Chonnam, Korea 548-910. [2]Department of Applied Biology and Horticulture, Sunchon National University, Sunchon, Chonnam 540-745, Korea

Seasonal changes of yuzu melanose on leaves and fruits, degrees of disease severity according to the tree ages, and fungicidal effects for the disease control were investigated at coastal regions in Chonnam province. In the yuzu plantation of 20 years old, the diseased leaves were observed from early May with a peak in late June in 1997. The disease occurred 20 days faster and more severely in 1998, which had a significant correlation with mean temperature and humidity of April. The diseased fruits observed from late June with a peak in early August in 1997. The disease occurred 10 days faster and more severely in 1998, which had a significant correlation with degrees of diseased leaf one-month before. Incidence of melanose on leaves and fruits was higher and faster in the yuzu plantation with higher tree ages. In the yuzu plantation of 5 years old, the disease did not observe in 1997 and was observed from early July on the leaves and early August on the fruits in 1998. In fungicidal effects for control of melanose, Dithianon WP, Mancozeb WP and Propined WP showed control value more than 80% on fruits, although less than 80% on leaves and twigs. When Mancozeb WP was sprayed on fruits from June 1 to August 3, control values were 84.8% in 5 times application, 80.4-81.8% in 4 times application and 74.8-76.8% in 3 times application.

C-13. **Studies on Major Factors Involved in Occurrence of Yuzu Melanose by *Diapothe citri.*** Kil Hyun Hur[1], Duck Soo Choi[1], Keun Cheol Lim[1], Ki Beum Park[2] and Seur Kee Park[2]. [1]Subtropical Fruit Crops Experiment Station, Chonnam ARES, Koheung, Chonnam, Korea 548-910. [2]Department of Applied Biology and Horticulture, Sunchon National University, Sunchon, Chonnam 540-745, Korea

Formations of diseased twigs, density of pycnidia, dispersal of pycnidiospores, degrees of disease severity by artificial inoculation were investigated in different time to find major factors associated with occurrence of yuzu melanose. In the yuzu plantation of 20 years old, the diseased twigs were observed from April to October with a peak in late July. Pycnidia on the diseased twigs were observed from April to October. The pycnidia was most on diseased twigs of July 31 and more on twigs of diameter 0.6-1.5cm The number of pycnidiospores dispersed by rainfall was most in early August in 1997 and late July in 1998, but very low in September. In artificial inoculation by the diseased twigs, degrees of diseased leaves and twigs were highest in inoculation of June, and degrees of diseased fruits were highest in inoculation of July 13. When yuzu trees of 3 years old were present in vinyl house, the disease did not occur. When yuzu trees of 3 years old were present under yuzu trees of 20 years old, however, the disease occurred in both leaves and fruits. These results suggest that degrees of diseased twigs, density of pycnidia on the twigs and dispersal of pycnidiospores by rainfall play very important role in the occurrence of yuzu melanose