진균병학(병원성)

A-01. A Simple Method for Sporangial Formation of Rice Downy Mildew Pathogen, *Sclerophthora macrospora*. Hyeong-Jin Jee[1], Jin-Hyeuk Kweon[2], Weon-Dae Cho[1] and Seong-Sook Han[1]. [1]Plant Pathology Div. National Institute of Agricultural Science and Technology, RDA, Suwon 441-707, Korea. [2]Kyeongnam Agricultural Research and Extension Service, Chinju 660-370, Korea

Downy mildew of rice caused by *Sclerophthora macrospora* (=*Phytophthora macrospora*) occurred in several areas of Chungnam, Chonnam, Kyeongnam, and Kyeongbuk provinces of Korea in 1999. Since the pathogen is not culturable, observation of the fungal structures on plant is essential for diagnosis. To elucidate prompt diagnosis of the disease, we developed a simple method for sporangial formation and observation as follows. Freshly infected young leaves showing white to yellowish small spots were selected and cut into small pieces ca. 2～3 cm in length. About 10～20 pieces were surface sterilized in a bottle containing 70% ethanol by vigorous shaking for 30 sec. After washing 3 times with DW, leaf pieces were submerged in 10 ml of membrane-filled paddy water and incubated at 20℃ in darkness. After 8～10 hours of incubation, the bottle was vigorously agitated on a voltex mixer and sporangia fallen to the bottom was directly observed under a light microscope. Sampling the freshly infected young leaves was found to be essential for sporangial formation. Sporangia started to form after 4 h of incubation and the light inhibited sporangial production. Oospores of the fungus were also abundantly formed on infected leave tissues and readily observed under the microscope.

A-02. First Report of *Phytophthora* Diseases on Herbs in Korea. Hyeong-Jin Jee[1], Weon-Dae Cho[1], Kyoung-Suk Han[2] and Wan-Gyu Kim[1]. [1]Plant Pathology Div. National Institute of Agricultural Science and Technology, RDA, Suwon 441-707, Korea. [2]National Horticultural Research Institute, Suwon 441-440, Korea

A total of 35 isolates of *Phytophthora* were collected from six herbs, namely; rosemary, lavender, pringed lavender, tricolor sage, golden sage and purple sage showing root rot or blights. The isolates were classified into three species as *P. palmivora, P. capsici,* and *P. drechsleri* based on their mycological characteristics. Seven isolates of *P. palmivora* were obtained from lavender and pringed lavender, three of *P. capsici* were from lavender, and 25 of *P. drechsleri* were from lavender, rosemary, tricolor sage, purple sage, and golden sage. In a pathogenicity test, *P. palmivora* and *P. capsici* caused root rot only on lavenders as they were originally isolated from. While, *P. drechsleri* infected all tested plants including rosemary laveders, sages and mints indicating that the pathogen has wider host range on herbs. Among the tested plants, rosemary, lavenders and sages were relatively susceptible and mints and thymes were resistant to the pathogens. This is the first report of *Phytophthora* diseases on herbs in Korea.

A-03. The Occurrence of Irregular Lesions on the Apple Leaves of 'Fuji' and 'Songbonkum' Cultivars, Caused by *Alternaria* sp. Dong Hyuk Lee[1], Jae Youl Uhm[2] and Sun Kyung Kim[1]. [1]Taegu Apple Research Institute, 286 Wisung Ri, Sobo Myon, Kunwi Gun, Kyungpook, Korea 716-810. [2]Department of Agricultural Biology, College of Agriculture, Kyungpook National University, Taegu 702-701, Korea

During 1997～1999, in Kyungpook province, a localized outbreak of the unknowned apple disease occurred in Young-ju, Ui-sung, Bong-hwa district. It was the highly susceptible 'Fuji'and 'Songbonkum' apple cultivars. Lesions first appear on leaves in early June as small round brownish spots with a blackish border, gradully become irregular enlarging to 5～20mm in diameter, finally resulting in serious defoliation in late July. Up to 80% defoliation can occur in unsprayed 'Fuji'and 'Songbonkum' apple cultivars.

The pathogenic fungi can easily be isolatied from affected leaves and grown in pure culture on Potato-dextrose agar, identified by *Alternaria* sp. The isolated pathogen have been followed as Koch's rules. It were inoculated on healthy 'Fuji' apple leaves, and it produced the similar disease on the inoculated plants. The pathogen isolated in lesions again.

A-04. The Collar Rot of Safflower Caused by *Sclerotium rolfsii*. Jin-Hyeuk Kwon, Soo-Woong Kang, Kyeng-Ae Son and Chang-Seuk Park[1]. Kyongsangnam-do Agricultural Research and Extension Services, Chinju 660-370, Korea. [1]Gyeongsang National University, College of Agriculture, Chinju 660-370, Korea

A destructive collar rot of safflower has severly occurred at Kyongsangnam-do Agricultural Research and Extension Services in 1999. Incidence of the disease surveyed at 3 fields in Chinju was ranged from 21.6 to 34.2 %. Upper parts of infected stems were mostly blighted and white mycelium were found on the lesions. The same fungus consistently was isolated from the infected tissues and confirmed its pathogenecity to safflower. The causal fungus of collar rot disease was identified as *Sclerotium rolfsii* after careful examination of hyphal mycelial growth, clamp connection colony type, sclerotinia formation and pathogenicity test. Collar rot is principal symptom, however, the fungus causes stem rot, crown rot, wilt or blight on the safflower. Infection commonly commences at about soil level and extends a few cm above and below. Epidermis, cortex and stele are invaded; necrosis precedes penetration. The fungus grow well on PDA at 15～30℃. Optimum temperature for mycelial growth was 30℃. This is the first report on the collar rot of safflower caused by *Sclerotium rolfsii* in Korea.

A-05. Occurrence of Eggplant Wilt Caused by *Verticillium dahliae.* Sung Kee Kim, Ki Woo Kim[1], Eun Woo Park[1], Soon Sung Hong and Jang Souck Yang. Kyonggi-do Agricultural Research and Extension Services, Hwasung 445-970, Korea, [1]School of Applied Biology and Chemistry, Seoul National University, Suwon 441-744, Korea

Verticillium wilt occurred on eggplants grown in greenhouses at Hanam and Yeojoo in 1998 and 1999. The wilted eggplants showed leaves with gradual yellowing, interveinal necrosis, and marginal crinkling. Vascular tissues of the stems were discolored, turned black later, and microsclerotia developed at the base of stems. The disease progressed from lower parts of the plant upward. Fungal isolates from discolored vascular tissues were initially whitish to cream color on culture plates, which turned black later due to formation of dark brown to black microsclerotia. Conidiophores were erect, hyaline, verticillately branched, and had 3 or 4 phialides arising at each node. Phialides were hyaline and measured as 17.5-32.5×2-3 ㎛. Conidia were hyaline, ellipsoidal to sub-cylindrical, mainly one-celled, and measured as 5-8.8×2-4 ㎛. They were borne in small clusters at the tips of phialides. Microsclerotia started to be formed centrally on culture plates, and consisted of swollen globular cells that formed irregular masses of various shapes. Chlamydospores were absent. Based on these cultural and morphological characteristics, the fungus was identified as *Verticillium dahliae* Kleb. Pathogenicity tests by root cutting, root dipping or soil drenching method revealed that the fungus caused the same symptoms as observed in the naturally infected eggplants. This is the first report on occurrence of Verticillium wilt of eggplant in Korea.

A-06. Occurrence of Carnation Wilt and Morphological Characteristics of Causal Pathogens, *Fusarium oxysporum* f.sp. *dianthi* and *F. graminearum.* Kyoung Suk Han, Ik-Hwa Hyun[1], Jong Han Park, Jung Sup Lee and Young Moon Choi. Div. of Holticultural Environment, National Holticultural Research Institute, RDA, Suwon 441-440, [1]Div. of Pathogen Research, National Plant Quarantine Service, Anyang 430-016, Korea

In 1998, the occurrence of carnation wilt was surveyed in the major cultivating areas of carnation(*Dianthus caryophillus* L.), including Pusan, Kimhae, Changwon etc. in Korea. Carnation wilt was severer at high temperature period(Jun.~Agu.) than at low temperature period(Feb.~May). The disease incidence was recorded from 0.5% to 57.0%(average 8.6%). Two species of *Fusarium* were isolated from symptoms of carnation wilt. Out of 38 isolates collected, 31 isolates were identified as *F. oxysporum* f.sp. *dianthi* and 7 isolates as *F. graminearum* which was reported on carnation plant at first in Korea. Mycelial growth of *F. graminearum* was rapid with dense aerial mycelium and colony color of undersurface on PDA was carmin red. Microconidia were absent and macroconidia were distinctly septate, straight to moderately sickle-shaped. Clamydospores were formed sparsely.

A-07. Root rot of *Astragalus menbranaceus* Burge caused by *Phytophthora drechsleri*. Il Chan Cho, Kyoung Yul Ryu, Young Il Hahm and Jeom Soon Kim[1]. [1]Crop Division, National Alpine Agricultural Experiment Station, RDA, Pyungchang, Kangwon 232-950, Korea

Root rot of *Atsragalus membranaceus* was observed in Pyungchang, Korea in 1999. The main symptom was appeared brown and black rot on root and above the ground showed yellowing and wilting. The pathogen isolated from symptom area of root was identified as *Phytophthora drechsleri* depend on physiological, morphological and cultural characteristics. Colony was formed rosaceous or cottony pattern and hyphal swelling was formed in aqueous solution. Non-papillate sporangia were persistent on stalk and the shape was variable from ellipsoid to ovoid. In general, size of sporangia was 41.3 to 77.6 ㎛ long× 33.8 to 56.4 ㎛ wide. Sexuality of *Phytophthora drechsleri* was heterothallic with A1 mating type. Oogonia were 22 to 35.3㎛ in diameter and have tapered bases. Oospores were 16 to 25.9㎛ in diameter and antheridia of spherical or ellipsoid type were always amphigynous. Temperature for mycelial growth was 10 to 40℃ and optimal temperature was 30℃.

A-08. Downy Mildew of *Astragalus menbranaceus* Burge caused by *Peronospora trifoliorum*. Kyoung Yul Ryu, Young Il Hahm and Gwan Yong Shin[1]. [1]Crop Division, National Alpine Agricultural Experiment Station, RDA, Pyungchang, Kangwon 232-950, Korea

In 1999, a severe downy mildew of *Astragalus membranaceus* caused by *Peronospora* sp. was occurred at Pyungchang and Jungsun areas in Kangwon. In those areas, incidence of downy mildew was showed 1 to 90 %. Symptoms were appeared light green leaves at the apex of the stem and grayish-white mycelium on the lower surface of leaves. Internodal elongation of infected plants was reduced, leaflets were twisted and rolled in severe infection. The causal agent was identified as *Peronospora trifoliorum* based on mycological characteristics. Mycelium was coenocytic and finger like extension of the fungal wall. Conidia were broadly ellipsoids on leaves and measured as 24 to 29㎛ long×16 to 20㎛ wide. Conidiophores were branched obscurely dichotomous and 180 to 320㎛ long×8 to 12㎛ wide. Oospores were 24 to 36㎛ in diameter and yellow outer wall was wrinkled. Downy mildew on *Astagalus membranaceus* is the first report in Korea.

A-09. Incidence of *Penicillium* Species in Decayed Citruses, Apples, Pears and Grapes and Their Ability to Produce Mycotoxins. Soh Young Oh[1], Su Bong Paik[2] and Seung Hun Yu[1]. [1]Department of Agricultural Biology, College of Agriculture, Chungnam National University, Taejon, Korea 305-764. [2]College of Agriculture, Kon-kuk University, Seoul 143-701, Korea

A total of 14, 17, 17 and 18 isolates of *Penicillium* were isolated from post-harvest decayed citrus, apple, pear and grape, respectively. The *Penicillium* species isolated from citrus were identified as *P. digitatum* and *P. italicum* and the species of *Penicillium* from apple, pear and grape were *P. expansum* and *Penicillium* sp.. Production of mycotoxins in the YES(yeast extract sucrose) broth was analyzed. *Penicillium* cultures were extracted with ethyl acetate and purified by thin-layer chromatography (TLC), and high performance liquid chromatography (HPLC). Among 52 isolates from apple, pear and grape, 14 isolates produced patulin, 13 isolates produced patulin and citrinin, and 6 isolates produced citrinin. All isolates of *Penicillium* from citrus produced patulin. Natural occurrence of the major *Penicillium* mycotoxins was surveyed from a moldy pear sample. The sample was contaminated with patulin. The contamination level in the sample was 6.2 μg/mg.

A-10. Identification and Characterization of *Trichoderma* Species Associated With Oyster Mushroom Green Mould. Jin Yeop Shim, Sun Chul Kim, Geon Sik Seo and Seung Hun Yu. Department of Agricultural Biology, College of Agriculture, Chungnam National University, Taejon 305-764, Korea

Trichoderma green mould is one of the most severe and epidermic diseases in oyster mushroom cultivation in Korea. In spite of it's severe damage, etiology, inoculum sources and control measures of the disease have been studies with rare. The survey of commercial oyster mushroom farms for *Trichoderma* green mould was carried out during 1998-1999. A total 101 isolates of *Trichoderma* were collected from oyster mushroom beds (substrates) and identified according to their morphological and cultural characteristics. Of total 101 isolates of *Trichoderma,* 71 isolates (70.3%) were identified as *T. virens*, 15 isolates (14.9%) as *T. viride*, 6 isolates (5.9%) as *T. koningii,* and 9 isolates (8.9%) as *T. harzianum. T. virens*, the predominant species, was isolated more requently from waste cotton substrate (80.0%) than from rice straw substrate (57.1%). Cultural characteristics and substrate colonization ability of the species were studied and *in vitro* interaction between *Trichoderma* species and *Pleurotus ostreatus* was investigated.

A-11. Shotgun Sequencing and Analysis of a 112 kb BAC Clone 6J18 of Chromosome 7 in *Magnaporthe grisea.* Young Jin Koh[1], Woo-bong Choi[2] and Ralph A. Dean[2]. [1]Department of Agricultural Biology, Sunchon National University, Sunchon, Chonnam 540-742, Korea. [2]Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29634, USA

A shotgun library with an average insert size of 1.9 kb and 3,360 individual clones was constructed from nebulized BAC DNA fragments of a 112 kb BAC clone 6J18 of chromosome 7 in *Magnaporthe grisea.* About 83% of 3,500 shotgun clones were sequenced successfully and the average high quality bases were 364 bp. The complete sequence of the BAC clone 6J18 was obtained from the robust contig with high quality in the final assembly of 2,985 reads of shotgun clones using Phred and Phrap. BAC clone 6J18 consists of 111,903 bp and the overall G+C nucleotide content is 51.39%. Analysis of the BAC clone 6J18 sequence by a BLAST search of the GenBank database and a GenScan reveals 16 open reading frames (ORFs) with significant homologous sequences and 21 ORFs with no homology to other known genes.

A-12. Current Status of Occurrence of Garlic Rust in Southern Areas of Korea. Dong Hyun Lee and Young Jin Koh. Department of Agricultural Biology, Sunchon National University, Sunchon, Chonnam 540-742, Korea

Current status of occurrence of garlic rust was investigated in two garlic cultivars Daeso and Namdo in Goheung, Chonnam and Namhae, Kyungnam during 1998-1999 growing seasons. The rust severities of cultivars Daeso and Namdo in Goheung were 85.8% and 10.8% in 1998, whereas those were 23.1% and 1.8% in 1999, respectively. The rust severities of cultivars Daeso and Namdo in Namhae were 76.1% and 4.8% in 1998, whereas those were 18.6% and 1.2%, respectively. The relationships between rust severity and yield loss were also investigated. Dramatic yield losses of bulb weight were measured in proportion to the increase of rust severities on leaves of garlic. The relationships between weather conditions in two areas investigated and rust severities of in two garlic cultivars were discussed during 1998-1999 growing seasons.

A-13. Identification of Three Different *Botrytis* Species from Bulbous Plants. Sung Kee Hong[1], Young Hee Lee[1], Dong Soo Ral and Hong Gi Kim[2]. [1]Division of Plant Pathology, Department of Crop Protection, National Institute of Agricultural Science and Technology, Suwon, Korea 441-707. [2]Department of Agricultural Biology, College of Agriculture, Chungnam National University, Taejon 305-764, Korea

Various type of symptoms were observed on flower, leaves and stem of tulip plants, on bulb of narcissus plants and on leaves of gladiolus plants during survey of *Botrytis* diseases in the major growing areas of bulbous plants such as Yongin, Asan, and Pusan in Korea from 1998 to 1999. Based on the morphological and cultural characteristics, fungal pathogens from the diseased parts of tulip, narcissus and gladiolus were identified as *Botrytis tulipae, B. narcissicola and B. gladiolorum,* respectively. *B. gladiolorum* showed strong pathogenicity on leaves of gladiolus plants by artificial inoculation. The pathogenicity of *B. narcissicola* and *B. tulipae* is being carried out. The three *Botrytis* species, *B. tulipae, B. narcissicola and B. gladiolorum,* are first identified in Korea.

A-14. Taxonomical Analysis of *Phytophthora* species and Selection of Distinct Marker of *P. infestans* with PCR. K. S. Kim[1], S. J. Woo[1], H. J. Kim[1], H. S. Shin[1]. Y. I. Ham[2], J. W. Lee[2], B. S. Kim[3] and Y. S. Lee[1], [1]Div. of Applied Plant Sciences, Kangwon National University, Chuncheon 200-701 [2]National Alpine Agricultural Experiment Station, RDA, Korea. [3]Kangnung National University, Kangnung

We studied on the taxonomy of *Phytophthora* species and selected specific marker of *P. infestans* through RAPD method. PCR products between 3.0~3.2kb were obtained using nine random primers, and the results were analyzed using *NTSYS-PC* program. As a result, we selected a 750bp-distinct band in *P. infestans* only and a 517bp-conserved band in all *Phytophthora* species at the same time. In RAPD analysis, *P. infestans* isolates from different locations showed more than 90% genetic similarity, and isolates of *P. capsici* were showed more than 80% similarity, and other *Phytophthora* species showed 60% similarity. Noticeably, isolates of *P. infestans,* except contaminated pathogen P9830, and isolates of *P. capsici* were grouped effectively. The result indicates that RAPD technique could be used for rapid and easy indentification and classification of the species.

A-15. Impact of Environmental Factors on *In Vitro* Interactions Between Forma Specialis and Races of *Fusarium oxysporum* and Tomato Soil-Borne Pathogens. Jong Tae Km, Hyang Burm Lee[1], In Hee, Park, Eum Ryang Im and Seung Hun Yu[2]. Puyeo Tomato Experiment Station, ARES, [1]Korea Research Institute of Bioscience and Biotechnology, [2]Detp. of Agricultural Biology, Chungnam National University

The influence of environmental factors such as water activity(aw) and temperature on mycelial growth and *in vitro* interactions between *Fusarium oxysporum* f. sp. *lycopersici* race 1(FOL-I), race 2(FOL-II), *F. oxy.* f. sp. *radicis-lycopersici*(FOL-C) and *Verticillium albo-atrum*(VEA), *V. dahliae*(VED), *Colletotrichum coccodes*(COC), *Pyrenochaeta lycopersici*(PYL), *Rhizoctonia solani*(RHS), *Sclerotium* sp.(SCs) isolated from diseased tomato plants and soils were investigated *in vitro* on 2% tomato leaf extract and malt extract agar medium. The types of interactions between forma specialis/races of *F. oxy.* and tomato soil borne pathogens when paired with each other under the different environmental conditions(aw; 0.955-0.995, and temperature; 15-30oC) were determined and given a numerical scores. A total numerical Index of Dominance(ID) to measure the ability of forma specialis/races and their interacting fungi to dominate or inhibit was obtained. Mycelial growth and interaction patterns were markedly influenced by water activities and temperatures. There was a mutual inhibiton among the forma specialis/races of *F. oxy.*, but the forma speciails/races at slightly drier conditions(0.955 and 0.971 aw) were competitive and dominant against all the interacting fungi except SCs and RHS, and significantly competitive against VEA and VED regardless of water activities and temperatures. The growth of forma specialis/races of *F. oxy.* were very significantly inhibited by RHS, especially at 0.999 aw/30oC. Mycelial growth of FOL-I at 15-20oC and FOLII, FOL-III at 15oC were very significantly inhibited not only by RHS but also SCs at high water availability level(0.995 and 0.999 aw). Mycelial growth of the forma specialis/races of *F. oxy.* at lowered temperatures(15-20oC), were significantly inhibited especially by SCs at 0.999 aw.

A-16. Influence of Water Activity and Temperature on Mycelial Growth, Germination and Sporulation of Different Forma Specialis and Races of *Fusarium oxysporum*. Jong Tae Kim, Hyang Burm Lee[1] and Seung Hun Yu[2]. Puyo Tomato Experiment Station, ARES, [1]Korea Research Institute of Bioscience and Biotechnology, [2]Dept. of Agricultural Biology, Chungnam National University

The effects of water activity(aw; 0.955-0.999) and temperature(15-30oC) on microconidial germination and sporulation of *Fusarium oxysporum* f. sp. *lycopersici* race 1(FOL-I), race 2(FOL-II), and *F. oxy.* f. sp. *radicis-lycopersici*(FOL-C) from tomato, *F. oxy.* f. sp. *cucumerium*(FOC) from cucumber and *F. oxy.* f. sp. *fragaria*(FOF) from strawberry were determined *in vitro* on 2% tomato leaf extract and malt extract agar medium. Mycelial growth rates and germination rates of the forma specialis/races varied for water activity, temperature and solutes tested. Growth rates at high water availability level(0.999-0.995 aw) were greatest on the medium adjusted with sucrose as a solute. Growth rates of them at lowered water availability level(0.955 aw) were higher on the medium adjusted with KCl. The lag phase time to germination varied with temperature/water activity, and between forma specialis/races. The germination and germ tube elongation of FOL-C at 30oC was very slow at 0.955 aw, and the lag phase time for germinarion of FOL-I was shortest, and germ tube length of FOC was longest regardless of water activity. Sporulation of all the forma specialis/races were best at slightly drier condition(0.971 aw) regardless of temperature. With increasing of temperature, there were significant increases in sporulation of FOC and FOF which were best at 0.955 aw/30oC, and 0.971 aw/30 oC, respectively. However, the sporulation of FOL-I and FOF at 0.955 aw was slightly lower at 30oC than 20 and 25oC.

A-17. Distribution and Pathogenicity of Forma Specialis and Races of *Fusarium oxysporum* causing Crown Rot and Wilt of Tomato in Korea. Jong Tae Kim, Hyang Burm Lee[1], In Hee Park, Eum Ryang Im and Seung Hun Yu[2]. Puyo Tomato Experiment Station, ARES, [1]Korea Research Institute of Bioscience and Biotechnology, [2]Dept. of Agricultural Biology, Chungnam National University

For survey of distribution and pathogenicity of forma specialis of *Fusarium oxysporum* causing crown rot and wilt of tomato, samples of soils and diseased tomato plants were collected from different tomato cultivation areas in Korea. From the result of pathogenicity test using four differential varieties of tomato(Ponderosa, Okitsu 3, Walter and Zuiken), forma specialis and race types of *F. oxy.* were decided and the isolation frequency(%) were determined. The *F. oxy.* isolates were identified as *F. oxy.* s. sp. *lyopersici* race 1 and race 2, and *F. oxy.* f. sp. *radicis-lycopersici*(FOL-C) of which *F. oxy.* f. sp. *radicis-lycopersici* was predominant. The isolation frequency of FOL-C from soils and diseased tomato plants was 37 and 54 %, respectively. Out of eighteen isolates of FOL-C, fourteen isolates showed pathogenicity against not only tomato but also cucumber, pumkin and bean. Most of the isolates of FOL-C showed no or slight pathogenicity against eight rootstock tomato cultivars, but three isolates(CJ-514, BS-465, CJ-516) out of them showed high pathogenicity against three rootstock cultivars such as Zuiken, Momotaroyouk and Taibyousinkouyo.

A-18. Pink Rot of Onion Caused by *Phoma terrestris*(syn. *Pyrenochaeta terrestris*). Yong-Ki Kim[1], Sang-Bum Lee[1], Sang-Yeob Lee[1], Chan-Jung Lee[2], Hee-Dae Kim[2] and Yong-Chul Choi[1]. Plant Patholog Div., Dept. of Crop Protection, [1]National Institute of Agricultural Science and Technology, Suwon 441-707, [2]Onion Experimental Station, Kyongnam Agricultural Research and Extention Services, Changryung 635-800, Korea

Pink rot of onion occurred at first in the field of Onion Experimental Station in 1998 and has found main cultivation area of onion locally. The pathogen was able to isolated only on Apricot agar(apricot 0.3%, pH 6.5) through a series of isolation procedure. The pathogen was not sporulated under radiation of fluorescent light or dark condition but under radiation of near ultraviolet light condition. Onions infected showed a typical symptom of pink rot on root of onion. Its morphological characteristics including shape, size and color of pycnidium and pycnidiospore , formation site and size of setae and pigment formation on water agar were similar with *Phoma terrestris* in Compendium of Onion and Garlic Diseases. The optimum temperature for the growth of the pathogen and disease development was 25~28℃. When onion seeds were inoculated with spore suspension(conc. 106spores/ml), and were cultivated in test-tube(diameter 4.5cm), disease symptoms were found on roots seven days after inoculation.

A-19. Bulb Canker of Garlic Caused by *Embellisia allii* in Korea: The Ecophysiological Effects on Mycelial Growth, Sporulation and Its *In Vitro* Interaction with *Fusarium* spp. Causing Bulb Rot of Garlic. Hyang Burm Lee, Chang-Jin Kim and Seung Hun Yu[1]. Korea Research Institute and Bioscience and Biotechnology, [1]Dept. of Agricultual Biology, Chungnam National University

In the course of study on post-harvest and storage disease and deterioration of garlic(*Allium sativum*) by fungi, *Embellisia allii* causing bulb canker of garlic was detected frequently together with *Fusarium* spp. causing bulb rot of garlic. The ecophysiological effects on mycelial growth, sporulation, and *in vitro* interaction between *E. allii* and *Fusarium* spp. were determined *in vitro* on 2% malt extract agar(MEA) mediated with glycerol to 0.937-0.995 aw under different temperature conditions(20-30oC). Growth of *E. allii* and *Fusarium* spp. were best at 0.995 aw/25oC, and 0.995 aw/30oC, repectively. At lowered water availability level(0.937 aw), *E. allii* showed almost no mycelial growth, regardless of temperature. However, sporulation of *E. allii* was better at lowered temperature(20oC), and almost no sporulation at 30oC regardless of media tested, while *Fusarium* spp. better at high temperature. Sporulation of *E. allii* on PDA basic medium was better than MEA, especially at high aw and low temperature. Interactions of each dual culture were examined *in vitro* on the MEA, and the interaction patterns determined for each fungus, and a numerical score(Index of Dominance, ID) given. The interaction patterns between *E. allii* and *Fusarium* spp. varied for water activity, temperature depending on growth. Generally, *Fusarium* spp. were more very inhibitive and dominant against *E. allii* and showed a high ID score. However, at 20oC, there was only a mutual inhibition between them in the range of 0.971-0.995 aw.

A-20. Identification of Seedborne *Fusarium decemcellulare* from *Hibiscus syriacus* Seeds. Ik Hwa Hyun[1], Byoung Chul Hwang[1], Yong Hwan Lee[2], Noh Youl Heo[1] and Kyoung Il Ko[1]. [1]National Plant Quarantine Service, 433-1, Anyang 6-Dong, Anyang, Korea 430-016. [2]Seoul National University, Seodun Dong, Suwon 441-744, Korea

During seed health testing of *Hibiscus syriacus* L. by blotter method, *Fusarium decemcellulare* was detected. The fungus was encountered from one seed lot with 4% infection rate among five lots of *H. syriacus* seeds collected in Korea in 1998. Mycelial growth on the seeds was scanty. Pionnotes containing numerous macroconidia were easily observed under steromicroscope and were yellowish white to light yellow. Long microconidial chains were also recognized. Macroconidia were very large with 60～90×5.5～7.5㎛ in size, falcate to slightly curved, thick-walled, 5 to 9 septate, mostly 7 septate with a hooked apical cell and a foot-shaped basal cell. Microconidia were oval to ellipsoidal and usually one celled. The fungus grew slowly on PDA and produced abundant light yellow sporodochia in a central area of colony. The undersurface of colony was carmine red. No chlamydospores were observed after one month incubation. The fungus showed pathogenicity to one-year-old seedlings of *H. syriacus*(cv. Banner) by wound inoculation.

A-21. The Difference of Response to Chemicals and Mating Type Distribution of *Phytophthora infestans* Collected from Kangwon Areas and Southern Areas in Korea. Chun Hwan Hong, Ryu Kyoung Yul, Hahm Young Il and Kim Byoung Sup[1]. Crop Division, National Alpine Agricultural Experiment Station, RDA, Pyungchang, Kangwon, Korea 232-950. [1]Dept. of Horticulture, Kangnung National University, Kangnung, Kangwon 210-702, Korea

Isolates of *Phytophthora infestans* from kangwon area and southern area in Korea were examined for mating type distribution and sensitivity to chemicals. Mating type of isolates was differently distributed between kangwon and southern areas. Mating type of kangwon isolates was coexisted with A1 and A2, however, A2 mating type was mostly distributed in southern areas. Sensitivity to chemicals of the isolates was determined by mycelial growth on V8+rye agar amended with various chemical concentration. Responses to metalaxyl of the isolates was differently revealed among isolates collected from various areas. Milyang isolates was highly developed resistance to metalaxyl but others were shown sensitive or intermediate resistance to metalaxyl. Response to metalaxyl of *Phytophthora infestans* isolated from kangwon areas was slightly changed from 1998 to 1999. In 10㎍/㎖ metalaxyl concentration, the mycelial growth of heonggae isolates in the same period was 3.9㎜ and 22.3㎜ after incubation for 10 days at 20℃. In 1.0㎍/㎖ dimethomorph concentration, all isolates was not grown at the same condition. We supposed that response to chemicals and mating type distribution of *Phytophthora infestans* was slightly changed.