University, 7 Jukhen-gil, Gangneung, Gangwon-do, 210702, Republic of Korea
Email: bskim@gwnu.ac.kr

This study was conducted to select potential soil micro-organisms that can be applied to environment friendly control against phytopathogenic fungi. Bacterial strain T-9 was isolated from soil of Samcheok city in Korea and identified as *Paenibacillus kribbensis* on the basis of morphological and biological characteristics and 16S rRNA gene sequence analysis. This bacterium exhibited broad-spectrum antagonistic activity against phytopathogenic fungi *in vitro*. The strain produced cellulase, pectinases, protease, HCN, phosphatase and siderophore. Also this strain had disease control effects against a variety of plant diseases *in vivo*. A bioactive metabolite was isolated from *P. kribbensis* T-9 and also showed potent antagonistic activity towards a range of phytopathogenic fungi. The above-described results indicate that *P. kribbensis* T-9 has the potential ability to be used as an antagonist against various phytopatho- genic fungi.

P03.022 The effect of *Pseudomonad fluorescens* and AM fungi indigenous isolated from healthy banana rizospheres at endemic Fusarium wilt areas as the potensial biocontrol agents to Fusarium wilt

S. Eri, H. Trimurti, F.H. Eti, D. Abdi and N. Nazril
Agroekotek, Agriculture Faculty, Andalas University, Indonesia, Padang
Email: erisulyanti@yahoo.com

In this study, to combinate of some biocontrol agents with different mechanisms is alternative to improve the effectiveness of the biological control agents. Single and combined applications of Pseudomonad fluorescens and Arbuscular Mychorrhizae Fungi (AM Fungi) indigenous isolates were tested to induce resistance in susceptible Cavendish banana against *F. oxysporum* f. sp. *cubense* race 4 under greenhouse conditions. These isolates originally isolated from healthy banana rhizosphere at endemic Fusarium wilt areas in the centre of production banana in West Sumatra. These researches were conducted with Block Randomized Design with 16 treatments and 10 replications. The treatments were Three isolates of Pseudomonad fluorescens indigenous (Par1-Cv, Par4-Rj_1, Par2-Jt_1) and 3 isolates of AM Fungi (Gl_1BuA_4, Gl_2BuA_6, and Gl_1KeP_3). The biocontrol agents were applied as single agents and combination two of them. This study demonstrated that the combined application of biocontrol organisms *Pseudomonas fluorescens* and AM Fungi can provide an effective control option for banana growers dealing with Fusarium wilt where the combination of Par1-Cv + Gl_1BuA_4 isolates are the most effective to control Fusarium wilt followed by the combination of Par1-Cv + Gl_2BuA_6 and Par2-Jt_1 + Gl_1KeP_3 isolates, reduced Fusarium wilt incidence by 87.4 and 75.0%, respectively.

P03.023 The potential of endophytic fungus *Colletotrichum* sp. CKL005 from *Cinnamomum kanehirai* on controlling anthracnose of *Brassica rapa*

S.Y. Wu[1], W.C. Chung[2] and W.H Chung[1]
[1]Department of Plant Pathology, National Chung Hsing University, No. 250, Kuo Kuang Rd., Taichung, 402 Taiwan, China; [2]Taiwan Seed Improvement and Propagation Station, No.46, Xingzhong St., Xinshe Dist., Taichung, 426, Taiwan, China
Email: wenchung@nchu.edu.tw

An endophytic fungus, *Colletotrichum* sp. CKL005 isolate, from *Cinnamomum kanehirai* could inhibit growth of several phytopathogens, including *Alternaria brassicicola*, *Botrytis cinerea*, *C. gloeosporioides*, *C. higginsianum*, *Fusarium oxysporum* f. sp. *lilii*, *F. oxysporum* f. sp. *lycopersici*, *F. oxysporum* f. sp. *tracheiphilum*, *Rhizoctornia solani* and *Phytophthora capsici*. Furthermore, the mycelial extract showed higher activity than culture filtrate on growth inhibition of phytopthogens. For examining the efficacy on controlling anthracnose of *Brassica rapa*, the mycelial mass was grinded and extracted by ethyl acetate. Results showed that the disease severity of anthracnose on *B. rapa* could be reduced by 41.7 or 33.4% after the application of 10 or 100 mg/L respectively of mycelial extract. On the contrary, spraying of 10 or 100 mg/L before *C. higginsianum* PA01 inoculation also decreased the disease severity by 27.8% as compared with no treatment. For the identification of the efficacious compounds, the mycelial extract was analyzed by HPLC and GC-MS. Results indicated that the mycelial extract of CKL005 contained [included] β-carotene, glycerol 1-palmitate, prednisolone acetate, ergosterol, gammabufotalin, hydrocortilsoreacetate, digitoxin and gibberellic acid. In addition, the CKL005 is the volatile-producing fungus and can inhibit the mycelial growth of *C. higginsianum*. The GC-MS analysis indicated that several compounds might be associated with the growth inhibition to *C. higginsianum* PA01, including [2,5- Cyclo-hexadiene-1,4-dione,2,6-bis (1,1-dimethylethy)-], [2,6-Bis(1,1-dimethylethyl)-4-methyl-phenol(BHT)] and [(3H)-one, 3,6,7-thimethoxy-isobenzofuran-1]. Based on the molecular phylogenetic analysis, the *Colletotrichum* sp. CKL005 isolate might be a new species which has the potential to act as a bioagent on disease control.

P03.024 Role of cell wall degrading enzymes and antimicrobial substances in biological control of plant pathogens of sorghum and chickpea

S. Gopalakrishnan, V. Srinivas, B. Prakash, A. Shravya, T. Naresh, G. Anusree, R. Vijayabharathi, R.K. Bhimineni and R. Sharma
International Crops Research Institute for the Semi-Arid

Tropics (ICRISAT), Patancheru 502 324, Andhra Pradesh, India
Email: s.gopalakrishnan@cgiar.org

Biological control of plant pathogens occurs in several ways, the most common mechanisms being parasitism and predation, competition for nutrients (carbon, nitrogen, oxygen, iron and other nutrients) or space, production of antimicrobial substances and induced resistance. A total of eight (CAI-21, CAI-26, MMA-32, CAI-17, CAI-68, CAI-78, KAI-26 and KAI-27) and five (CAI-24, CAI-121, CAI-127, KAI-32 and KAI-90) strains of *Streptomyces* were earlier reported by us as having potential for the biocontrol of charcoal rot of sorghum, caused by *Macrophomina phaseolina* (Tassi) Goid., and wilt of chickpea, caused by *Fusarium oxysporum* f. sp. *ciceri* (FOC), respectively and plant growth promotion (PGP) of the plant. In the present investigation, all thirteen strains of *Streptomyces* were further evaluated for their production of cell wall degrading enzymes such as B-glucanase, chitinase, cellulase, lipase, protease, siderophore, hydrocyanic acid and indole acetic acid. Further, all the strains were evaluated for their production of secondary metabolite(s) and volatiles. This study confirms that the selected *Streptomyces* strains have broad-spectrum biocontrol and PGP properties.

P03.025 Biological control of stem blight disease in Asparagus

N. Khositchareonkul, A. Somrith, T. Passabuth and T. Tassakorn
Plant Protection Research and Development Office, Department of Agriculture, Chatuchak, Bangkok, 10900, Thailand
Email: tadsakorn@yahoo.com

Isolation and efficacy testing of *Bacillus subtilis* and *Trichoderma harzianum* in controlling the stem blight fungal pathogen *Phomopsis asparagi* in asparagus were performed. Ten out of thirty isolates of effective antagonistic bacteria that exhibited mycelia growth inhibition of *P. asparagi* (AS2, AS5, AS8, AS9, AS15, AS18, AS21, AS23 and AS24) on PDA agar were preliminary screened and observed. Spraying method was used to select four *Bacillus subtilis* (AS2, AS5, AS8 and AS9) under greenhouse condition and the results indicated that at 7 days post inoculation, the lesion sizes were reduced to 1.06, 1.58, 1.72 and 1.65 centimeter, respectively. Further study of a hundred of *Trichoderma harzianum* isolated from mushroom materials and mushroom composts in inhibiting the fungal mycelia growth revealed that eighteen species among them exhibiting 90 to 100 percent mycelia growth inhibition. Then, five of *Trichoderma harzianum*, TS15, TS29, TS31, TS33 and TS38 were further selected to test the efficacy controlling of stem blight disease under greenhouse condition by applying *Trichoderma harzianum* on the soil surface before inoculation. The results showed that at 10 days post inoculation, TS29 and TS31 had percent disease incidence at 10.07 and 15.72 percent respectively and revealed significant statistically difference with control treatment at 42.54 percent.

P03.026 Production and biological evaluation of biopolymers from isolated *Rhodotorula glutinins* against *Botrytis* blight disease

W.M. Haggag
Department of Plant Pathology, National Research Centre, Egypt
Email: wafaa_haggag@yahoo.com

Yeasts have been receiving great attention in science and industry for over one hundred years because they can produce many kinds of bioactive substances. In recent years, it has been found that *Rhodotorula glutinis* yeast have wide applications as biocontrol and other fields. One of the main characteristics shared among Rhodotorula strains is the ability to produce biopolymers as antifungal compounds active against fungi. *Rhodotorula glutinins* is isolated from garden soil and identified according to morphological and biochemical keys. It has the ability to produce biopolymers as an exopolysaccharide (EPS), siderophore, rhodotorulic acid carotenoids and glucane and showed inhibitory effect against *Botrytis cinerea* causing grey mould disease. In order to standardize the mass and metabolite production some cultural conditions like different incubation time in hours, pH, carbon sources and concentrations and nitrogen source were determined. During fermentation, growth, pH and exopolysaccharide, siderophore, rhodotorulic acid carotenoids and glucane production were monitored. Under artificial and natural condition, *Rhodotorula* formulation was effective in reducing *B. cinerea* disease in strawberry, grape and bean fruits. Pre-harvest treatment protected fruits from *Botrytis* post-harvest disease in comparing of fungicide. In addition, the obtained results showed that *Rhodotorula* treatment significantly increased the growth parameters as well as dry weights and yield. *Rhodotorula glutinis* have proved safe and non-toxic in experimental rat animal.

P03.027 A high-throughput metabolomics approach for the study of the mycoparasitic interaction between *Stachybotrys elegans and Rhizoctonia solani*

R. Chamoun, S. Jabaji and K.A. Aliferis
McGill University, Department of Plant Science, 21111 Lakeshore Rd., Sainte-Anne-de-Bellevue, QC H9X 3V9, Canada
Email: suha.jabaji@mcgill.ca

The study presents the first proof-of-principle of metabolite profiles of the fungal mycoparasite *Stachybotrys*