S3-1

Biological Control of Soil-borne Diseases with Antagonistic Bacteria

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Biological control has many advantages as a disease control method, particularly when compared with pesticides. One of the most important benefits is that biological control is an environmental friendly method and does not introduce pollutants into the environment. Another great advantage of this method is its selectivity. Selectivity is the important factor regarding the balance of agricultural ecosystems because a great damage to non target species can lead to the restriction of natural enemies' populations. The objective of this research was to evaluate the effects of several different bacterial isolates on the efficacy of biological control of soil borne diseases.

White rot caused by *Sclerotium cepivorum* was reported to be severe disease of garlic and chive. The antifungal bacteria *Burkholderia pyrrocinia* CAB08106-4 was tested in field bioassays for its ability to suppress white rot disease. In field tests, *B. pyrrocinia* CAB08106-4 isolates suppressed white rot in garlic and chive, with the average control efficacies of 69.6% and 58.9%, respectively. In addition, when a culture filtrate of *B. pyrrocinia* CAB08106-4 was sprayed onto wounded garlic bulbs after inoculation with a *Penicillium hirstum* spore suspension in a cold storage room (-2^{o}C), blue mold disease on garlic bulbs was suppressed, with a control efficacy of 79.2%. These results suggested that *B. pyrrocinia* CAB08106-4 isolates could be used as effective biological control agents against both soil-borne and post-harvest diseases of Liliaceae.

Chinese cabbage clubroot caused by *Plasmodiophora brassicae* was found to be highly virulent in Chinese cabbage, turnips, and cabbage. In this study, the endophytic bacterium *Flavobacterium hercynium* EPB-C313, which was isolated from Chinese cabbage tissues, was investigated for its antimicrobial activity by inactivating resting spores and its control effects on clubroot disease using bioassays. The bacterial cells, culture solutions, and culture filtrates of *F. hercynium* EPB-C313 inactivated the resting spores of *P. brassicae*, with the control efficacies of 90.4%, 36.8%, and 26.0%, respectively. Complex treatments greatly enhanced the control efficacy by 63.7% in a field of 50% diseased plants by incorporating pellets containing organic matter and *F. hercynium* EPB-C313 in soil, drenching seedlings with a culture solution of *F. hercynium* EPB-C313, and drenching soil for 10 days after planting. Soft rot caused by *Pectobacterium carotovorum* subsp. *carotovorum* was reported to be severe disease to Chinese cabbage in spring seasons. The antifungal bacterium, *Bacillus* sp. CAB12243-2 suppresses the soft rot disease on Chinese cabbage with 73.0% control efficacy in greenhouse assay. This isolate will increase the utilization of rhizobacteria species as biocontrol agents against soft rot disease of vegetable crops.

Sclerotinia rot caused by *Sclerotinia sclerotiorum* has been reported on lettuce during winter. An antifungal isolate of *Pseudomonas corrugata* CAB07024-3 was tested in field bioassays for its ability to suppress scleritinia rot. This antagonistic microorganism showed four-year average effects of 63.1% of the control in the same field. Furthermore, *P. corrugata* CAB07024-3 has a wide antifungal spectrum against plant pathogens, including *Sclerotinia sclerotiorum*, *Sclerotium cepivorum*, *Botrytis cinerea, Colletotrichum gloeosporioides, Phytophotra capsici, and Pythium myriotylum.*