



Book review

Biotechnological Approaches in Biocontrol of Plant Pathogens

Edited by K. G. Mukerji, B. P. Chamola and R. K. Upadhyay. Kluwer/Plenum, New York, 1999, 255 pp., ISBN 0-306-46104-8

Up to 50% of world agricultural production is being lost to diseases, pests and weeds. Chemical crop protectants have been effective in limiting losses when total production increased tremendously in the last century as a result of selective breeding. However, chemicals have caused severe environmental problems and are seldom durably effective. For more sustainable agriculture alternative strategies must be sought. Biocontrol involves the use of naturally occurring non-pathogenic (micro)organisms that are able to reduce the activities of plant pathogens and, thereby, suppress diseases. Such antagonistic microorganisms can compete with pathogens for nutrients, inhibit pathogen multiplication by secreting antibiotics or toxins, or reduce pathogen populations through parasitism. Moreover, some of these microorganisms induce resistance in plants, which enables plant hosts to better defend themselves against different pathogens. In spite of this impressive range of antagonistic activities, biocontrol agents only rarely reduce diseases to economically acceptable levels. Lack of sufficient effectivity and reliability of microbial antagonism can usually be ascribed to either poor colonization of sensitive host plant tissues and/or variable expression of the antagonistic trait(s). Biotechnology can provide tools for improving biocontrol properties when the genetic basis of antagonistic activities has been properly established. This book provides a number of timely reviews of agents employed, their mechanisms of action, and activities in laboratory and field experiments, and illustrates further approaches to be taken for benefits of biotechnological applications to materialize.

Five chapters discuss specific types of applications. Yeasts are natural colonizers of above-ground plant parts and M. H. Jijakli and co-authors describe how application of antagonistic yeasts can protect fruits from postharvest diseases. S. M. Boyetchko describes various fungi and bacteria that can reduce fungal diseases of Brassica's. Bacteria are easily amenable to

genetic modification and, as shown by S. Kaur and K. G. Mukerji, avirulent mutants of pathogens may be used to control bacterial diseases. Mukerji illustrates that mycorrhiza can physically protect plant roots from attack by soil-borne fungi, whereas Tilak et al. describe the role of plant growth-promoting rhizobacteria in reducing pathogen activity. These are mostly excellent chapters in which it is outlined how effective biocontrol agents can be selected and what mechanisms may be involved in disease suppression. Inevitably, there is overlap in the descriptions in different chapters but this only reinforces the notion that similar mechanisms can be involved in different settings. A chapter by Kaur and Mukerji on bacteria as biocontrol agents of insects is largely devoted to Bt toxin. The use of Bt toxin either as a bioinsecticide or in transgenic plants is one of the most successful applications and has already received much attention. In contrast, a chapter by Boyetchko on biological weed control clearly discusses new information on the various fungal and bacterial agents targeted to specific applications as bioherbicides and the techniques being developed to enhance their effectivity.

Three descriptive chapters deal primarily with methods and techniques that can aid in manipulating and tracking selected types of biocontrol agents: on fusion of protoplasts of antagonistic fungi by Mukerji, on genetic manipulation of antagonistic *Fusarium* spp. by Q. Migheli et al., and on application of *lux*-gene technology to monitor bacterial spread or activity in the environment by D. White et al. A chapter by P. S. Srivastava et al. on the role of tissue culture in plant disease control seems out of place, but may be justified as the only opportunity to deal with suppression of viral diseases by e.g. meristem culture and coat protein-mediated protection. However, examples of engineered resistance against fungi, bacteria, insects and herbicides are also treated, be it in little detail. An introductory chapter by R. Gupta and Mukerji attempts to provide coverage of host parasite specificity and pathogenesis, but falls regrettably short as a result of a quite unbalanced description of the variety of phenomena and mechanisms involved.

In general, the book satisfactorily reflects the current trends in the development and use of biocon-

trol agents. However, production could have been better. Some chapters suffer from many misspellings and typing errors. Line spacing varies between pages and the more elaborate tables are set in such small type that they are difficult to read. Division in different categories in the index makes its use not straightforward. These shortcomings detract a

little from the comprehensive information that is provided.

L.C. van Loon
*Institute of Biology, Section Phytopathology,
Utrecht University,
Utrecht, The Netherlands*