Book review

***Rhizoctonia* Species: Taxonomy, Molecular Biology, Ecology, Pathology and Disease Control**. Edited by B. Sneh, S. Jabaji-Hare, S. Neate and G. Dijst. 1996. XVI+577 pp. Kluwer Academic Publishers, Dordrecht, the Netherlands. Price Dfl 345,00

Species of the genus *Rhizoctonia* belong to the most common and ubiquitous soil fungi. Their best-known representative, *R. solani*, is a destructive plant pathogen, being able to attack a wide variety of crops in almost all regions of the world. It is, therefore, no surprise that *Rhizoctonia* has been and certainly will remain to be the object of many research efforts. As a result, a vast amount of literature has accumulated.

In 1970, a summarizing book on *Rhizoctonia* (G. Parmeter's well-known 'Biology and Pathology of *Rhizoctonia solani*') was published, which turned out to be a successful and widely used book. Now, approximately 25 years later, it was felt necessary to prepare a new, up-to-date comprehensive work. This resulted in the appearance of the present book '*Rhizoctonia* Species: Taxonomy, Molecular Biology, Ecology, Pathology and Disease Control'. Basically, this book contains the extended reviews of papers presented during the Second International Symposium on *Rhizoctonia* held in Noordwijkerhout, the Netherlands, in 1995, but these were complemented with many other reviews. The aim was to give a comprehensive coverage of the research on *Rhizoctonia* since 1970. Indeed, the book contains a wealth of research information, gathered in 50 chapters, which are grouped together into six main sections. Here, I can no more than pick just a few topics.

Rhizoctonia is a complex genus; its anamorphs have teleomorph stages whose genera are classified in three orders of the Basidiomycota. There are many *Rhizoctonia* species; best known is *R. solani* (with the teleomorph *Thanatephorus cucumeris*). The first section 'Taxonomy and evolution of *Rhizoctonia* spp.' deals with the various methods that are tried to describe and order the inter- and intraspecific variation. Based on hyphal anastomosis reactions, nearly all isolates of *R. solani* can be placed into a specific anastomosis group (AG); however, the existence of bridging isolates complicates this task. Moreover, still little is known about the process of anastomosis and the genetic factors that control it. Nevertheless, grouping into AG's appears to be a useful and important part of the process of characterizing isolates of *R. solani*. Within AG's a further subdivision into subgroups, e.g. based on plant host specificity, appears possible. However, attempts of integration with additional classification methods: biochemical (electrophoretic isoenzyme profiles), or molecular (DNA base sequence complementarity, ribosomal RNA genes) into one comprehensive phylogenetic system have not yet been successful.

In the section on 'Genetics and pathogenicity of *Rhizoctonia* spp.' G.C. Adams pleas for population genetic studies (with DNA fingerprinting technology) of subgroups, as they represent the evolutionary units of *Rhizoctonia*; such studies are now just beginning to emerge. An additional variability factor is the widespread occurrence of extrachromosomal dsRNA elements in *R. solani*. Their function, if any, is unknown, although a few specific elements are associated with hypovirulence.

There is a small section on 'Plant-pathogen interactions of *Rhizoctonia* spp.' This may be illustrative for the relatively little progress that has been made in this area during the last 25 years. The initial steps of the infection process are nicely reviewed by J. Keijer.

The fourth section ('Ecology of *Rhizoctonia* spp., population and disease dynamics') contains several interesting chapters. The review by S. Neate and J.H.M. Schneider on sampling and quantification of *R. solani* in soil gives a concise description of the various methods that are employed. Each method, however, has its limitations, especially because quantification is a problem, and, consequently, statistics are often difficult to apply. A problem is also that *R. solani*

often has a patchy distribution in soil. An eye-opener was the chapter (by S. Naito) on basidiospore dispersal and survival. Although basidiospores are believed to be rather uncommon, yet numerous infections by them are reported. Airborne basidiospores can be disseminated rapidly over long distances, and can infect upper plant parts and cause disease under suitable moist conditions. Basidiospores may contribute to epidemic spread of disease, such as in foliage blight of sugar-beet (Japan).

The next section ('Characterization of *Rhizoctonia* spp. isolates, disease occurrence and management in various crops') is mainly devoted to specific crops: oilseed rape and canola, cereals, cotton, flowerbulbs, forage and oilseed legumes, ornamentals, peanut, potato, rice, sugar-beet, forest trees, turfgrasses, and vegetables. And there is an interesting chapter on mycorrhizal species of *Rhizoctonia*. The section ends with a chapter containing 34 photographs, mostly in colour, of symptoms incited by *Rhizoctonia* spp. in the crops treated in the section. Most pictures are a good illustration of the symptoms described in the text, and enhance the value of the book. Unfortunately, the legends of a few photographs are interchanged, which may lead to confusion.

It is not surprising that the final chapter, which deals with the 'Control of diseases caused by *Rhizoctonia* species', is one of the largest. Although there are in certain crops moderately resistant cultivars that provide effective protection against diseases caused by *Rhizoctonia* spp., in many crops hardly any resistant germplasm is available, and if there is any, it is mostly polygenic. Crop protection must, therefore, rely mainly on other means. The best results have been obtained with fungicides. However, in order to reduce fungicide usage, much research has been done into other possibilities of control. With soil solarization *R. solani* can be effectively controlled, as this pathogen is relatively sensitive to higher temperatures; the method is, however, restricted to warm climatic areas. Soil amendments such as organic manure, composts, or organic or inorganic fertilizers in several empirically formulated combinations have been proven useful. However, generalized concepts have been found difficult to develop, except that it is generally assumed that organic amendments reduce root diseases by increasing the general level of microbial activity in the soil, resulting in increased competition or antagonism in the rhizosphere. Relatively few examples are available of biocontrol of *R. solani* by antibiotic- or siderophore-producing soil bacteria. Also antagonism by certain actinomycetes, cyanobacteria and algae has been demonstrated. Non-pathogenic isolates of *Rhizoctonia* spp. offer interesting possibilities for biological control; they may use different mechanisms, including plant growth promotion. Other successful candidates for biocontrol are fungal mycoparasites, such as the ecologically facultative *Trichoderma* and *Gliocladium* spp. and the ecologically obligate *Verticillium biguttatum*. Finally, the role of the soil fauna, especially certain Collembolan species, in the biocontrol of *R. solani* is being investigated. Several formulations of fungi or bacteria with a biomass product have been developed that give good results in the control of *Rhizoctonia*. But rapid introduction and development is hampered by inconsistent results in the fields. Much research input will undoubtedly be needed for the development of several forms of integrated control, including a reduced use of fungicides, for the next decades to come.

The set-up of the book has the advantage that the research on *Rhizoctonia* is dissected in many small, easily readable portions, practically without omitting even one literature reference. The disadvantage, however, is that not much effort has been done to integrate the various aspects into summarizing schemes, general concepts or strategic research plans. It is a pity that e.g. a comprehensive scheme containing all known AG's, together with their preferred hosts, their regional or global distribution, etc., is lacking. In addition to this shortcoming, two other points should be mentioned. The book suffers from a multitude of typing errors, especially in running titles. More importantly, the subject index at the end of the book is of little value. The entries are fairly arbitrary and are often not very specific, and do mostly not refer to the correct pages.

In spite of these weaknesses, this book covers so much of the relevant literature, that it has to be considered as 'the' reference book for *Rhizoctonia*. One should, however, keep in mind, that one often will not find the desired data themselves in the book, but instead the references that will contain these data. So, this book is a must for anyone who is interested in *Rhizoctonia*, be it in research, extension, teaching or otherwise.

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