

with coverage of basic applications, explanations, refinements, instrumentation, continuous forest inventory, applications in other countries, and finally applications to computers.

The book is an ideal text book, as the coverage of how to carry out the various procedures is extremely detailed. As a reference book for the sometime user it would be as valuable. It is a little too detailed for the forester who would be constantly using it, as the detail then becomes somewhat tedious and makes it harder to find the material of interest. However, the 125 Figures help to hold attention, and some detail has been banished to the 14 Appendices, one of which is a thumb calibration chart, which also works for Imperial thumbs.

Bitterlich has covered the field, and presents information from the work of Grosenbaugh, Kitamura, Minowa, and a host of others. The use of the Spiegelrelaskop is explained in fine detail, and examples are given of the wide range of measurements which can be taken.

The text contains a bibliography with over 250 references, including 63 to Bitterlich's papers. There is a comprehensive glossary and index. The book would be a worthwhile addition to any mensuration library.

R. B. Tennent

FRANKIA SYMBIOSES

Edited by A. D. L. Akkermans, D. Baker, K. Huss-Danell, and J. D. Tjepkema

Developments in Plant and Soil Sciences No. 12

Martinus Nijhoff/Dr W. Junk, The Netherlands. 1984.

258 pages. ISBN 90-247-2967-X. £33.00

I wonder how many scientists working in the broad field of biological nitrogen fixation will reach for this monograph with a sense of eager anticipation, only to find that it is an exact reprint of "Plant and Soil" 78(1-2) which has been on New Zealand library shelves for a whole year? Presentation is now in hardback, with the same preface, the same dedication, and no explanation about the need for reprinting in a more expensive format. The papers, as is usual in scientific journal format, pursue their individual themes with little cross-referencing. Surely the publishers would have been justified in encouraging some sort of overview as an additional contribution to the new publication? At the very least, a new and expanded preface and a subject/species index would have been welcome. As it is, we have only the original set of 22 rather specialised contributions (one in French) which were presented at the Workshop on *Frankia* Symbioses, held in Noordwijkerhout and Wageningen, The Netherlands, in September 1983.

Most of the work on actinorhizas (non-leguminous nitrogen-fixing symbioses) has been concentrated on the *Alnus-Frankia* association, but it is heartening to see papers which document work with other higher plants, some of which are important understorey or tree species in temperate forests. They include the genera *Comptonia*, *Ceanothus*, *Dryas*, *Rubus*, *Datisca*, *Hippophaë*, *Myrica*, *Eleagnus*, *Colletia*, and *Casuarina*.

In the first paper, Mary Lechevalier describes the difficulties associated with the taxonomy of *Frankia* and explains the newly adopted system of designating and cataloguing strains. Collectively, these are referred to as "*Frankia* spp." even though individual species have not yet been defined. Taxonomic problems stem from diversity in morphology, physiology, chemistry, serology, DNA homology, and the host range of isolates. While some progress has been made within the "*Alnus* group" (Horrière), isolates from other higher plant species pose new problems (Lechevalier and Ji-sheng Ruan).

Methods for isolating and growing *Frankia* in pure culture have been developed only during the last decade. These are reviewed concisely by Baker and O'Keefe who report the first successful isolations from soil and recommend an improved method for isolation from root nodules. Various characteristics of *Frankia* isolates in pure culture are described by other workers.

The identification of *Frankia* as the endophyte of *Dryas drummondii* and of *Rubus ellipticus* is described by J. H. Becking with the aid of an excellent series of photomicrographs. This paper reintroduces the dual nature of the symbiotic relationship and the following group of contributions concentrates on various aspects of root nodule and whole-plant physiology, especially nitrogenase activity.

The wider ecological perspective and its complexity is underlined by Gardner, Clelland, and Scott in their discussion of the "triple symbiosis" observed between higher plant, *Frankia*, and a mycorrhizal fungus in *Alnus*, *Hippophaë*, and *Myrica*, and reported elsewhere in *Ceanothus*. This paper should raise interesting questions about the ecological significance of nutrient uptake and nitrogen fixation data presented, for species of *Alnus* and *Myrica*, in the remaining five contributions. Three of these describe studies in mixed stands of alder and either poplar or Douglas fir, but only one (Tessier du Cros, Jung, and Bariteau) acknowledges the possibility of triple symbiosis and provides evidence that interactions between *Frankia* strains and *Alnus* species are not always positive in terms of *Alnus* growth. Growth studies with *Casuarina* will be possible now that Zhang, Lopez, and Torrey have demonstrated successful inoculation of *Casuarina* spp. with a number of cultured isolates of *Frankia*.

It is unlikely that this book will be of direct use to the field manager interested in *Alnus*, *Casuarina*, or the harnessing of nitrogen fixation by understory species. The basic message is that we still know too little about *Frankia* to be able to improve tree growth by modification of the symbiotic relationship.

As a postscript, I would like to ask why the publishers have adopted a number system for references, rather than using author's name and year. I have a feeling that a majority of readers would prefer the instant association of name with topic, and an alphabetic listing by author's name in the bibliography.

Ruth L. Gadgil