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Book review

A. Krieg, 1986. *Bacillus thuringiensis*, ein mikrobielles Insektizid: Grundlagen und Anwendung. Acta Phytomedica 10. Paul Parey Scientific Publishers, Berlin and Hamburg. In German, with 16 figures and 10 tables, 191 pp. Price DM 58.

Insect-pathogenic bacteria with a potential for plant protection and control of human disease vectors are limited to three species of spore-forming bacteria., viz. *Bacillus thuringiensis*, *B. sphaericus* and *B. popilliae*. The first two species are characterized by the presence of an insecticidal proteinaceous inclusion body in the spores. This body contains a substance highly toxic to the gut epithelium of insects; it usually kills the insect rapidly. The toxin gene is plasmid-borne and this convenience allows, in principle, the manipulation of bacterial strains by conjugation or genetic engineering in order to produce more strains with extended host range and/or increased virulence. The main emphasis so far has been on *B. thuringiensis* and this bacterium has been advocated by the Food and Agricultural Organization and the World Health Organization as a biological insecticide for a long time and has gained world-wide acclaim in insect control.

B. thuringiensis (*Bt*) was first isolated and described by Ernst Berliner in 1911 from diseased larvae of the Mediterranian flour moth, *Ephestia kühniella*. Since then, over 800 strains of *Bt* have been described and they are effective against many noxious Lepidoptera, Diptera and Coleoptera. A wealth of information on *Bt* is available now in the literature and warrants a com-

prehensive review on this bacterial species. It certainly adds lustre to the 75th anniversary of the discovery by Berliner that a monograph on the fundamental and applied aspects of *Bt* is now available presenting the state of the art. It is most appropriate that this monograph is written by Berliner's scientific descendant and a well known expert in the field, Aloysius Krieg, who discovered the first *Bt* isolate from a coleopteran in 1983.

After a brief introduction to the subject in Chapter 1, a detailed account is given on the microbiology of *Bt*, including its taxonomy, physiology and genetics (Chapter 2). A review in dept of the various strains is presented but is only readily assimilable for experts. The plasmid-borne nature of the toxin gene is only briefly touched on. It is certainly a pity that the recent developments in cloning and sequencing of various toxin genes and the integration of toxin genes in plant genomes to give insect-resistant plants could not be documented in this chapter.

The pathology in insects as a consequence of the action of *Bt* and toxin is the subject of Chapter 3, which describes the initial events after toxin release in the gut and the saprophytic growth of the bacteria. The majority of this chapter is focused on the action of the insecticidal toxins, on virulence, sensitivity and potential for resistance to the toxin.

Apart from the specific action of the toxins, the success of *Bt* as a recognized insecticide is also explained by the relative ease with which the bacterial spores with toxins are commercially produced. In Chapter 4, the various aspects related to fermentation processes and production are discussed, including aspects such as shelf-life, quality control, standardization and formulation.

As the action of the bacterial toxin occurs in the insect gut, the spores must be ingested in order to be effective. The application technology of *Bt* is discussed in Chapter 5. Many field studies in agriculture and forestry are reviewed. The succesful control of vectors of human diseases, in particular *Culex*, *Anopheles* and *Simulium* spp. is also reported.

Chapter 6 covers the safety considerations involved in application of *Bt* as bacterial insecticide, notably the inadvertant presence of exotoxins and bacterial spores. The effect of *Bt* on non-target insects and other living organisms is highlighted. On ecological grounds, the use of crystaliferous but sporeless mutants is highly advocated.

Although the latest developments in genetic manipulation of the various toxin genes could not be included, this book gives ample background information on *Bt* and gives the state of the art up to the end of 1985. The monograph is exhaustively referenced with more than 500 key articles. The subject index is rather short and on some matters insufficient: target insects are not indexed. For students and other interested individuals, this monograph may be somewhat detailed. Specialists in invertebrate pathology and microbial control should have ready access to this valuable edition.

The monograph is written in German and may therefore attract limited readership. It is hoped that the author can put together an (updated) English version, as this monograph deserves a much wider readership. It is regretable that the publisher used a matrix dot print instead of a more appropiate professional letter-type. The book is not excessively priced, considering the wealth of information presented.

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