Book review

A.Z. Joffe, 1986. Fusarium species: their biology and toxicology. J. Wiley & Sons, New York/Chichester/Brisbane/Toronto/Singapore. 588 p. Price: £ 71.75.

A review of two symposium volumes dealing with toxins of *Fusarium* species has just been published by W. Gams and G.W. van Eijk in this journal (Vol. 93: 13-14) when another major volume on the same topics appears.

'This monograph is a summary of nearly 50 years' research and study of the taxonomy of all the *Fusarium* species and their toxicity. I was Director of the Laboratory of Mycology of the Institute of Epidemiology and Microbiology of Orenburg, USSR, from 1943 to 1950. I established the etiology of alimentary toxic aleukia (ATA) and the role of overwintered cereals infected by cryophilic *Fusarium* species in specific climatic and environmental conditions that produced toxins causing thousands of deaths.'

This introductory statement characterizes the work in several ways. The book partly supplements the monograph by W.F.O. Marasas, P.E. Nelson & T.A. Tousson. (1984: Toxigenic *Fusarium* species, identity and mycotoxicology. Pennsylvania State Univ. Press) but it also has to compete with it. In the last five years, *Fusarium* taxonomy has made considerable progress, though the author takes little account of this developement. The methods used for indentification, crucial to anyone concerned with *Fusarium* species, are not specified here, except by reference to previous publications.

The chapters deal with the following: (1) a brief historical background of fusariotoxicoses; (2) toxic *Fusarium* species and varieties in nature and under laboratory conditions (lengthy tables of strains tested at various temperatures in Appendices I and II); (3) principal toxins produced by *Fusarium* species; (4) antibacterial, antiprotozoal and insecticidal effects of toxic *Fusarium* species; (5) phytotoxic effect of *Fusarium* species; (6) effects of fusariotoxins in human beings; (7) human infections associated with *Fusarium* species; (8) fusariotoxicoses in laboratory animals; (9) fusariotoxicoses in domestic animals; (10) taxonomic problems of the genus *Fusarium*; (11) the question of yellow rain.

Joffe's book is a monument to the many thousands of victims of ATA, and this statement is repeated many times. The whole work with about 1200 references is primarily a documentation of the history of *Fusarium* mycotoxicoses. This is its greatest merit but is also a drawback. The text is often drowned by literature references, and text and citations are often repetitious.

A reliable taxonomy of the species is the only key to a critical evaluation of research on mycotoxicoses. Marasas et al. (1984) have endeavoured to be objective by re-examining all available strains for which a report on toxigenicity had been published. Joffe cites uncritically the often confusing names used by other authors. Joffe is an authority in *Fusarium* taxonomy too, but his views of a 'modern system' in Chapter 10 are identical with those published by him in 1974. His drawings are meagre, and the photographs of overstained conidia are poor. He does not present any argument why he does not adopt more recent and well founded views. His analytical keys to sections and species are unworkable and often misleading. The crucial criteria for the distinction of the toxicologically most important species, *F. tricinctum*, *F. poae*, *F. sporotrichioides* and *F. chlamydosporum*, monophialides in the first two, and polyphialides with multiple and solitary conidia in the other two species, respectively, are ignored and three of the four very distinct taxa are only regarded as varieties of *F. sporotrichioides*. The segregation of *F. nivale* from *Fusarium* because of its annellidic conidiogenesis (published in 1980) seems unknown to Joffe, although his documentation is generally up to 1984.

Probably because of misidentifications, some controversial statements are perpetuated: *F. tricinctum* is stated to be one of the main toxigenic species, though Marasas et al. could not find a single properly indentified strain that produced T-2 toxin or zearalenone. According to

these authors, *F. nivale* produces deoxynivalenol (= vomitoxin) only exceptionally in low concentration, whilst Joffe still retains the species as a producer of fusarenone-X, nivalenol and vomitoxin. The finding that moniliformin production is largely restricted to *F. sacchari* var. *subglutinans* (or whatever this taxon is now called) and only exceptionally occurs in *F. moniliforme* sensu str. (= *F. verticillioides*) is equally ignored by Joffe.

The major mycotoxicosis caused by *Fusarium* is ATA, which is due to a series of trichothecene compounds. A chronic painful attack of the joints, called Urov or Kashin-Beck disease, often ascribed to low concentrations of the same toxins, is still incompletely known in its etiology. Oestrogenic toxicoses due to zearalenone and related compounds, and toxicoses caused by moniliformin and butenolide are also dealt with. Fusariotoxicoses of domestic animals, most important for pigs, horses and cattle, are extensively covered too; for toxicoses affecting poultry, even more data are available because of easier experimental accessibility. The diseases called fescue foot and ryegrass staggers are mentioned and ascribed possibly to *Fusarium* species without taking into account recent findings on the role of endophytic fungi. Biological assays on shaved rabbit skin or with brine shrimps are considered to be the most suitable methods for detecting *Fusarium* toxins. Numerous chemical tests to detect specific toxins are also cited, but a critical selection of the most suitable ones is missing.

Ecological factors leading to accumulation of the toxins were intensely studied by the author. Not all overwinterd cereals are toxic. It was an unusual constellation of factors that caused the many victims of ATA in 1943/44. Chapter 5 contains a considerable amount of hitherto unpublished information on toxic effects of *Fusarium* plants. Unfortunately, the methods and the concentrations used are not specified, and this reduces the scientific value of the data. It is not surprising that the most toxic strains in the assays with animals are also most toxic to plants. An evaluation of the effect of toxin accumulation under natural conditions is impossible with these data. The crucial question, What percentage of isolates of the species of sect. *Sporotrichiella* is toxigenic? is answered contradictorily on pages 261, 267 and 274.

A more thorough editorial scrutiny would have been desirable in several respects. The specification of methods is essential in a monograph like this. Symbols used in the voluminous tables on reactions to toxins in assays on rabbit skin and the methods of extracting are not properly explained. An explanation of symbols is hidden on page 174. Curiously, the finding of a correlation between oesophageal cancer in man and an increased occurrence of *F. moniliforme* in the food are dealt with in Chapter 8 (toxicoses of animals). Abbreviations of test organisms on pages 143 and 147 are not preceded by full names. Printing errors are few, but the formulae of the T-2 and HT-2 toxins appear to be indentical on page 276 (but not on page 56). The index is rather incomplete, in that repeated occurrences of some entries are often not listed and many important keywords are missing. Though the references are particularly useful in unearthing a great deal of Russian literature, the way periodicals are described in translation makes it difficult to get hold of the original.

Joffe is sceptic about the suggestion that *Fusarium* toxins are involved in the warfare agent yellow rain, because the associated drastic symptons were not observed in victims of ATA and it is unlikely that trichothecenes can be detected in ATA patients three days after exposure or later. A personal statement that these extremely dangerous and persistent toxins must never be used as weapons because they will kill both friend and foe and that they must also be handled with extreme care in the laboratory would have been appropriate. In a monument for the victims of ATA, an analysis of the political situation that forced the population to eat field-overwintered cereals would also have deserved inclusion. Hopefully present knowledge will prevent any repetition of such disasters.

To specialists, the book provides a major source of documentation on the history, aetiology and ecology of mycotoxicoses and on the analysis of the toxins. However, it does not give up-to-date and fully described instructions. Hence it is with some reservation that I welcome this monograph.

W. Gams