Mycotoxins Other than Aflatoxins--Their Relationships to Food Safety

INTRODUCTION 1

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Mycotoxins are toxic substances produced by molds which may cause disease in animals or man. Acute diseases caused by mycotoxins are called mycotoxicoses. History has recorded several human disease outbreaks and numerous animal poisonings thought to be mycotoxicoses. The outbreak of a disease known as Turkey X disease in England in 1960 led to the discovery of aflatoxins and the realization that low levels of mold metabolites in foods and feed could cause disease in man and animals. This gave great impetus to the study of mycotoxins in the early 1960's. By the mid-1960's the carcinogenic nature of the aflatoxins was well known and the toxicity of other mold metabolites was beginning to be recognized. The 1960's saw a great deal of work on the aflatoxins in all aspects of the area, ranging from chemistry to toxicology to conditions governing the growth of the producing mold and production of the toxins. This work continued through the 1970's to the present, during which time literally thousands of papers have appeared in scientific literature around the world concerning all aspects of the significance of aflatoxins. While little direct evidence exists of the involvement of aflatoxins in human disease, particularly in terms of controlled experiments with man, considerable indirect evidence has linked aflatoxins to acute poisonings of humans in Africa, southeast Asia and India. Epidemiological studies have correlated aflatoxin contamination of foodstuffs with high incidences of liver cancer and other liver disease in certain regions of the world. Based on these studies aflatoxins are generally accepted as serious potential hazards to human health.

During the late 1960's and throughout the 1970's, other mold metabolites began to receive increasing attention and study as potential causes of animal and human disease outbreaks. Human cases of ergotism and alimentary toxic aleukia have been known for some time to be of fungal origin. Other mycotoxins have also been linked to human disease in an indirect way. It has been suggested that ochratoxin A, known to be a cause of porcine nephropathy, may be involved in a fatal kidney disease of humans known as Balkan Endemic Nephropathy. Ochratoxin A has been found in foodstuffs from endemic areas of this disease. In Japan, spoiled rice, known as "yellowed rice", has caused serious liver damage when ingested by animals and has also been suspected of causing human ailments. This condition was studied extensively by the Japanese and detailed work was published as early as the 1950's. It was found that a number of *Penicillium* species, notably *Penicillium citreo-viride, Penicillium citrinum, Penicillium islandicum* and *Penicillium rugulosum* were involved.

It is now known that a variety of molds, especially in the genera *Aspergillus, Penicillium* and *Fusarium*, are capable of producing numerous toxic metabolites which are totally different and unrelated to the aflatoxins. In many cases the significance of these compounds in terms of human and animal health is not fully known. Even the mold used in the manufacture of blue-veined cheeses, *Penicillium roqueforti*, has been shown to produce biologically active substances of unknown toxicological significance.

The purpose of this symposium was to discuss the significance of mycotoxins, other than aflatoxins, to food safety. Papers that were presented discussed the toxins of *P. roqueforti* and similar organisms, other *Penicillium* toxins, tremorogenic toxins produced by both *Aspergillus* and *Penicillium* species and sterigmatocystin and...
other toxic substances produced by Aspergillus species. A paper on the trichotheccenes and other mycotoxins produced by Fusarium and Stachybotrys species was included in the symposium but does not appear here.

The contributors to the symposium, all experts in their specific areas, have attempted to review the literature in these areas and provide an update on what is known about a number of mycotoxins other than the aflatoxins.