

Zearalenone, Deoxynivalenol, and T-2 Toxin Associated with Stalk Rot in Corn†

C. J. MIROCHA,* BETH SCHAUERHAMER, C. M. CHRISTENSEN, AND T. KOMMEDAHL

Department of Plant Pathology, University of Minnesota, St. Paul, Minnesota 55108

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The mycotoxins zearalenone (2.8 µg/g), deoxynivalenol (1.5 µg/g), and T-2 toxin (110 ng/g) have been found in the pith of corn stalks standing in the field. Such contaminated stalks may contribute to mycotoxicoses of farm animals.

Zearalenone is a phytoestrogen produced by various species of *Fusarium*, including *Fusarium roseum* and *F. tricinctum*, which are commonly involved in problems of hyperestrogenism in farm animals (1). T-2 toxin, diacetoxyscirpenol, and deoxynivalenol are also produced by these fungi and are members of a group of secondary metabolites called trichothecenes (4). These toxins are also involved in mycotoxicoses of farm animals and associated with signs of dermal necrosis, hemorrhaging, refusal of feed, and bone marrow depression. The implication of these mycotoxins as causal agents of mycotoxicosis is well established, and most often they have been looked for and found in corn kernels, either on the cob or as shelled corn. This is the first report of the occurrence of zearalenone, T-2 toxin, and deoxynivalenol in corn stalks which are often eaten by grazing cattle or fed to them as silage. The implication of corn stalks posing a hazard when fed to farm animals is apparent.

Stalk rot resulting from infection by *Fusarium* spp. was common in field corn in Minnesota in 1978. Because of wet weather early in the growing season the roots of many corn plants did not penetrate deeply into the soil, and with the advent of dry weather in late August and September, many of these roots died, providing a ready avenue of entrance for fungi into the basal portion of the stems. Subsequently the interior tissues of the lower internodes were decayed. The decayed tissues of some of the stems was pink or reddish, characteristic of corn invaded by some species of *Fusarium*, and it was thought that these tissues might contain one or more of the toxins that *Fusarium* is capable of producing.

Stems of approximately 50 corn plants were collected in a research field near St. Paul in

October. The lower two internodes of each stem were split with a knife, and portions of 10 stems, in which the partially decayed tissues were pink or red, were selected, cut into short pieces, and ground in a Stein mill. The resulting sample was analyzed for zearalenone and zearalenol by the method of Mirocha et al. (2), for T-2 toxin, diacetoxyscirpenol, monoacetoxyscirpenol, and scirpentriol by methods of Pathre and Mirocha (3), and for vomitoxin (deoxynivalenol) by a modification of the method of Nakano et al. (Chem. Abstr. 80:204, 1974). By using selected ion monitoring on a computerized LKB-9000 gas chromatograph-mass spectrometer, 2.8 µg of zearalenone, 110 ng of T-2 toxin, and 1.5 µg of vomitoxin per g were found. No zearalenol, diacetoxyscirpenol, monoacetoxyscirpenol, or scirpentriol was detected. These concentrations are sufficient to cause hyperestrogenism in swine (zearalenone) or partial refusal of the feed (T-2 and deoxynivalenol).

As far as we are aware, this is the first report of these toxins associated with stalk rot of corn. Several species of *Fusarium* are involved in the stalk rot syndrome, and as many as five species of *Fusarium* have been isolated from a single decayed stalk and even from a single fragment of decayed stem tissue of corn near harvest time (T. Kommedahl, C. E. Windels, and R. E. Stucker, Phytopathol, in press). Whether any of the toxins produced in the stem tissues might at times contribute to toxicoses in farm animals remains to be determined.

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