COMMUNICATION TO THE EDITOR

Emetic Material in Scabbed Wheat

DEAR SIR:

Cereal crops in the midwestern and eastern states are sometimes infected with *Fusarium* species which cause a condition known as "scab." Scabbed grain often contains one or more substances that cause vomiting when consumed by animals having simple stomachs (1). The emetic material has been shown to persist for at least 56 months in stored

barley, although the causative fungus, *Fusarium graminearum* Schwabe (*Gibberella saubinetii* [Mont.] Sacc.), was not viable after 27 months (2).

Previous work (3) has shown that some strains of *F. moniliforme* Sheldon, *F. poae* (Pk.) Wr., *F. culmorum* (W. G. Sm.) Sacc., and *F. nivale* (Fr.) Ces. will produce emetic material when grown in artificial medium. *F. sporotrichioides* Sherb, *F. equiseti* (Cda.) Sacc., *F. graminearum*, and a strain of *F. moniliforme* did not produce emetic material under the conditions used. When they infect cereal crops during the growing season, all of these produce or cause the host to produce emetic material in the kernels. No chemical identification of this substance has been reported.

A supply of emetic material from infected cereal crops was needed for comparison with that produced in artificial medium. Since extensively infected grain is not commonly available, conventional wheat milling was investigated as a possible means of obtaining a physical separation in which one or more fractions from lightly or moderately infected wheat might contain all or most of the active material from the kernels.

Moderately scabbed Rushmore wheat grown in South Dakota in 1962 was used. Plating of whole kernels, surface-sterilized with 2% sodium hypochlorite in 50% ethanol for 30 sec., indicated that *Fusarium* was present in all kernels of this sample. The wheat was milled by conventional roller-milling procedures to obtain the following products: germ, bran, first and second clear flours, patent flour, head-end shorts, and tail-end shorts.

The wheat fractions were extracted with 90% aqueous ethanol containing 0.1 mole of hydrogen chloride per liter. The extract was neutralized, and proteins were precipitated with saturated basic lead acetate solution. Excess lead was removed with hydrogen sulfide, and ethanol was evaporated under nitrogen at 30°C. The residue was taken up in water and the aqueous solution was extracted at pH 9 with diethyl ether. The ethereal extract was dried and evaporated.

A cellulose column, 80 cm. high and 3.0 cm. in diameter, was equilibrated with benzene. To this column approximately 1.5 g. of the ether-soluble material was applied in a minimum quantity of ethanol. The column was developed exhaustively with benzene, then with a mixture of benzene (2 vol.) and isopropanol (1 vol.), and finally with 95% ethanol, so that three solutions were obtained from the column. Upon the removal of solvents under nitrogen at 30°C. the solutes were examined for emetic activity by injection of 10–20 mg. in 0.15 ml. water intravenously in the wing vein of pigeons. Emetic material, when

present, was found in the benzene-isopropanol fraction from the cellulose column.

The only wheat fractions that contained emetic material were the bran and tail-end shorts, which yielded 0.15 and 0.01 g. of active material per kg. respectively. These results indicate that the emetic material is localized in the periphery of the kernels represented by the bran fraction. Previous studies (4) of the distribution of the fungus within scabbed wheat kernels showed that this area is extensively infected. Much of the aleurone layer of the kernel is generally considered to be in the tail-end shorts. These infected cells may have contributed to the emetic activity of this fraction, rather than the head-end shorts fraction.

For the preparaton of emetics from moderately or lightly scabbed grain, separation of the bran and aleurone layer as source material is recommended. Furthermore, these results suggest that the endosperm portion of such grain might be utilized as food in countries having an acute food shortage.

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