The Differential Effect of Mercuric Chloride on Growth of Certain Fungi Associated with Corn Seed

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Mercuric chloride has been used for treatment of certain diseases of seeds, bulbs and tubers, and to preserve industrial materials.

Moore and Olien (7) demonstrated that cereal seeds treated with mercuric chloride carried a residue, which was not removed even after a 24-hour rinse in distilled water.

Davies (4) showed that the use of mercuric chloride can make the isolation of *Ophiobolus graminis* difficult from wheat. Ions of mercury compounds are protein precipitants; the mechanism of action is attributed to a reaction with the (-SH) groups of essential metabolites (2, 3, 5, 6, 8). The action of mercuric chloride can be reversed by the addition of sulphur-containing compounds (1, 5, 6, 8, 9).

I undertook to determine the residual effects of mercuric chloride on the growth of some of the fungi commonly isolated from corn stalks and kernels (Table 1).

Materials and Methods

Kernels of the hybrid US-13 were surface desinfected by immersing for different times in 0.1% mercuric chloride and/or 5.25% sodium hypochlorite (Clorox). The fungi were subcultured in 50 cc of 10% mal-extract (Difco) in 250 cc Erlenmeyer flasks.

The treated kernels were rinsed twice for 5 minutes with constant agitation in sterile water. The kernels were then dried on sterile blotting paper. Five kernels were placed on each of three PDA (Difco) plates. Prior to pouring, the agar had been seeded with the specific fungi to be studied. The plates were then incubated at 26$\pm$ 1° C and examined after four days. The degree of inhibition was determined by measuring the diameter of the clear zone around the kernels.

Results and Discussion

Corn kernels immersed in 0.1% mercuric chloride for 1, 2, 4, and 6 minutes retained a sufficient amount of the chemical to inhibit growth of *Cephalosporium acremonium* Corda, *Penicillium cyclopium* series, *P. frequentans* Westling, *P. funiculosum* Thom., *P. herquei* Bainier & Sartory, *P. multicolor* Grigorieva-Manoilova & Poradielova, *P. rugulosum* Thom., *P. variable* Scop., and *Pythium ultimum* Trow. (Table 1).

The zone of inhibition increased in proportion to the immersion time. Seeds immersed for 2 or 4 minutes, retained enough mercuric chloride to effect only slightly the growth of *Fusarium moniliforme* Sheldon.

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TABLE 1. Diameters (in mm) of zones of inhibition surrounding kernels subjected to different surface disinfectants

	Mercuric chloride alone as a surface disinfectant				Mercuric chloride used as a surface disinfectant followed by 4-minute immersion in sodium hypochorite				Sodium hypo-chlorite alone	Control
	Immersion time in minutes									
Fungus:	1	2	4	6	1	2	4	6	4	0
A. flavus	...	...	...	...	...	...	...	...	...	...
C. acremonium	7.0	8.0	14.0	15.0	...	...	...	...	...	...
D. maydis	...	...	...	...	...	...	...	...	...	...
F. moniliforme	...	...	...	...	...	...	...	...	...	...
G. zeae	...	...	...	...	...	...	...	...	...	...
N. oryzae	...	...	...	...	...	...	...	...	...	...
Penicillium cyclopium	8.0	11.0	12.0	15.0	...	...	...	6.0	...	...
P. frequentans	...	...	...	17.0	...	...	...	...	...	...
P. funiculosum	24.0	24.0	26.0	26.0	16.0	17.0	18.0	19.0	...	...
P. herquei	15.0	18.0	19.0	19.0	1.0	1.0	1.0	6.0	...	...
P. multicolor	16.0	19.0	24.0	24.0	7.0	6.0	11.0	12.0	...	...
P. rugulosum	21.0	24.0	24.0	24.0	6.0	6.0	9.0	13.0	...	...
P. variable	19.0	22.0	24.0	24.0	...	6.0	11.0	12.0	...	...
Pythium ultimum	16.0	19.0	20.0	21.0	16.0	15.0	15.0	20.0	...	...

Mercuric chloride residue caused a fairly marked inhibition of *C. acremonium* (Table 1), but when a sodium hypochlorite rinse followed the chloride, the zone of inhibition was eliminated.

Immersion for 1 or 2 minutes in mercuric chloride followed by 4 minutes in sodium hypochlorite did not affect the growth of *P. cyclopium*, *Penicillium variable* was not inhibited by residues adhering after 1 minute in mercuric chloride.

P. multicolor and *P. funiculosum* were greatly inhibited following all treatments. Inhibition was reduced by the sodium hypochlorite treatment growth of *P. frequentans* was affected only after 6 minutes in mercuric chloride.

There was no observable inhibition of the growth of *Diplodia maydis* (*D. zeae* [Schw.] Lev.), *Nigrospora oryzae* (Berk. & Br.) Fetch, *Gibberella zeae* (Schw.) Petch, and *Aspergillus flavus* Link in any treatment.

Sodium hypochlorite alone did not inhibit growth. Maximum immersion periods in mercuric chloride or sodium hypochlorite did not impair the germinability of the kernels and apparently had no effect or the fungi beneath the seed coat.

Results indicate that the residue of mercuric chloride, following its use as a surface disinfectant, inhibits the growth of some fungi isolated from corn. But the ear and stalk rot fungi such as *F. moniliforme*, *D. maydis*, *G. zeae* and *N. oryzae* were not affected.

The inhibition following short immersion periods indicates that it is important to evaluate the toxic effect of mercuric chloride on specific fungi.

Sodium hypochlorite had no inhibitory effect at immersion periods used. When used after mercuric chloride it tended to reduce the inhibitory effects of residues.

Summary

The residue of mercuric chloride, following its use as a surface disinfectant of corn kernels, inhibited growth *in vitro* of *Cephalosporium acremonium*, *Penicillium cyclopium*, *P. frequentans*, *P. funiculosum*, *P. herquei*, *P. multicolor*, *P. rugulosum*, *P. variable*, and *Pythium ultimum*. Growth of *A. flavus*, *D. maydis*, *F. moniliforme*, *Gibberella zeae* and *Nigrospora oryzae* was not affected. A sodium hypochlorite rinse after mercuric chloride treatment removed a large part of the residue.

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