SEED-BORNE DISEASES OF CORN IN 1964 AND THEIR EFFECT ON GERMINATION [1]

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Adverse weather conditions during the summer of 1964 have been responsible for an unusual number of diseased corn seeds being found in samples received from southern Ontario. These adverse conditions were: a cool spring resulting in uneven emergence; midsummer drought with consequent light ears; cold weather in September which delayed maturity; early frosts which arrested maturity (the temperature dropped to 18°F. on October 11 for a period of four hours); and good harvest weather shortly after the frost, resulting in the storage of corn before it had been sufficiently dried (1, 2).

In a series of samples submitted for investigation of the germinability of seed corn produced under these adverse conditions, two abnormal seed conditions were found in many of the samples. These were "red stripe" and "silk cut". Neither of these conditions had previously been reported in Canada.

"Red stripe" appears as red streaks in roughly parallel lines along the side of the seed and sometimes extending over the crown. These streaks may be very narrow or quite prominent in appearance and occur only in the pericarp. Germination of these seeds was not affected and no injurious pathogens were found when the seeds were plated on agar. It is believed that this condition is caused by physiological changes in the seed brought about by frost injury to the connective tissue, which causes an interference in the transport of carbohydrates. "Red stripe" was found in most of the corn varieties examined.

The condition known as "silk cut", a misnomer, appears as a transverse rupture of the pericarp above the embryo (Fig. 1). It may also occur as a rupture of the crown (popped kernels) (3). "Silk cut" was found only in certain of the corn hybrids which had a common seed parent and is believed to be due to a genetical weakness in some inbred lines. The presumption is that this condition occurs when there is a resurgence of growth and development following a period when the expansion of the grain is slowed down by dry weather (4).

These breaks in the pericarp allowed the soft starch in the endosperm to become colonized by Fusarium moniliforme Sheldon. Normally, this fungus is weakly parasitic but has become destructive in the past when it gained entrance to the endosperm following breaks in the pericarp caused by birds or the corn ear worm. Obviously "silk cut", in providing the break in the pericarp, allows a similar penetration of F. moniliforme. Because of the high seed moisture content when harvested, many of the seeds with "silk cut" became heavily infected with this fungus. Death of the embryo and, therefore, a reduction in the germination of the sample (Fig. 2) resulted. This is further illustrated in Table 1 where a direct relationship is shown between the amount of "silk cut" and the incidence of Fusarium moniliforme with a corresponding decrease in germination. Forty-four per cent of all seeds showing "silk cut" and tested for disease were found to be infected with F. moniliforme.

In a subsequent test made on seed showing "silk cut" and sorted from 10 bushels of seed, 29% were found to be infected with F. moniliforme (Fig. 3). This seed germinated 78%, a somewhat higher percentage than that noted in the earlier tests on seeds with large amounts of "silk cut", but the association between the fungus and the ruptured pericarp was still evident.

Tests made on corn samples harvested in the laboratory from cobs obtained directly from the field and the corn crib and free of "silk cut" indicated that other fungi were also responsible for reduction in the germination of corn seed harvested in 1964 (Table 2). In many of the samples examined, Fusarium graminearum and Fusarium oxysporum were found in a high proportion of the seeds. Where the percentage of infection was high, the germination was correspondingly low. Cladosporium cladosporioides and Alternaria tenuis, normally found under conditions of high humidity, were also present in the seed.

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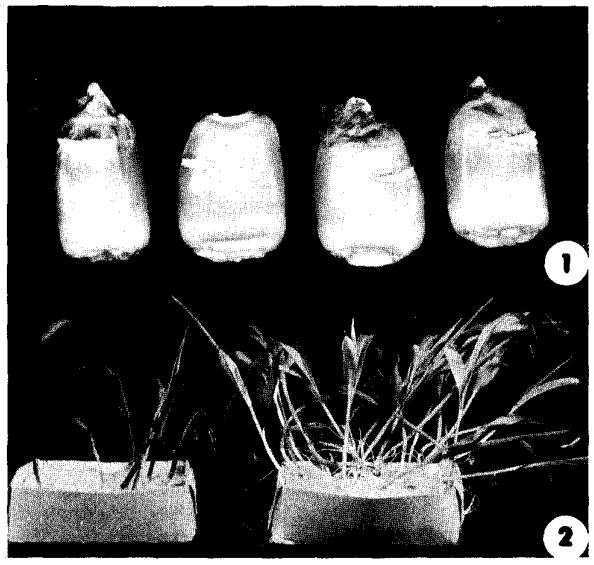

Fig. 1. Silk cut - Note transverse rupture of the pericarp. Right - emergence of healthy seed.

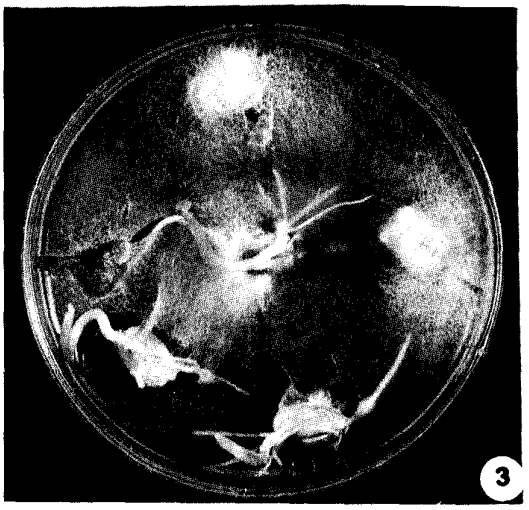

Fig. 2. Left - emergence of silk cut seed. Fig. 3. Silk cut seeds infected with Fusarium moniliforme.

Table 1. Relationship of "silk cut" to the incidence of Fusarium moniliforme

Sample No.	Per cent Germination	Per cent silk cut	Per cent seed infected with F. moniliforme (surface sterilized seeds)
2990A	28	63	62
2990B	31	100	65
2991	63	15	5
3046	78	5	1
2988	94	0	0

Table 2. Germination and the presence of Fusarium spp. on corn, hand-threshed from cobs obtained directly from the field and the crib.

Sample	Per cent Germination	Per cent F. graminearum	Per cent F. oxysporum
Field No. 1	38	88	32
Field No. 2	72	20	0
Field No. 3	89	0	0
Crib No. 1	62	32	12
Crib No. 2	82	12	2
Crib No. 3	85	0	0
Crib No. 4	64	30	0
Crib No. 5	64	40	40

Literature cited

1. Personal correspondence to D.W. Creelman from R.E. Wall, Plant Pathologist, Research Station, Harrow, Ont.
2. Personal correspondence to T.F. Cuddy from R.A. Sanderson, Senior Inspector, Plant Products Division, Chatham, Ont.
3. Personal correspondence to D.W. Creelman from A.J. Ullstrup, Pathologist, Purdue University.
4. 1930. Koehler, B. and J.R. Holbert. Corn diseases in Illinois. Univ. Ill. Agr. Expt. Sta. Bull. 354, 1930.