

# A NOTE ON INVASION OF DURUM WHEAT BY STORAGE FUNGI<sup>1</sup>

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## ABSTRACT

Samples of freshly harvested durum wheat stored at moisture contents of 13.4 to 13.6% and 25°C. for 493 days were slowly invaded by *Aspergillus halophilicus* and *A. restrictus*, but germination percentage of the seed did not decrease, no brown embryos developed, and fat acidity values did not rise above 30.6. In samples held at moisture contents between 14.2 and 15.4%, storage fungi increased, germination percentage decreased to 0, and fat acidity values increased. In the range of moisture contents studied, durum wheat did not differ greatly from other classes of wheat in the degree of invasion by storage fungi and in changes that accompany such invasion.

Recent evidence (1) indicates that hard red spring and winter wheats differ only slightly in the degree to which they are invaded by fungi when held at moisture contents near the lower limits that permit the fungi to grow. No data of this sort are available for durum wheat, and the work here reported was undertaken to obtain such information.

## Materials and Methods

*Grain Samples.* Forty samples of durum wheat, about 1 kg. each, were taken from farmers' trucks at elevators in northwestern Minnesota and eastern North Dakota in August 1964, put in double polyethylene bags of 6-mil wall thickness to prevent loss of moisture, and carried to St. Paul. It was assumed that these would have moisture contents up to 15%, but the early-harvest season was dry, and nearly all of the samples had moisture contents below 14%. Portions of 200 g. were taken from nine samples with moisture contents above 13.0% and placed in double polyethylene bags; to some of these distilled water was added to raise the moisture contents to the desired amounts, after which the samples were stored for 2 days at 4°-5°C. and shaken frequently to equilibrate the moisture. All samples were then stored in an incubator at 25° ± 0.5°C. and 50-60% relative humidity. Part of each sample was removed after 140, 272, 351, and 493 days for testing.

*Moisture Contents.* These were determined by the two-stage air oven method (2), and are given on a wet-weight basis.

*Numbers and Kinds of Fungi.* The numbers of surface-disinfected kernels yielding fungi and the numbers of colonies per g. of grain were determined by standard procedures (2) with the use of malt agar containing 10% NaCl.

*Germination Percentage.* One hundred kernels of each sample were wrapped loosely in a moist paper towel and held at 25°C. in a plastic box; seedlings

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were counted each day for 7 days, and any seed that produced a root or coleoptile was counted as germinated.

*Discolored Embryos.* The pericarps covering the embryo were removed from 100 kernels and the embryos examined with and without the aid of a stereoscopic dissecting microscope.

*Fat Acidity Value (FAV).* This was determined according to *Cereal Laboratory Methods* procedure 02-04 (2), using a Stein mill and a Bausch & Lomb Spectronic 20 spectrophotometer.

## Results and Discussion

For the sake of brevity, only the data from tests after 493 days of storage are summarized in Table I, since at this time the differences in the characteristics tested were most evident.

TABLE I  
INFLUENCE OF SMALL DIFFERENCES IN MOISTURE CONTENT UPON THE  
CHARACTERISTICS OF DURUM WHEAT STORED 493 DAYS AT 25°C.

Sample No.	Moisture Content		Germination	Colonies per Gram of <i>A. glaucus</i> <sup>a</sup>	Dark Embryos		FAV
	Initial	Final			Tip	All	
	%	%	%	(10 <sup>3</sup> )	%	%	
1	13.4	13.0	91	1	0	0	30.6
2	13.6	13.3	95	1	2	0	24.1
3	14.2	13.7	5 <sup>b</sup>	550	5	0	28.4
4	14.2	13.8	4 <sup>b</sup>	<sup>c</sup>	8	0	33.9
5	14.3	14.0	0	1,750	8	2	36.1
6	14.7	14.5	0	4,800	12	11	47.6
7	14.7	14.7	0	<sup>c</sup>	11	36	47.6
8	15.1	14.9	0	<sup>c</sup>	33	7	60.5
9	15.4	15.2	0	<sup>c</sup>	90	10	52.0

<sup>a</sup>Over 90% of the colonies were *A. restrictus*.

<sup>b</sup>All seedlings were stunted and malformed.

<sup>c</sup>Not determined.

No obvious changes occurred in the two samples with beginning moisture contents of 13.4 and 13.6%; germination remained above 90%, storage fungi did not increase, no embryos became discolored, and FAV's remained low. In the samples stored with beginning moisture contents above 14.0%, germination was less than 10% after 493 days (in all but two of these, the germination percentage was 0 after 351 days), and numbers of colonies of storage fungi, percentage of discolored embryos, and FAV's increased with increasing moisture content, although the FAV of sample 1 was higher and that of sample 8 was lower than would have been expected from the other data.

*Aspergillus halophilicus* (Fig. 1) grew from 42% of the surface-disinfected kernels of the sample stored 272 days at 13.4-13.3% moisture content, but was not recovered from many kernels of this sample later. The fungus evidently caused no injury, since the seeds of this sample germinated 91% after 493 days. This fungus has been found in other classes of wheat (1,3), in sorghum (4) and in soybeans (5) stored for some months at moisture contents

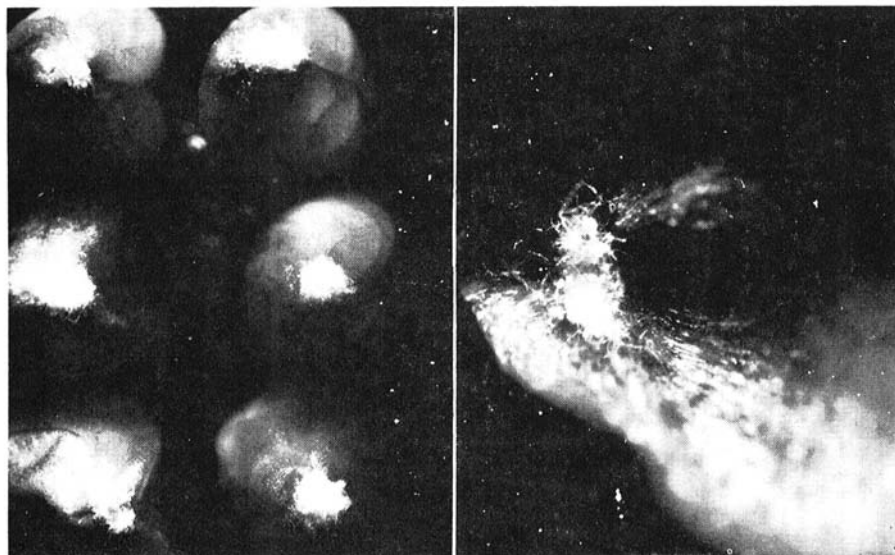


Fig. 1. Durum wheat stored 272 days at 13.4–13.3% moisture content and 25°C., surface-disinfected and cultured on weak tomato juice agar containing 10% NaCl; *Aspergillus halophilicus* growing from the hilum of the seeds. Left, several kernels; right, one kernel.

just below those that permit invasion by other species of *Aspergillus*, but its significance, if any, in stored grains and seeds remains to be determined.

The results do not indicate that durum wheat differs much from other classes of wheat in degree of invasion by storage fungi and in changes that accompany such invasion, when kept for almost 500 days at 25°C. and at moisture contents between 13.0–13.5 and 15.0–15.5%.

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