

**DETERIORATION OF CORN
GRAINS IN STORAGE BY
FUNGI**

By

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corn is maize (Zea mays, L.) ranks as one of the most important field crops in E.A.A. It is used principally as human food, animal feed, and also in some industries. The annual yield of the country obtained 16.9, 15.4, and 16.4 million ardabs in 1966, 67, and 68 respectively (Anon., 1968&69). The local yield almost does not cover the consumption. The shortage is usually compensated by importation. Both local and imported amounts are almost kept in storage for a time of few months and may exceed one year. That is due to the prolonged commercial season of the yield which starts from November and extending to the sequent October (Anon., 1968).

There is a wide range of storage facilities in the country. At the farm level, they range from the earthenware jars or containers, in which the farmers generally store their family supply, to the room-type brick-walled granaries on large farms. On the other hand, for the large scale collecting and storing of grains, there are the "Shunas". The "Shuna" is an enclosed area where grains are , stacked in bags or in bulk. Although recently, establishment of silos network started all over the country in

as accompanying mold/moisture and deterioration of the
during commercial, laboratory and, small scale storage
storage.

- 5) Feasibility of using the promising preservatives against
corn deterioration in storage.

REVIEW OF LITERATURE

Microflora of Stored Grains .

Semeniuk (1954) reported that the microflora of cereal grains was made up by a wide variety of fungi and bacteria. These microorganisms were the same as those found in soil and air. Bacteria did not normally appear to be involved in the deterioration of stored seeds because they require free water to grow, and seed seldom were stored under conditions where free water was available. On the other hand, they were incapable of mechanically penetrating intact cereal grain tissues. Thus the deteriorative action of stored grains was principally a role of fungi.

He added that the kind and abundance of fungi of stored grains depended principally on the conditions prevailing during storage as moisture content, temperature , and time. He then added that the relation of fungi at the deteriorative sorts such as decrease of viability and non-reducing sugars content, besides the increase of seed invasion, respiratory rate, fat acidity value (F.A.C.) and reducing sugars content, was then generally accepted. This relation that proved recently to be solely by invasion of the stored grains by mold fungi, had been attributed by the common to mysterious causes.

Christensen (1957) proposed that fungi in seed grains be divided into two groups, designating field fungi and storage fungi. The field fungi were those that invaded the developing or mature seed while it was still on the plant. The major genera were Alternaria, Helminthosporium, Fusarium, Cladosporium, Diplodia, Chaetomium, Rhizopus and Absidia. These fungi usually did not continue to grow in grains or to reinvade after harvest. They might die within few months of storage and not survive much longer, their damage was done by the time the grains were harvested, and no further damage was to occur during storage, Christensen and Kaufmann (1965).

The storage fungi were those which develop on and within seeds at moisture contents often encountered in storage, principally Aspergillus and Penicillium. They did not invade grains to any appreciable degree before harvest.

Concerning the microflora of corn grains, Koeller (1930) found that Aspergillus flavus Link, Aspergillus glaucus group, Aspergillus ochraceus Wilhelm, Aspergillus niger v. Tiegh, Aspergillus versicolor (Vuill.) Tiraboschi, Aspergillus wentii Wehmer, Cephalosporium acremonium Corda, Diplodia zeae (Schw.) Rev., Fusarium moniliforme (Sheldon)

Aspergillus sp., Fusarium graminearum Saw., Nigrospora oryzae (S. and Br.) Petch, Penicillium notatum Westling, and Penicillium palitans Westling, were commonly associating stored grains.

Nagol and Semenjuk (1947) isolated Aspergillus amstelodami (Mangin) Thom and Church, Aspergillus candidus Link, A. flavus, A. niger, Mucor sp., Penicillium chrysogenum Thom, P. palitans, and Penicillium rugulosum Thom from naturally molded stored corn grains.

Christensen and Gordon (1943) found that A. candidus, A. flavus, Aspergillus fumigatus Fresenius , A. glaucus, A. niger, Aspergillus terreus Thom, A. versicolor, C. acremonium, D. zeae, F. moniliforme, Homodendrum sp., Monilia sp., Mucor sp., N. oryzae, and Penicillium sp. were common on moist stored corn grains.

Bottomley et al (1952) isolated each of A. candidus, A. flavus, A. glaucus, Aspergillus tamarii Kita, Cephalosporium sp., Fusarium sp., Mucor sp., and Penicillium sp. in increasing counts accompanying the deteriorating stored corn samples.

Lichwardt et al (1953) isolated a large number of fungi associating the deteriorating corn grains. Within 19 Penicillia, Penicillium cyclopium series, Penicillium

Aspergillus species were isolated from stored corn grains. The most frequent species were: 25 Aspergilli, A. flavus, A. glaucus, A. niger; 23 genera of imperfect fungi, Alternaria, Candida, Diplodia, Epicoecum, and Helminthosporium; 3 genera of Concomycetes, Chaetomium; besides 7 genera of Phycomycetes, Mucor and Rhizopus; were the most frequent.

Barron and Lichtwardt (1959) found that Aspergillus restrictus G. Smith, A. candidus, Penicillium spp., P. cyclopium, Aspergillus ruber (Bremer) Rapar and Thom , Aspergillus chevalieri (Mangin) Thom and Church, A. amstelodami, A. flavus, Aspergillus umbrosus Bain. and Sart., Aspergillus repens (Jorda) de Bary, F. moniliforme, P. viridicatum, A. versicolor, Absidia sp. Mucor sp., and A. niger recorded the higher total count respectively of the fungi isolated from stored corn from three harvest years.

Qasem (1959) isolated members of A. glaucus besides A. restrictus from stored corn grains. He added that they invaded via the point of attachment of kernel to the cob in uninjured grains.

Assawah and Elarosi (1960) found that Penicillium rubrum Stoll, A. niger, Aspergillus nidulans (Eidam) Wint. Rhizopus nigricans Ehrenb., Cladosporium sp., P. notatum, and A. flavus recorded high frequency of the total fungi isolated from maize grains stored 9-12 months when plated

Factors Influencing Deteriorative Changes

Moisture

As early as 1938, Koehler found that at the moisture content of 15.5%, the percentage permitted by regulations for safe long storage of corn grains, some species of Aspergillus could invade and deteriorate these grains.

Bottomley et al (1950 , 1952) investigated the effect of moisture content of corn grains, besides other factors conditioning storage. Their results proved that the moisture was the main factor limiting the different deteriorative actions.

Olafson et al (1954) investigated moisture content as the sole variable affecting stored corn, while other conditions were constant. Six percentage levels (13.5-19%) induced pronounced differences in the deterioration of corn quality as measured by different indices.

Zelony (1954) reported that moisture content of grains, of the factors influencing their deterioration rate, was by far the most important. If the moisture content was maintained at a sufficiently low level, grains could be stored for many years with little deterioration even under conditions that were otherwise unfavourable. He added that grains as brought from the farm often had moisture contents near or above the critical levels for safe storage. In