

Fungi and Maize Seed Biodeterioration in Storage

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Abstract Fungi and biodeterioration of maize seed in storage under different condition were studied. The results showed that, among the high moisture content (16.6%) seeds, *Aspergillus* spp were the main fungi, but in seeds with medium and low moisture content (13.6%, 10.3%), *Rhizopus*, *Aspergillus*, *Fusarium* and *Penicillium* species were common. It was also found that stored seed contained aflatoxin (0~7.66 ng/g). Aflatoxin and the like could affect seed viability, germination and vigour.

Key words maize seed; fungi; biodeterioration; aflatoxins

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摘要 研究了真菌与玉米种子在不同贮藏条件下的生物劣变关系. 结果表明: 在含水 16.6% 的玉米种子上生长的主要真菌是曲霉菌, 而在含水 13.6% 和 10.3% 的玉米种子中则为根霉菌、曲霉菌、镰刀菌和青霉菌. 研究中还发现, 不同贮藏条件下, 玉米种子中还含有 0~7.66 ng/g 的黄曲霉毒素, 这种毒素将会影响种子的生活力、发芽率和活力.

关键词 玉米种子; 真菌; 生物劣变; 黄曲霉毒素
中图分类号 S339.3; Q939.5; S513

Maize is an important food and fodder crop in dryland agriculture. In many developing countries, poor storage conditions could permit easy access to micro-organism and could produce undesirable effects. The aim of this report was to show influences of storage fungi on biodeterioration of maize seeds stored in different conditions.

1 Materials and methods

Seed samples were taken from seeds

treated for 14 months in the following conditions: ① Ambient (A), 1°C~30°C, paper bag; ② Underground warehouse (U), 17°C~18°C, polyethylene bag; ③ Low temperature (L), 12°C~14°C, polyethylene bag; ④ Refrigerator (R), 2°C~4°C, polyethylene bag.

The seed initial moisture contents are 16.6%: High (H); 13.6%: Medium (M) and 10.3%: Low (L). The germination rate was recorded. From each sample seeds were taken and plated with 10 seeds per petri dish. The petri dishes lined with water soaked filter paper were incubated at (22±2)°C under 12/12 hours fluorescent light / dark for 5 days.

Then the seeds were examined for fungal growth under stereoscopic binocular microscope and under magnification ($20\times\sim 40\times$), spores and conidies were examined, Fungi up to genus level were identified according to illustration and description given by Singh *et al*^[1]. Level of aflatoxin B1 were determined according to Kamimura.^[2]

2 Results and discussion

During investigation, 12 seed samples were tested for seed storage fungi and species of 5 fungi species were identified (Table 1). Among the high moisture content seed, *Aspergillus* spp. were the main fungi of maize

followed by *Fusarium* spp. and *Penicillium* spp. In the seeds with medium and low moisture content, *Rhizopus*, *Aspergillus*, *Fusarium* and *Penicillium* species were common. *Alternaria* spp. were not observed among seeds packed in polyethylene bags. All the fungi detected in this study are listed to be seedborne in nature^[2]. *Penicillium*, *Rhizopus* and *Aspergillus* are known storage fungi which occur on different plant seeds^[3]. These storage fungi could cause deterioration of seeds during storage^[4]. Similarly, Simay^[5] observed *Alternaria*, *Aspergillus*, *Fusarium*, *Penicillium* and *Rhizopus* species in stored flax, rice, maize or soybean seeds.

Table 1 Some storage fungi and aflatoxin production in maize seed stored under different conditions for 14 months

Initial moisture content	Storage condition	Storage fungi species					Range of Aflatoxin B1 (ng/g)
		<i>Alternaria</i>	<i>Aspergillus</i>	<i>Fusarium</i>	<i>Penicillium</i>	<i>Rhizopus</i>	
High	A	++ ^①	++	++	+	++	1.34~2.02
	U	ND	+	+	+	ND	1.52~2.33
	L	ND	++	+	+	+	1.09~1.81
	R	ND	++	+	+	+	2.51~3.66
Medium	A	+	++	+	+	++	2.00~3.90
	U	ND	++	++	ND	++	4.00~7.66
	L	ND	+	+	ND	+	0.49~0.53
	R	ND	+	+	+	++	0.12~0.21
Low	A	+	+	++	+	++	0.49~0.90
	U	ND	+	+	+	+	0.19~0.25
	L	+	+	+	+	++	0.00~0.00
	R	ND	+	+	+	+	0.73~1.00

①ND; not detected +, observed in 1~2 petri dishes. ++, observed in 3~5 petri dishes.

In wheat, a direct relationship between the bunt infection and reduction of seed germination has been established by Bedi an Madhumeet. Mycock^[6]*et al* reported the declining germinability of maize seeds infected by an *Aspergillus flavus*.

These fungal species are also known to

produce mycotoxin. Thus the presence of these mycotoxic moulds indicate mycotoxin contamination of maize grains samples, Maize grains stored under unhygienic and unscientific conditions could produce mycotoxic moulds. The stored seed contained aflatoxin from 0.00 to 7.66 ng. g⁻¹. Aflatoxins and other myco-

toxins may affect seed viability, germination and vigour which ultimately affect seed yield. More than one hundred mycotoxins produced by about two hundred fungal species are known to exist^[7-9]. Several of the mycotoxins are very potent toxicants which may cause adverse effects on experimental animals when exposed to even minute amounts. In developing countries, seed health testing techniques including detection of mycotoxins could enhance seed or food grain quality, and so there is an urgent necessity to build up the manpower to control the alarming situation created by disease.

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References

- 1 Singh K, *et al.* An illustrated manual on identification of some seed-borne *Aspergilli*, *Fusaria*, *Penicillia* and their mycotoxins. Denmark: DGISP, 1991
- 2 Shetty H S. Different types of damage to seeds caused by seedborne fungi. In: Seed Pathology (Proceedings of the CTA Seminar held at Copenhagen, Denmark on 20~25 June, 1988), 1992, 53~63
- 3 Christensen C M. Microflora and seed deterioration. In: Roberts E H eds. Viability of seeds. London: Chapman and Hall Ltd., 1972. 59~93
- 4 Halloin J M. Microorganism and seed deterioration. *Physiology of Seed Deterioration*. 1986, 11: 89~99
- 5 Simay I E. Seedborne fungi of flax. *Plant Genet. Resour. (Newsl)*. 1994, 97: 45~46
- 6 Mycock *et al.* *Miaropylar* infection of post-harvest caryopses of *Zea mays* by *Aspergillus flavus* var. *columnaris* var. *nov.* *Seed Science and Tech.* 1988, 16: 647~65
- 7 Bilgrami K S, *et al.* Mycotoxin contamination in food and its control. *Indian Rev. Life Sci.* 1984, 4: 19~36
- 8 Kamimura H, *et al.* Simple Rapid cleanup method for analysis aflatoxins and comparison with various methods. *J. Assoc. of anal. chem.* 1985, 68(3): 458~461
- 9 Krogh P. Adverse effect of mycotoxins on human. In: Seed pathology (Proceedings of the CTA seminar held at Copenhagen, Denmark 1988), 1992, 149~197

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