

SUCCESSION OF MYCOFLORA IN DIFFERENT SEEDS IN NATURAL STORAGE

BY

P. S. MUKHERJEE,
S. K. NANDI AND B. NANDI

Mycology and Plant Pathology Laboratory,
Department of Botany,
Burdwan University, Burdwan 713104.

The present study of fungal succession in different seeds in storage revealed that species of *Aspergillus* was dominant over other fungi. Moreover, different stages of deterioration depending on the breakdown of the substrate.

INTRODUCTION

Fungi are the most important of all biological agencies that cause seed deterioration in storage. Seeds, at various stages of their development become infected with fungi either in field before they mature, or in storage. Under a suitable environment these fungi colonise seeds that provide them nutrients and cause severe damage to the substrates (Mallick and Nandi, 1979; Nandi *et al.*, 1982; Ghosh *et al.*, 1981; Mondal *et al.*, 1981). However, various seed fungi may show differences in the modes of succession in different seeds at different stages of storage. In the present study, fungal colonisation of three economic seed crops in natural storage have been recorded.

MATERIALS AND METHODS

Three important grains/seeds, one starchy. maize (*Zea mays* var. 'Ganga'), an oil yielding, groundnut (*Arachis hypogea* var. Nizam) and a proteinaceous, soybean (*Glycine max* var. 'Bragg') were collected from local markets just after harvest in Nov. '85, Dec. '85 and May '86 respectively and stored separately in gunny bags in the laboratory under natural storage conditions. Seed mycoflora were studied by surface sterilising 100 grains/seeds of each type in 2% sodium hypochlorite solution, plating them on malt-agar (2%) for field fungi and salt-malt (2% malt-agar containing 10% NaCl) for storage fungi in Petridishes and incubated for 7 days following De-Tempe (1962). Seeds showing fungal growth around them were counted to be infected. The fungal colonies were separated, the cultures were purified and identified.

RESULTS

The studies revealed that *Aspergillus* spp. invaded all the three seeds considerably. However, presence of certain field fungi belonging to Phycomycetes and Deuteromycetes (grouped under 'Miscellaneous fungi') in the earlier period of storage were also recorded upto 3 months. *Penicillium* another storage fungus known to be commonly associated with stored seeds was, however, conspicuous by its absence in all cases. Extensive colonization of the storage fungi, belonging *Aspergillus* spp. in seeds succession, was probably responsible for elimination of the field fungi. Initial infection just after harvest were 81%, 90% and 82% in maize, groundnut and soybean respectively. Seed infection gradually increased to 100% within 6 months of storage in all cases. In maize, *A. niger*, *A. versicolor* were present predominantly since harvest. While the former was constantly present in fairly large number of seeds throughout the experiment period, the latter showed an initial increase but later disappeared completely after 7 months. *A. ruber* and *A. flavus* were initially not very pre-dominant but increased tremendously after some months. While the former species showed decrease afterwards and disappeared after 11 months, the latter became the most important seed fungus in the present study at the later stage of storage. The fungi grouped under 'Miscellaneous' and *A. terreus* showed evident decrease from the initial, disappearing after a few months. *A. candidus* appeared after 3 months of storage and gradually increased (Fig. 1).

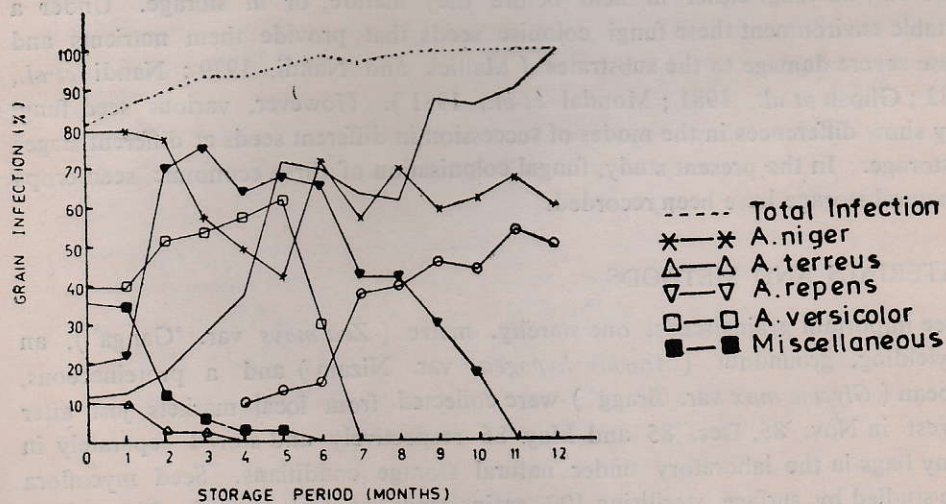


Fig. 1. Succession of mycoflora in maize seed.

In groundnut seeds, *A. flavus*, *A. niger*, and *A. ruber* were the three most dominant species initially. The first one showed further increase with storage while the two others showed gradual decrease, with the ultimate elimination of *A. ruber* after 11 months. *A. chevalieri* and 'Miscellaneous fungi' disappearing after varied

periods of storage, the former showing an initial increase to a certain extent. In this case also *A. candidus* appeared after some months of storage and increased gradually (Fig. 2).

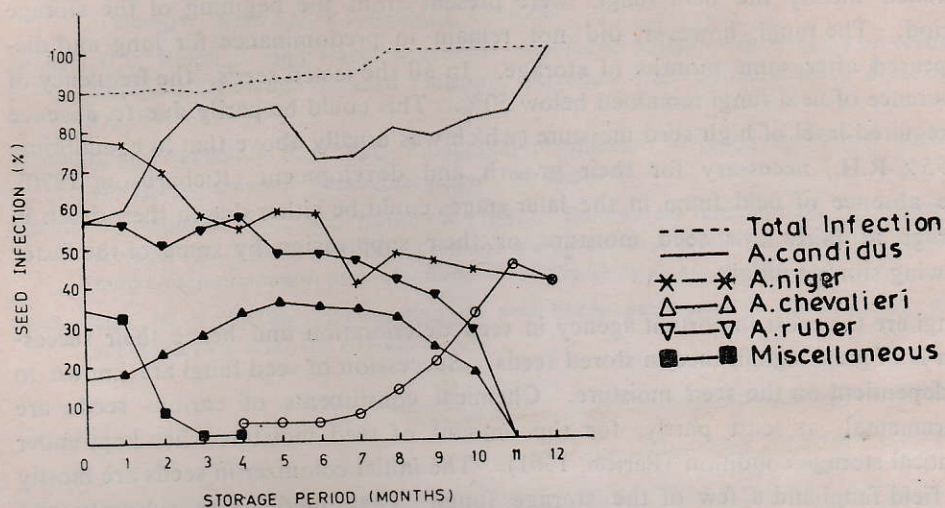


Fig. 2. Succession of mycoflora in groundnut seeds.

In soybean, *A. flavus*, *A. niger*, *A. repens*, *A. versicolor* and the field fungi grouped under 'Miscellaneous fungi' were predominantly present in the beginning. While the first one only showed gradual increase, the others showed decrease and disappeared after different periods of storage. *A. panamensis* and *A. sulphuratus* were present in much less extent from the beginning and disappearing after some months (Fig. 3).

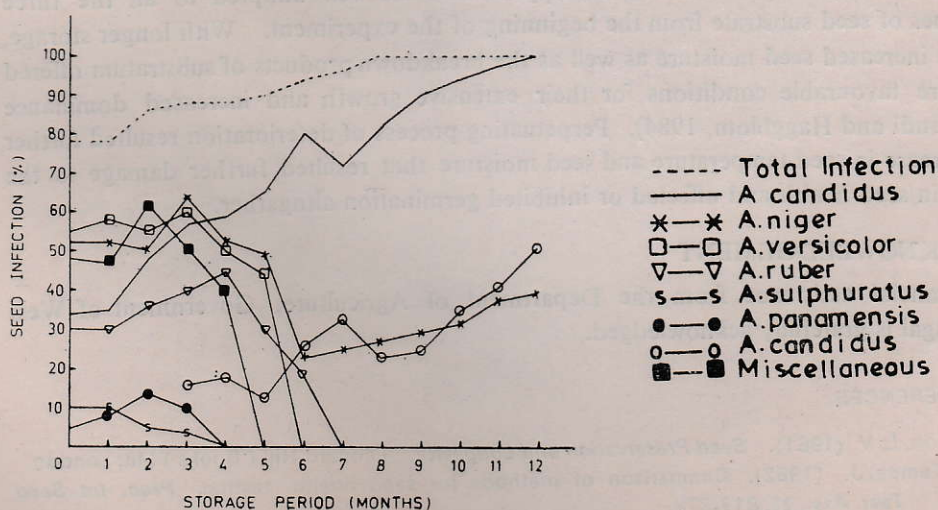


Fig. 3. Succession of mycoflora in Soybean seeds.

DISCUSSIONS

The study revealed some distinct trend in the appearance and disappearance of different fungi, after different periods of storage. The 'Miscellaneous fungi' which included mostly the field fungi, were present from the beginning of the storage period. The fungi, however, did not remain in predominance for long and disappeared after some months of storage. In all the tested seeds, the frequency of occurrence of field fungi remained below 50%. This could be partly due to absence of required level of high seed moisture (which was usually above that in equilibrium of 95% R.H.) necessary for their growth and development (Richardson, 1970). The absence of field fungi in the later stages could be either due to their death in storage at fairly low seed moisture, or their suppression by some of the faster growing storage fungi.

Fungi are the most important agency in seed deterioration and hence their succession is of great significance in stored seeds. Succession of seed fungi are known to be dependent on the seed moisture. Chemical constituents of various seeds are instrumental, at least partly, for the amount of seed moisture when kept under identical storage condition (Barton, 1961). The initial colonizer in seeds are mostly the field fungi and a few of the storage fungi. They modify the substrate and increase the seed moisture for growth of other colonizers mostly the *Aspergillus* spp., which in turn modify the substrate further. While *A. niger* and *A. flavus* were present in all the seeds from the beginning of the storage period, *A. candidus* appeared after some months of storage. From the late appearance of *A. candidus*, it seemed probable that the fungus establishes when some simpler breakdown products of the stored nutrients become available in the substrate along with the increase of seed moisture resulting from the metabolic activity of the fungi (Unpublished data). *A. flavus*, however, appeared to be well adapted to all the three types of seed substrate from the beginning of the experiment. With longer storage, the increased seed moisture as well as the breakdown products of substratum offered more favourable conditions for their extensive growth and increased dominance (Nandi and Haggblom, 1984). Perpetuating process of deterioration resulted further increase in seed temperature and seed moisture that resulted further damage to the grain/seed health and affected or inhibited germination altogether.

ACKNOWLEDGEMENT

Financial assistance from the Department of Agriculture, Government of West Bengal is gratefully acknowledged.

REFERENCES

- Barton, L. V. (1961). *Seed Preservation and Longevity*. Leonard Hill (Books) Ltd, London.
De Tempe, J. (1962). Comparison of methods for seed health testing. *Proc. Int. Seed Test. Ass.*, 27, 819-828.

- Ghosh, J., Nandi, B. and Fries, N. (1981). Deterioration of stored wheat caused by fungal infections under different conditions of temperature and relative humidity. *Z. Pflenk. Pflanzenschutz*, **88** (1), 9-17.
- Mallick, A. and Nandi, B. (1979). Role of moisture content in deterioration of rough rice in storage. *Seed Sci. & Technol.*, **7**, 423-429.
- Mondal, G.C., Nandi, D. and Nandi, B. (1981). Studies on deterioration of some oil seeds in storage I. Variation in seed moisture, infection and germinability. *Mycologia*, **73**, 157-166.
- Nandi, B. and Haggblom, P. (1984). Production of aflatoxin in rough rice under different storage conditions. *Acta Agric. Scand*, **34**, 128-132.
- Nandi, D., Mondal, G. C. and Nandi, B. (1982). Studies on deterioration of oil seeds in storage. 3. Effects of different storage temperatures and relative humidities on seed moisture, germination and infection. *Seed Sci. & Technol.*, **10**, 141-150.
- Richardson, M. J. (1970). Investigation on seed-borne pathogens of *Brassica* spp. *Proc. Int. Seed Test. Ass.*, **35**, 207-223.

(Accepted for publication 20th January 1988)