

Occurrence fungi in *Tribolium confusum* infested flour*

S. K. Srivastava, S. Chatterjee & K. Wadhvani

Mycology Laboratory, Department of Botany, University of Lucknow, Lucknow 226 007

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An analysis of flours of wheat, gram, rice and maize infested with *Tribolium confusum* Vigg. revealed the presence of 32 fungal taxa (zygomycotina-6, Ascomycotina-2 and Deuteromycotina-24). Among the taxa common in all the five types of flours, were *Mucor racemosus* Fres., *Rhizopus stolonifer* (Ehr. exr.) Lind., *Chaetomium nigricolor* Ames, *Emericella nidulans* (Eid.) Vuill., *Aspergillus flavus* Link, *A. fumigatus* Fres., *Curvularia lunata* (Wakker) Boed., *Fusarium oxysporum* Sch., *Penicillium citrinum* Thom., *Rhizoctonia solani* and *Trichoderma viride* Pres. ex. Fr.

Key-words - Fungi, *Tribolium confusum*, infested flour.

INTRODUCTION

The flours of wheat, rice, gram and maize heavily infested with *Tribolium confusum* emit foul smell during rainy season. The infestation results in the formation of small lumps often covered with fungal spores, and increase in temperature and moisture content of flours. The infested flours have been analysed for the occurrence of fungi.

MATERIAL AND METHOD

Five type of insect infested flours were collected from different markets of Lucknow. One hundred milligram of flour and 20 sterilized insects/larvae were inoculated in triplicate, separately onto previously poured petridishes, containing Czapek-Dox agar + 0.1 dicrysticin, and were incubated at $28 \pm 2^\circ\text{C}$. After 4 days, the fungal taxa were isolated and identified with the help of available literature (Raper & Fennell, 1965; Booth, 1977; Barnett & Hunter, 1987).

RESULTS AND DISCUSSION

The average number of adult insect and larvae (living and dead) with number of fungal species per 10 gm. of flour is given in Table-1. It is evident from the data presented that maximum number of living insect adult/larvae were found

in fine (34/85) and coarse (30/74) wheat flours followed by gram (20/68), maize (18/40) and rice (14/7) flours in decreasing order. In rice flour living adults were more in comparison to living larvae. Almost same trend was observed with regard to fungal species, but there was not much variation in fungal types and their occurrence in all the flours. Percentage of fungal taxa per 0.1 gm. flour is presented in Table 2, and the fungi isolated from adult insects and larvae are marked with asterick. The fungi found common in all flours are *Mucor racemosus*, *Chaetomium nigricolor*, *Emericella nidulans*, *Aspergillus flavus*, *A. fumigatus*, *A. niger*, *A. terreus*, *Cladosporium* sp., *Curvularia lunata*, *Fusarium oxysporum*, *Penicillium citrinum*, *P. funiculosum*, *Trichoderma viride* and *Rhizoctonia solani*.

The insects infest cobs at fruiting stage and lay their eggs on grains. During grinding these eggs remain in the flour unharmed. In rainy season, with the increase in moisture, the eggs hatch into larvae and adult insects and their activity results in the "heating" of flour. The propagules of seed-borne fungi germinate, grow and sporulate, emitting mouldy and rotting odour (Christensen & Kaufmann, 1974; Neergaard, 1979). Ecological relationship of stored products and mites on seed-borne fungi has been established and it has been observed that stored product mites feed on storage fungi (Sinha, 1964, 1966, 1971). Contaminated food, particularly with moulds is a potential risk to human health,

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Table 1. The average number of adult living and dead insects and larvae of *Tribolium confusum* per 10 gm. of flour.

| Flour | Adult | | Larvae | | Number of fungal species |
|----------------|--------|------|--------|------|--------------------------|
| | Living | Dead | Living | Dead | |
| Rice | 14 | 3 | 7 | 2 | 18 |
| Wheat (fine) | 34 | 4 | 85 | 7 | 26 |
| Wheat (coarse) | 30 | 2 | 74 | 12 | 26 |
| Gram | 20 | 3 | 68 | 10 | 21 |
| Com | 18 | 4 | 40 | 8 | 20 |

Table 2. Per cent occurrence of fungi per 0.1 gm. flour.

| | Rice* | Wheat (fine) | Wheat (coarse) | Gram | Com |
|------------------------------------|--------|-----------------|-------------------|-------|-------|
| ZYGOMYCOTINA | | | | | |
| <i>Choanephora cucurabitarum</i> | - | - | 2.88 | - | - |
| <i>Cunninghamella echinulata</i> | 7.85 | 8.65 | - | 4.66 | 7.2 |
| <i>Mucor racemosus</i> | 23.81 | 12.45 | 22.14 | 21.00 | 14.6 |
| <i>Rhizopus stolonifer</i> | - | - | 5.77* | 9.72 | 4.6* |
| <i>Syncephalastrum racemosum</i> | - | - | - | 1.16 | - |
| <i>Zygorhynchus</i> sp. | - | 1.03 | - | - | - |
| ASCOMYCOTINA | | | | | |
| <i>Chaetomium nigricolor</i> | 1.38 | 1.73* | 1.28 | 2.33 | 1.2* |
| <i>Emericella nidulans</i> | 1.38* | 4.03* | 1.60* | 3.11* | 3.2 |
| DEUTEROMYCOTINA | | | | | |
| <i>Alternaria alternata</i> | 1.38* | 1.73* | 2.24* | - | 1.4* |
| <i>Aspergillus carbonarius</i> | - | 3.11* | 2.24 | - | 3.2 |
| <i>A. carneus</i> | 7.62* | 1.38* | 0.96* | - | - |
| <i>A. flavus</i> | 13.39* | 19.03* | 4.17* | 5.05 | 4.2* |
| <i>A. flavo-furcatis</i> | - | 3.11* | 4.81* | - | 2.3 |
| <i>A. fumigatus</i> | 11.08* | 7.61* | 6.09* | 12.05 | 12.8* |
| <i>A. japonicus</i> | 3.23* | - | - | - | - |
| <i>A. niger</i> | 9.7* | 10.72* | 5.13* | 8.55* | 7.6 |
| <i>A. niveus</i> | - | 2.76 | 0.96* | - | 2.1* |
| <i>A. oryzae</i> | 5.54 | - | 5.13 | - | - |
| <i>A. parasiticus</i> | - | 18.7 | - | 2.33 | 1.2 |
| <i>A. sulphureus</i> | - | 4.03 | - | - | - |
| <i>A. tamarii</i> | - | 2.07* | - | 1.94 | - |
| <i>A. terreus</i> | - | 1.03* | 1.28* | 5.05* | 1.2* |
| <i>A. versicolor</i> | - | 2.07* | 1.92* | - | - |
| <i>Cladosporium herbarum</i> | 3.69* | 1.38* | 4.49* | 3.11* | 1.2* |
| <i>Curvularia lunata</i> | 1.38 | 1.03 | 1.28* | 3.5* | 1.6 |
| <i>Fusarium oxysporum</i> | 4.62 | 2.42 | 9.3 | 3.5 | 2.3* |
| <i>Helminthosporium spiciferum</i> | - | 1.03* | 2.24* | 3.89 | - |
| <i>Monilia</i> sp. | - | - | 2.24 | 2.72 | - |
| <i>Penicillium citrinum</i> | 2.77* | 1.03* | 2.56* | 2.33* | 1.2* |
| <i>P. funiculosum</i> | 1.38* | 1.38* | 0.96* | 2.33* | - |
| <i>Trichoderma viride</i> | 1.84* | 7.26* | 3.53 | 3.89* | 4.6* |
| <i>Mycelia sterila</i> | - | - | - | - | - |
| <i>Rhizoctonia solani</i> | 3.69* | 2.42* | 4.81* | 5.83* | 3.8* |

as many *Aspergilli* and *Penicillia* such as *Aspergillus flavus*, *A. ochraceus* and *Penicillium citrinum* are known to produce aflatoxin, ochratoxin, citrinin etc. which damage human liver, kidney and other tissues and could initiate development of malignant cells (Krogh, 1969; Krogh & Hasselanger, 1968). The entry of fungal spores of *Aspergillus*, *Alternaria*, *Cladosporium* and *Penicillium* in respiratory tract of sensitive people suffering from fungal allergies may cause various respiratory disorder (Austwick, 1965; Rippon, 1988; Vijay *et al.*, 1989). It is quite possible that allergenic reactions of sensitive persons may get aggravated while handling mould infested flours. Recently, Wadhvani *et al.* (1992) reported allergenic effects of twenty fungal taxa including eight aspergilli from wheat, cotton and house dust. The symptoms were sneezing, rhinitis, breathlessness, and chest pain. The diagnosis in most of the cases was bronchial asthma.

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