

## STORED GRAIN INSECTS AS CARRIER OF FUNGI

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Various fungi were isolated from insects *Bruchus chinensis* (Linn.), *Trogoderma granarium* (Everts.), *Tribolium confusum* (DuVal) and *Sitophilus oryzae* (Linn.) obtained from stored moong, wheat, flour and rice respectively. Four genera and 14 species belonging to fungi Imperfecti were found to be associated with these insects. The genus *Aspergillus* dominated over all the fungi prevalent on various insects. *Sitophilus oryzae* carried more fungi while *Tribolium confusum* carried least number of organisms than other insects.

### Introduction

Since the storage facilities are not adequate in the developing countries like Pakistan, the losses due to pests are fairly high. The damage is caused by insects (5-6%), rats (6-10%) and fungi (1-2%).<sup>1</sup>

Association of insects and fungi in storage has been reported by many investigators. Agarwal *et al.*<sup>2</sup> found a close relationship between the granary weevil, *Sitophilus granarius* (L.) and certain fungi that cause damage in stored grains especially *Aspergillus restrictus* G. Smith. Christensen and Kaufman<sup>3</sup> strongly support that all higher and field fungi infect the grains and proliferate at definite moisture level, temperature and time, but as the moisture decreases field fungi disappear and consequently insects and fungi relationship is affected.

Transmission of fungi, pathogenic to grains, by stored grain insects has been reported from the Science Service Laboratory, Winnipeg, Canada.<sup>4</sup> The rusty grain beetle *Cryptolestes ferruginens* (Waltl.) transmitted pathogenic fungi to healthy stored grains in 469 instances. The fungi transmitted include *Scopulariopsis brevicaulis* (Sacc.) Bain, *Penicillium melinii* Thom., *Aspergillus flavus* Link. and *A. glaucus* Link.

Grains being a poor conductor of heat, protect the insect and fungi from the lethal influence of prolonged low temperature and retain heat produced by insects and other microorganisms thus aiding in their survival and increase in population of pests. Although wind is the most common agent of dissemination of fungus spores, some pathogenic fungi are almost entirely dependent upon insects. Insects associated with grains consume nutrient from the grain and transfer the pathogenic and saprophytic fungi which grow internally and externally in the grain and in the presence of required moisture and temperature, survive and reproduce quickly resulting in total deterioration and loss of cereal grains. In view of the above-mentioned facts the present investiga-

tion was undertaken to isolate fungi from various insects which were found in stored grains.

### Materials and Methods

Samples of moong (*Mungo phaseolus*), rice (*Oryza sativa*), flour and wheat (*Triticum vulgare*) were taken from different places for the isolation of different insects infesting them. *Bruchus chinensis* was present on moong, *Tribolium confusum* and *Trogoderma granarium* were present on flour and wheat, respectively. Moong, wheat and flour were taken from the hatchery of these laboratories while rice was taken from a house which was infested with *Sitophilus oryzae*. These insects were studied for any possible fungi which might be present on them.

Five different media, oatmeal, lima bean, cornmeal, Sabour dextrose agar and Czapek's agar were taken for the isolation of fungi from the above-mentioned insects. These media were prepared, poured in test tubes and sterilized for 15 min at 15-lb pressure. The media were allowed to cool and solidify. Three tubes of each medium were taken for each insect. One tube each was kept as control. Two insects of each of the four insects used in these studies were introduced into the tubes. For control, the insects were surface sterilized with 1% HgCl<sub>2</sub> for 2 min. The insects were then removed and introduced into the tubes which served as control.

Fungal growth in various tubes started after 2, 3 and 4 days. Various fungi which appeared in these tubes were isolated into pure cultures through transfer and retransfer technique. The various fungi thus isolated were identified and described.

### Results and Discussion

In present investigation four insects *Bruchus chinensis* (Linn.) *Trogoderma granarium* (Everts), *Tribolium confusum* (DuVal) and *Sitophilus oryzae* (Linn.) isolated from moong, wheat, flour and

TABLE I.—FUNGI ISOLATED FROM FOUR INSECTS.

<i>Sitophilus oryzae</i>	<i>Bruchus chinensis</i>	<i>Trogoderma granarium</i>	<i>Tribolium confusum</i>
<i>Cladosporium herbarum</i> Link ex Fries	<i>Cladosporium herbarum</i> Link ex Fries	<i>Cladosporium herbarum</i> Link ex Fries	<i>Aspergillus niger</i> Van Tieghem
<i>Cladosporium</i> sp.	<i>Aspergillus ruber</i> (Bremer) Thom et Raper	<i>Aspergillus ruber</i> (Bremer) Thom et Raper	<i>Aspergillus flavus</i> Link
<i>Aspergillus niger</i> Van Tieghem	<i>Aspergillus flavus</i> Link.	<i>Aspergillus flavus</i> Link.	<i>Penicillium implicatum</i> Biourge
<i>Aspergillus flavus</i> Link	<i>Aspergillus sydowi</i> Thom et Church	<i>Aspergillus terreus</i> Thom	<i>Penicillium janthinellum</i> Biourge
<i>Penicillium janthinellum</i> Biourge	<i>Aspergillus niger</i> Van Tieghem	<i>Penicillium funiculosum</i> Thom	<i>Penicillium purpurogenum</i> Stoll
<i>Penicillium purpurogenum</i> Stoll	<i>Penicillium cyclopium</i> Westl.	<i>Helminthosporium nodulosum</i> (Berk. et Curt.) Sacc.	
<i>Penicillium oxalicum</i> Currie et Thom	<i>Penicillium implicatum</i> Biourge		
<i>Penicillium cyclopium</i> Westl.			

rice, respectively and the fungi associated with the above insects were studied. Fourteen species of fungi belonging to 4 genera, *Penicillium*, *Aspergillus*, *Cladosporium* and *Helminthosporium* were found to be associated with these insects (Table 1). Among these four genera *Aspergillus* and *Penicillium* were more frequent than the other two. The presence of *Aspergillus ruber* on *Bruchus chinensis* and *Trogoderma granarium* may possibly be due to the selective nature of the insects with regard to harboring certain specific fungi. *A. niger* and *A. flavus*, the two saprophytic fungi, were carried by all the four insects and frequency of their prevalence was comparatively higher than other fungi.

The frequency of other *Aspergillus* like *A. sydowi* and *A. terreus* associated with *Bruchus chinensis* and *Trogoderma granarium*, respectively, was low as compared to *A. niger* and *A. flavus*. *Cladosporium herbarium* was isolated from all insects except from *Tribolium confusum*, while *Helminthosporium nodulosum* was isolated from *Trogoderma granarium* alone which in turn was isolated from wheat. The presence of *H. nodulosum* in wheat may be due to higher moisture content in grains as has been reported by Koehler.<sup>5</sup> Seven species of *Penicillium* were found to be present on all the four insects but its frequency of occurrence was higher on *Sitophilus oryzae* than on other insects. *Penicillium oxalicum* and *P. cyclopium* pathogenic to corn seedlings and bulbous plants, respectively, were carried by *Sitophilus oryzae* and *Bruchus chinensis* from rice and moong, respectively. *Penicillium purpurogenum* and *P. janthinellum* were isolated from *Tribolium confusum* and *Sitophilus oryzae*, respectively. *Penicillium implicatum* was associated with *Bruchus chinensis* and *Tribolium confusum* while *P. funiculosum* was isolated from *Trogoderma granarium*. The frequency of fungi isolated from each of the four insects is shown in Fig. 1.

As a result of the present study, it may be stated that *Sitophilus oryzae*, a common rice weevil, carried

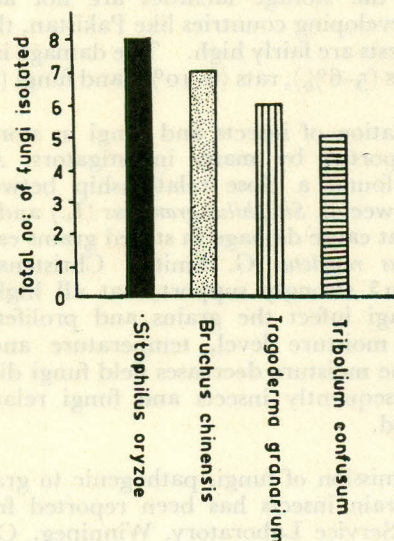


Fig. 1.— The frequency of fungi isolated from four insects. more fungi while *Tribolium confusum* carried least amount of fungal inoculum in the storage than other insects studied.

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