STUDIES ON OSMOPHILIC, THERMOPHILIC AND OSMO-THERMOPHILIC FUNGI ASSOCIATED WITH SEEDS OF *LINUM USITATISSIMUM**

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ABSTRACT

Stored seeds of five cultivars of *L. usitatissimum* were analysed for osmophilic, thermophilic and osmo-thermophilic fungi using standard methods. Species of *Aspergillus* constituted the major component. Fungi belonging to *A. glaucus* group were isolated frequently, which could grow at low moisture content where other seed-borne fungi failed to grow. Moisture content (8.5-9.5%) appeared to play important role in the activity of Aspergilli of *A. glaucus* group. The combined activity of osmophilic fungi (*A. glaucus* group) and less xerophilic fungi (*A. flavus*, *A. versicolor* and *Penicillium* sp.) 'heated' the grains alongwith an increase in the moisture content so that thermophilic fungi followed. The thermophilic and osmophilic fungi along with mesophiles rendered the seed non-viable.

INTRODUCTION

Linum usitatissimum suffers from some very common diseases, considered to be seed-borne. Comparatively little work has been done on seed mycoflora of *Linum;* whatever meagre information is available (KADIAN & SURYANARAYANA, 1971 ; MISRA & KANAUJIA, 1973 ; CHANDRA *et al.*, 1981), is mainly related to the mesophilic fungi. Present paper reports osmophilic, thermophilic and osmo-thermophilic fungi associated with stored seeds of five cultivars of *L. usitatissimum.*

MATERIALS AND METHODS

Five cultivars of *L. usitatissimum*, viz.—Hira, Mukta, Lc-45, Neelum & T-397, were analysed for the isolation of seed-borne fungi using 'Agar plate' and 'Blotter' methods (ISTA, 1966). Both, surface sterilized and non-sterilized seeds were analysed. Surface sterilization was done by using 0.1 per cent mercuric chloride solution. For each experiment 200 seeds were used. Moisture content of the seeds was obtained by drying 10 gm of seeds at 110°C, till constant weight. The moisture content of stored seeds was 8.5-9.5 per cent. Experiments were conducted in three sets. In the first set, for osmophilic fungi, seeds were placed on agar-plates containing 10 per cent sodium chloride in addition to normal malt extract agar (MEA) and petridishes with normal malt extract served as control. For the isolation of thermophilic fungi, seeds placed on agar-plates were incubated at different temperatures ranging from 20°C to 45°C. The fungi, which could not grow at or below 20°C and showed optimum growth between 35°C-45°C were considered as thermophilic fungi (FERGUS, 1964). Petridishes at 30°C served as controls. In the third set, seeds were placed on petridish containing 10 per cent NaCl in addition to MEA, were incubated at 25-45°C for the isolation of osmo-thermophilic fungi. After 4-8 days incubation, the appearing fungi were isolated and identified with the help of available literature (RAPER & THOM, 1945 ; GILMAN, 1959 ; BARNETTE, 1960 ; RAPER & FENNELL, 1965). Most of the species isolated as thermophilic or osmophilic fungi were the strains of common seed-borne fungi and are known from India.

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Those species which could not be identified have been sent to Commonwealth Mycological Institute, Kew for identification.

RESULTS AND DISCUSSION

Out of 27 fungi isolated during present investigation as thermophilic and osmophilic fungi, most belonged to Aspergilli and Penicillia, except two Deuteromycetes, *Humicola* sp. and *Paecilomyces varioti*, which were found to be associated with different cultivars, differently. *Humicola* sp. occurred as a thermophilic in one cultivar, osmophilic in another and osmo-thermophilic still in other. This may be due to the fact that there were different strains of *Humicola* sp., or spores of this fungus were not present on those seeds which were plated for other experiments. The fungi isolated were as follows :

OSMOPHILIC FUNGI—*Aspergillus amstelodami, A. brunneo-uniserialus, A. carbonarius, A. flavus, A. chevalieri, A. halophilicus, A. japonicus, A. niger, A. parasiticus, A. phoenicis, A. tamarii, A. terreus, A. ustus, A. versicolor, Humicola* sp. *Paecilomyces varioti, Penicillium citrinum, P. decumbens.*

THERMOPHILIC FUNGI—*A. brunneo uniseriatus, A. flavus, A. japonicus, A. niger, A. terreus, Humicola* sp., *Paecilomyces varioti.*

OSMO-THERMOPHILIC FUNGI—*Aspergillus fumigatus, A. chevalieri, A. halophilicus, A. terreus, A. tonophilus, Humicola* sp., *Paecilomyces varioti, Penicillium decumbens, Penicillium* sp. I.

Maximum number of osmophilic and thermophilic fungi have been isolated from cv. T-397, the moisture content of stored seeds of this particular cultivar was 8.0-8.5 per cent. Aspergilli, especially belonging to *A. glaucus* group were isolated regularly and consistently from different seeds.

Association of *A. glaucus* group fungi with the *Linum* seeds may be due to low moisture content. QASEM AND CHRISTENSEN (1958) viewed that 13-15 per cent moisture content was necessary for the growth of various Aspergilli on seeds. RAPER AND FENNELL (1965) described the species of *A. glaucus* group capable of growing at a very low moisture content, where other fungi fail to grow. They also added that activity of these fungi provided additional water for the less xerophilic fungi, such as, *A. flavus, A. versicolor* and certain species of *Penicillium.* If growing rapidly they also increase the temperature of grain to 35-40°C along with increase in moisture content. CHRISTENSEN AND KAUFFMAN (1974) have observed that *A. candidus* and *A. flavus* growing together could increase the temperature of grains to 55°C and could held it for weeks. Depending upon their activity the heating may subside or may pass into next stage in which the thermophiles are involved.

The present findings are in accordance with those of RAPER AND FENNELL (1965) and CHRISTENSEN AND KAUFFMAN (1974). The osmophilic fungi of *Aspergillus glaucus* group could grow on the *Linum* seeds even at low moisture content which was not sufficient for the growth of other seed-borne fungi. Their activity paved way for less xerophilic fungi, such as *Aspergillus flavus, A. versicolor* and *Penicillium* spp. resulting in an increase in moisture content and stimulating the activity of other fungi. The combined growth of various fungi produced the 'heating effect', which was enough for the thermophiles to follow. Thus osmophilic fungi in combination with thermophiles resulted in mouldiness of the seeds ultimately affecting seed viability.

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