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FUNGI ON INDOOR WALLS AND THEIR MANAGEMENT BY FUNGICIDES

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Abstract

Fungal colonies were found growing as patches round the year on the distempered indoor damp walls of ground floor of the Department of Botany, University of Dhaka. Fungi were isolated and identified as *Cladosporium oxysporum* Berk & Curt., *Curvularia lunata* (Wakker) Boedijn and species of *Fusarium* and *Penicillium*. Fungicides namely, bendazin 50% WP, calixin, champion 75 WP, companion, mancozeb and provex were sprayed on the indoor damp walls to control the fungal growth. All the fungicides controlled the growth of all fungi except *C. oxysporum* at 500 ppm concentration which was controlled by 1000 ppm.

Fungi were found to colonize the damp distempered indoor walls of Botany Department, Dhaka University, Dhaka, Bangladesh in the first week of January 2011. Within two weeks white as well as greyish black colonies, circular to irregular outline were found to be growing all over walls up to seven feet height from the floor (Fig. 1a).

Cladosporium oxysporum is a common saprophyte frequently grows on various substrata (Burnett and Hunter 1972). *Curvularia lunata* and *Fusarium* sp. are facultative parasites having a wide host range (Booth 1971, Ellis 1971, 1976), while *Penicillium* sp. is mostly responsible for fruit rot symptoms (Raper *et al*. 1949). Simon *et al*. (2008) reported that several species of indoor and outdoor molds such as *Aspergillus*, *Cladosporium*, *Curvularia*, *Fusarium*, *Penicillium* and *Stachybotrys* are pathogens both for plant and human pathogens and allergenic. Dampness is a problem of the 10 - 15% of the buildings and fungal growth is a problem in 15 - 40% of North America and Northern European homes (Sivasubramani *et al.* 2004).

Research work on fungi of indoor damp walls has been done in abroad (Dales *et al*. 2010, Graham 2009 and Park *et al.* 2008) but there is no report from Bangladesh. The present work was undertaken to identify the fungi associated on the damp walls of Botany Department and their control using fungicides.

Microscopic observations of fungal mycelia, spore bearing structures and spores were made on the scrapped materials. The fungi were isolated from the scrapped materials following Dilution plate method on PDA medium, at temperatures between 25 and 28^{o} C. pH of the medium was maintained at 6.0. The fungi were mounted on lactophenol and were stained with aniline blue (cotton blue).

Six fungicides *viz.* bendazin 50% WP, calixin, champion 75 WP, companion, mancozeb and provex were used to control the fungi that frequently grow on indoor damp walls. Bendazin is a systemic with protective and curative fungicide having 50% carbendazim as active ingredient. Calexin is also systemic with excellent prophylactic and curative having 83% tridemorph (N-tridecyl-2-6-dimethylmorpholin) as active ingredient. Champion is synthetic systemic agricultural fungicide having 75% copper hydroxide as active ingredient. Companion is systemic fungicide. Its active ingredient are 12% carbendazim and mancozeb 63 WP. Mancozeb is a broad spectrum contact fungicide with a protective action by affecting lipid metabolism. Provex is natures strongest fungicide whose active ingredient is terpinen-4-0l and a lower content of 1, 8 cineol.

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All fungicides were used at 500 and 1000 ppm concentrations to control fungal growth in the month of February 2011. Five replications were maintained per treatment in each.

The patches on examination were found to be deuteromycetous fungi, such as *Cladosporium oxysporum*, *Curvularia lunata* and species of *Fusarium* and *Penicillium* belonging to the order Moniliales. The former two belong to the Family Dematiaceae, where as *Fusarium* and *Penicillium* species belong to Tuberculariaceae and Moniliaceae, respectively.

Taxonomy and biology of the four fungi associated with indoor damp walls are described below.

Cladosporium oxysporum Berk & Curt. (**Fig.1c**)

(Ellis 1971, p. 312, Fig. 216 A)

Colonies effuse, greyish-green, small 6-10 mm diam.; mycelia greenish, septate and branched; conidiophores solitary or in fascicles straight or slightly flexuous, distinctly nodose, pale to mid brownish green, septate; smooth, with terminal and intercalary swellings; conidia arising as simple or branched chains, cylindrical, ellipsoidal, lamoniform or sub-spherical sub hyaline or pale olivaceous brown, 5-31 × 3-6 µm.

Specimen examined: S. Shamsi, 2087, 3 February 2011.

Curvularia lunata (Wakker) Boedijn. (**Fig. 1e**)

(Ellis 1971, p. 456, Fig. 323 G)

Colonies effuse, greyish-black; mycelia greenish, septate and branched; conidiophores solitary, mostly unbranched, straight or slightly undulated, brown and septate; conidia mostly 3 septate, olivaceous brown, slightly curved, third cell from the base is broader and darker than others, surface smooth, 18-32 × 8-16 µm.

Specimen examined: S. Shamsi 2094, 10 February 2011.

Penicillium Link. (**Fig. 1f**)

(Raper *et al.*1949, p. 216, Fig. 60)

Colonies greenish, tiny, compact; mycelia pale green, septate, branched; conidiophores arising from the mycelium, branched near the apex forming a broom like structure; conidia bearing apparatus ending in phialides which pinch off conidia in chain, one-celled, mostly globose or ovoid, pale green, 4-5 × 8-10 µm.

Specimen examined: S. Shamsi 2098, 10 February 2011.

Fusarium Link. (**Fig. 1g-h**)

(Booth 1971, p. 43, Fig. 6)

Colonies white cottony but with some tint of pink at maturity; mycelium hyaline, septate, branched; conidiophores hyaline, short, branched, bearing phialides, 14-20 × 2-3 µm; conidia hyaline, micrconidia mostly two celled, ovoid or oblong, borne singly, 8-12 × 2-4 µm.; macroconidia hyaline, mostly 3 celled, typically canoe-shaped, 10-18 × 3-5 µm.

Specimen examined: S. Shamsi 2088, 3 February 2011.

Prevalence of *C. oxysporum* was highest (100%) followed by *Fusarium* sp. (92%), *Penicillium* sp. (78%) and *C. lunata* (19%). *Penicillium chrysogenum*, *Acremonium* spp. *Ulocladium* spp. and *Aspergillus versicolor* are most common fungal species in water damaged

buildings. *Aspergillus fumigatus*, *A. melleus*, *A. niger*, *A. ochraceus*, *Chaetomium* spp., *Mucor recemosus* and *M. spinosus* grows on concrete and other floor related materials (Anderson *et al.* 2011).

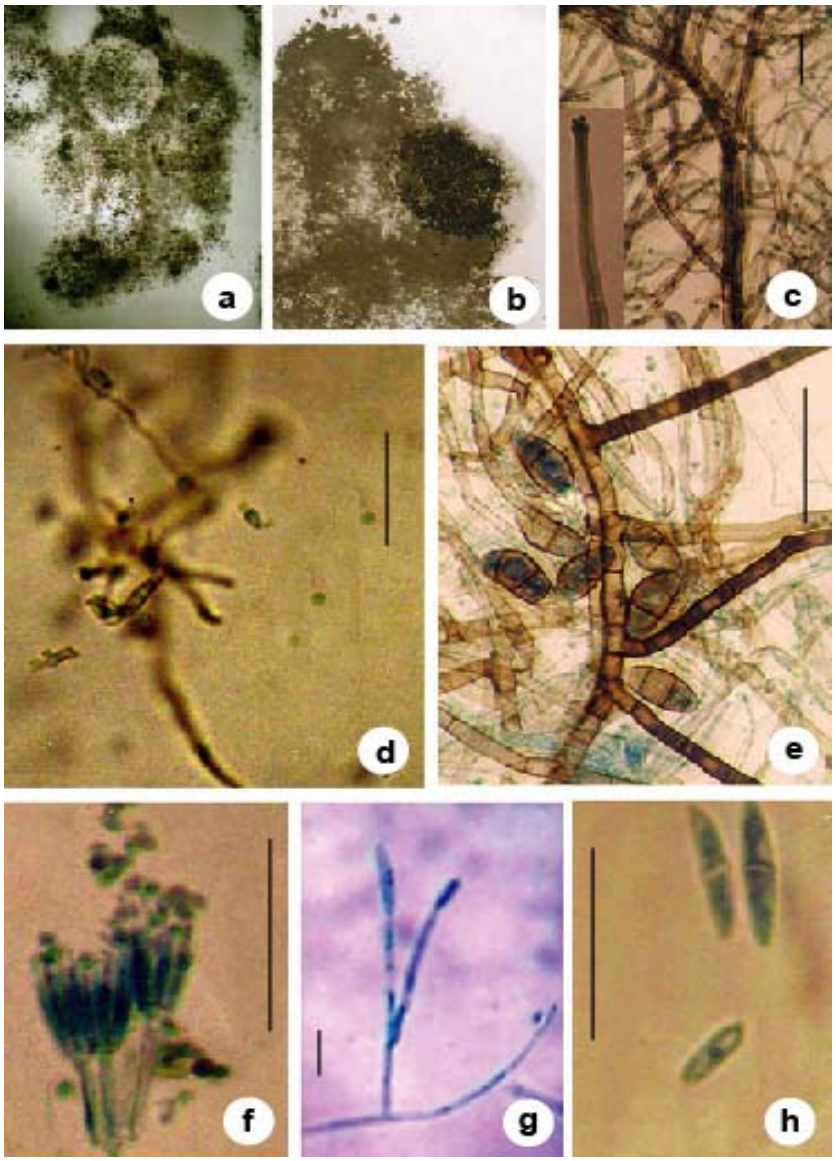

Fig. 1. Fungal association with indoor walls and morphological characteristics of different fungi. a. Patches of fungal colonies on distempered indoor wall. b. A patch of fungi showing a black treated area. c. Photomicrograph showing mycelia, conidiophores and conidia of *Cladosporium oxysporum.* d. Disorganized mycelia, conidia and conidiophores of *C. oxysporum* after 1st application of mancozeb. e. *Curvularia lunata*. f. *Penicillium* sp. g-h. Mycelia, conidiophores phialides, micro- and macroconidia of *Fusarium* sp. (Bar = 40 µm).

Carrageenan and alginic acid are the components of distempered paints for smoothering the surface (Lee 2008). The polysaccharides are used by the fungi for their nutrition and growth. Most of the good quality paints used algaecides and fungicides to prevent the growth of saprophytes. It is likely that the brand used for distempering the walls of the Botany Department did not use any antifungal substances in preparation of the paint.

Fungicides at recommended dose (500 ppm) controlled fungal growth within seven days except *C. oxysporum* (Fig. 1b). Growth of the fungus was controlled by applying 1000 ppm concentration of the fungicides used.

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