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Morpho-Pathological Effects of Isolated Fungal Species on Human Population

Kumari Manisha* **and Nirmal Panwar**

Department of Microbiology, Mahatma Jyoti Rao Phoole University, Jaipur, India

Abstract

The present investigation deals with identification and isolation of 17 fungal spp. from MJRP Institution Garden Environ and a record of their pathogenecity on humans. These were *Alternaria teunis, Aspergillus flavus, Aspergillus fumigatus, Aspergillu niger, Candida albicans, Cladosporium sphaerospermum, Curvularia lunata, Fusarium culmorum, Fusarium oxysporum, Geotrichum indicum, Mucor mucedo, Penicillium chrysogenum, Rhizoctonia solani, Rhizopus nigricans, Scopulariopsis brevicaulis, Trichoderma harzianum* and *Trichothecium roseum*. It has been found that out of the 17 spp., 2 spp. were non-pathogenic on humans, however they can cause infection in plants. The genus *Aspergillus* was the most abundant showing 3 spp. viz. *A. niger, A. flavus* and *A. fumigatus. Fusarium* was the second abundant genus with 2 spp viz. *F. culmorum* and *F. oxysporum*. The morphological structure of these fungi was studied microscopically in detail. The pathogenic impacts of these identified fungi on humans were classified into 4 kinds of infections viz. superficial, subcutaneous, systemic and opportunistic. It has been thus shown that fungi also possess negative impacts along with their utilization in the fields of environment, biotechnology and microbiology. Thus, it is very necessary to delete the negative pathogenic aspects of fungi by using proper treatment and care. Necessary precautions should be undertaken by scientists, medical professionals, laboratory personnels etc., while testing or experimenting with fungi. The medications include four categories for the treatment of fungal infections i.e. Polyenes, Flucytosine (5-fluorocytosine; 5FC), Phenethyl imidazole derivatives, Allylamines and Echinocandins (semi-synthetic cyclic lipohexapeptides).

Introduction

Fungi are heterotrophic organisms which are able to reproduce sexually as well as asexually. About 100 infectious fungal agents have been detected in man.

The mycoses or fungal infection can be of various forms as:

- Superficial – seen on the skin, the hair, and nails.
- Subcutaneous – infection reaching dermis or subcutaneous tissue
- Systemic – internal organs infected deeply
- Opportunistic – infection in immunocompromised patients

Pathogenic fungi cause disease in humans or other organisms. The study of pathogenic fungi is referred to as medical mycology. Pathogenicity is an accidental phenomenon and is not essential to the survival or dissemination of the fungal species involved. Most infections are either completely asymptomatic or of very short duration and quickly resolved.

Constant exposure to fungal spores in the atmosphere can induce respiratory allergies. Elevated antibodies to a range of common spore forming fungi have been demonstrated in occupational diseases such as Humidifier fever, Malt workers' lung, Farmers' Lung and Wheat threshers' disease. Certain fungi, such as mushrooms, can produce poisonous toxins that may prove fatal if ingested. Many moulds produce secondary metabolites that are highly toxic to humans.

Materials and Methods

The fungal species were obtained from the soil samples of garden site of Mahatma Jyoti Rao Phoole Institution Environ, New Sanganer Road, Jaipur. The sediment samples were serially diluted upto 10-3 and inoculated in Potato Dextrose Agar medium by spread plate technique. This was performed in a laminar air flow hood utilising following steps:

1. Pouring of 10-15 ml of sterilised/autoclaved PDA in autoclaved petriplates. This was allowed to solidify.

2. Inoculum of 10^{-3} diluted sediment sample is put by micropipette in the center of petriplate.

3. Glass spreader is sterlised in ethanol, flamed on bunsen burner and cooled.

4. Place glass spreader on solidified PDA and rotate the petriplate.

5. Cover the petriplate and incubate at 30°C.

The fungal polycultures/consortium initiated after 2-3 days, which converted into distinct colonies within 10 days. The mixed fungal colonies consisted of various species required to be identified. Adhesive tape impressions were taken from fungal colonies on petridish. Tape was slightly pressed onto fungal colony and mounted on slides. The stain solution cotton blue + lactophenol were applied directly to the tape mounted on the slide, and a cover slip was placed. This was followed by microscopic visualization of spore morphology and the fungal species were identified accordingly. A total number of 17 species were identified in the consortia viz. *Alternaria teunis, Aspergillus flavus, Aspergillus fumigatus, Aspergillu niger, Candida albicans, Cladosporium sphaerospermum, Curvularia lunata, Fusarium culmorum, Fusarium oxysporum, Geotrichum indicum, Mucor mucedo, Penicillium chrysogenum, Rhizoctonia solani, Rhizopus nigricans, Scopulariopsis*

***Corresponding author:** Kumari Manisha, Department of Microbiology, Mahatma Jyoti Rao Phoole University, jaipur, India, Tel: +917737491557; E-mail: manishaforever123@gmail.com

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braevicaulis, Trichoderma harzianum and *Trichothecium roseum*. These 17 fungal species were individually isolated in PDA slants.

For preparation of PDA slants following steps were carried out:

1. PDA media was prepared and autoclaved thoroughly at 15 lbs pressure, 121°C for 15 min.

2. Sterilized/ autoclaved test tubes were taken and 10-15 ml of liquified PDA is carefully poured in them.

3. The PDA is solidified by keeping the tubes in slanted position.

The sub-culturing process was carried out by transferring specific fungal culture from petridish consortium to the PDA slant. The inoculation loop was touched on the colony and streaked on slope of PDA slant. This was incubated at 30°C and allowed to grow. Contaminated cultures were further sub-cultured until pure monoculture was obtained. Detailed morpho-pathological study was carried out about each species, using reference medical pathology books and internet.

Observations

The fungal morphology was investigated by slide preparation and microscopic identification utilising reference books viz. Mehrotra & Aneja, Bilgrami & Sinha. The pathogenesis in humans was studied and a record was maintained utilising medical pathology sites in internet.

The morpho-pathological study of 17 fungi and their impact on humans is as follows:

Alternaria tenuis

Morphology: *Alternaria tenuis* species colonies were flat, downy to woolly and was covered by grayish, short, aerial hyphae. Conidiophores were also septate. They bore simple or branched large conidia which had both transverse and longitudinal septations. These conidia were observed singly or in acropetal chains and produced germ tubes. They were ovoid to obclavate, darkly pigmented, muriform, smooth or roughened. The end of the conidium nearest the conidiophore was round while it tapered towards the apex. This gave the typical beak or club-like appearance of the conidia.

Pathogenicity: They are common allergens in humans, growing indoors and causing hay fever or hypersensitivity reactions that leads to asthma. They readily cause opportunistic infections in immunocompromised people such as AIDS patients. A case of phaeohyphomycosis caused by *Alternaria tenuis* in a renal transplant recipient with pulmonary infiltrates and multiple skin lesions has been reported. Diagnosis has been based on microscopy and culture of the skin lesions.

Aspergillus flavus

Morphology: Colonies were granular, velvety, or wooly and yellow or yellow-brown to lime green, consisted of a dense felt of conidiophores or mature vesicles bearing phialides over their entire surface. *Aspergillus flavus* hyphae were septate and showed dichotomous branching. Conidiophores were coarsely roughened, uncolored, with vesicles spherical, metulae covering nearly the entire vesicle. Conidial heads were radiate, uni- and biseriate. Conidia were pale green and conspicuously echinulate, smooth to very finely roughened, (sub) spherical.

Pathogenecity: *Aspergillus flavus* causes chronic granulomatous sinusitis, keratitis, cutaneous aspergillosis, wound infections and osteomyelitis following trauma and inoculation. It is the main agent of acute and chronic invasive and granulomatous *Aspergillus sinusitis*. It also causes otitis, keratitis, pulmonary and systemic infections in immunocompromised patients, and cutaneous aspergillosis.

Aspergillus fumigates

Morphology: Surface colony color was smoky gray - green and the reverse was yellow. Conidiophores were smooth–walled, often tinted greenish, and terminated in a dome–shaped vesicle. Hyphae were septate and hyaline. The species was uniseriate producing closely compacted phialides and only occurring on the upper portion of the vesicle. Conidia were round to sub–globose, smooth to finely roughened.

Pathogenecity: Many people develop symptoms much like allergic reactions such as running nose, itchy eyes, or swelling of the throat in the case of allergic aspergillosis by *Aspergillus fumigatus*. People with invasive aspergillosis usually have nose stuffiness, headache, facial discomfort, cough (often with blood), fever, and chest pain. This includes invasion and damage of tissues that can be wide spread and rapidly fatal. For emphasis, aspergillosis is the second most common fungal infection requiring hospitalization. The fungus can cause infections in any type of tissue, even the brain, but the lungs are where it is most common.

Aspergillus niger

Morphology: Mature colonies with spores were seen as structures with numerous black dots. Hyphae were septate and hyaline. Conidial heads were radiate initially, splitting into columns at maturity. The species was biseriate (vesicles produces sterile cells known as metulae that support the conidiogenous phialides). Conidiophores were long, smooth, and hyaline, becoming darker at the apex and terminating in a globose vesicle. Metulae and phialides covered the entire vesicle. Conidia were brown to black, very rough, globose.

Pathogenecity: *Aspergillus niger* is less likely to cause human disease than other *Aspergillus* species, but, if large amounts of spores are inhaled, a serious lung disease, aspergillosis can occur. Aspergillosis is, in particular, frequent among horticultural workers that inhale peat, dust, which can be rich in *Aspergillus niger* spores. It is one of the most common causes of otomycosis (fungal ear infections), which can cause pain, temporary hearing loss, and, in severe cases, damage to the ear canal and tympanic membrane. A fungal ball in the lungs is eventually created by *Aspergillus niger* after it infects the lungs and begins to grow.

Candida albicans

Morphology: The colonies were white to creamish shiny, powdery in nature, which contained round to oval budding yeast-like cells or blastoconidia.

Pathogenecity: Clinical manifestations of candidiasis are extremely varied, ranging from acute, subacute, chronic and episodic. Involvement may be localized to the mouth, throat, skin, scalp, vagina, fingers, toes), nails, bronchi, lungs or gastrointestinal tract. It may also be systemic as in septicemia (circulating in the blood and causing damage to blood vessels and sometimes blood cells), endocarditis and meningitis. Pathologic processes evoked are diverse and vary from irritation and inflammation to chronic and acute suppuration or granulomatous response. Factors predisposing people to candidiasis include AIDS, burn patients, young individuals, pregnancy, oral birth control, high

fruit diets, steroids, antibiotic therapy, immunosuppressants, cancer treatments, heart surgery, genetic deficiency, endocrine deficiency, diabetes, use of catheters, and use of dirty needles.

Cladosporium sphaerospermum

Morphology: Colonies were grey, buff or brown, often becoming powdery due to the production of abundant conidia. Conidiophores were more or less distinct from the vegetative hyphae, and erect, straight or flexuous, unbranched or branched only in the apical region, with geniculate sympodial elongation. Conidia were 1- to 4-celled, smooth, verrucose or echinulate, with a distinct dark hilum and were produced in branched acropetal chains. The conidia closest to the conidiophore and where the chains branch, were usually "shield-shaped". The presence of shield-shaped conidia, a distinct hilum, and chains of conidia that readily disarticulate, were diagnostic for the genus *Cladosporium sphaerospermum*.

Pathogenecity: An intrabronchial lesion caused by *Cladosporium sphaerospermum* in a healthy and non asthmatic 59-year-old woman has been reported. It is known to be the cause of opportunistic mycosis. *Cladosporium sphaerospermum* has been implicated as the cause of human corneal ulcer, skin lesions and infection of nails. There are also documented cases of subcutaneous phaeohyphomycosis caused by this species. Spores of the fungus can elicit allergic reactions in the respiratory tract of susceptible individuals as well as cause invasive infections of the respiratory tract.

Curvularia lunata

Morphology: *Curvularia lunata* produced rapidly growing, woolly colonies. Hyphae were septate and brown in color, conidiophores were brown, geniculate, simple or branched and conidia were visualized under microscope. The conidia also called the poroconidia, were straight or pyriform, brown, multiseptate, and having dark basal protuberant hila. The septa were transverse and divided each conidium into multiple cells. The central cell was typically darker and enlarged compared to the end cells in the conidium. The central septum also appeared darker than the others. The swelling of the central cell usually gave the conidium a curved appearance. The conidia of *Curvularia lunata* had 3 septa and 4 cells, while those of other species possess different septal & cell number.

Pathogenecity: *Curvularia lunata* is the most commonly encountered species. *Curvularia lunata* are among the causative agents of phaeohyphomycosis. Wound infections, mycetoma, onychomycosis, keratitis, allergic sinusitis, cerebral abscess, cerebritis, pneumonia, allergic bronchopulmonary disease, endocarditis, dialysis-associated peritonitis, and disseminated infections may develop due to *Curvularia lunata*. Importantly, the infections may develop in patients with intact immune system. However, similar to several other fungal genera, *Curvularia lunata* has recently emerged also as an opportunistic pathogen that infects immunocompromised hosts.

Fusarium culmorum

Morphology: The colonies were cream colored, felty, cottony or wooly and wet-looking. Hyaline septate hyphae, conidiophores, phialides, macroconidia, and microconidia were observed microscopically. *Fusarium culmorum* had septate hyphae with two types of conidiation: unbranched or branched conidiophores with phialides that produce large, sickle- or canoe-shaped macroconidia, and long or short simple conidiophores bearing small oval, 1 or 2 celled microconidia singly or in clusters. Chlamydospores were sparse, in pairs, clumps or chains, thick-walled, hyaline, intercalary or terminal.

Pathogenecity: *Fusarium culmorum* may cause a range of opportunistic infections in humans. In humans with normal immune systems, fusarial infections may occur in the nails (onychomycosis) and in the cornea (keratomycosis or mycotic keratitis). In humans whose immune systems are weakened in a particular way, (neutropenia, i.e., very low neutrophils count), aggressive fusarial infections penetrating the entire body and bloodstream (disseminated infections) may be caused by it.

Fusarium oxysporum

Morphology: *Fusarium oxysporum* colonies were cottony, white to pinkish. Hyphae were septate, conidiophores, phialides, macroconidia, and microconidia were observed. *Fusarium* had two types of conidiation: unbranched or branched conidiophores with phialides that produce large, sickle- or canoe-shaped macroconidia, and long or short simple conidiophores bearing small oval, 1 or 2 celled micro conidia singly or in clusters.

Pathogenecity: *F. oxysporum* is harmful to humans with it's mycotoxins causing the diseases Fungal keratitis, Onychomycosis and Hyalohyphomycosis which are elaborated as follows:

(i) Fungal keratitis - The fungal infection of the cornea that can infect the eyeball and causes abscesses to form on it.

(ii) Onychomycosis - The fungal infection of the nail that can cause fingernails or toenails to thicken, discolor, disfigure, and split.

(iii) Hyalohyphomycosis - A fungal infection of the skin that can result in an extreme rash or penetrate the dermis and cause infection or internal bleeding.

Clinical manifestations of the conditions caused by *Fusarium oxysporum* in humans are much more likely in immuno-compromised individuals, especially those experiencing cutaneous and subcutaneous infections, inflammation, arthritis, or dialysis.

Geotrichum indicum

Morphology: Colonies were white to cream to pink on surface recognised by the formation of arthrospores. Hyphae were hyaline, septate, branched and broken up into chains of hyaline, smooth, one-celled, subglobose to cylindrical arthroconidia. Conidiophores were absent.

Pathogenecity: It has been reported to cause disease in immunosuppressed people. It affects mainly patients with systemic diseases like diabetes mellitus and those with neoplasms. Clinically it is similar to candidiasis and may cause oral, vaginal, skin or systemic infection. Disseminated infection has also been reported in literature in patients with malignancy. Fungal colonization of the duodenum by *Geotrichum indicum* was seen in a child with low serum levels of IgA and IgM antibodies. Oesophageal ulcers caused by *Geotrichum indicum* has also been reported in AIDS patients. In some patients of bronchitis and tracheaitis white patches were seen lining the trachea and bronchi and *Geotrichum indicum* was isolated from the blood tinged sputum.

Mucor mucedo

Morphology: Colonies of *Mucor mucedo* had fluffy appearance with a height of several cm resembled cotton candy. Hyphae were nonseptate or sparsely septate, broad, sporangiophores, sporangia, and spores were visualized. Sporangiophores were short, erect, tapered

towards their apices and formed short sympodial branches. Columella was hyaline or dematiaceous. Sporangia were round, gray to black in color, and were filled with sporangiospores. Following the rupture of the sporangia, sporangiospores were freely spread. A collarette was sometimes seen left at the base of the sporangium following its rupture. The sporangiospores were round or slightly elongated.

Pathogenecity: It sometimes causes opportunistic, and often rapidly spreading, necrotizing infections known as zygomycosis. It can also cause life-threatening opportunistic infections of diabetic, immuno-suppressed, and immuno-compromised patients [1]. They attack immuno-suppressed humans and also cause serious human infections.

Penicillium chrysogenum

Morphology: The colonies of *Penicillium chrysogenum* were rapid growing, flat, filamentous, and velvety, woolly, or cottony in texture. The colonies were initially white and became blue green, gray green, olive gray. The conidiophores were branched at the tip. At the end of each branchlet was a cluster of spore-producing cells called phialides. A chain of spores was formed from the tip of each phialide. The spore is called a conidium or phialsopore. The spores in *Penicillium chrysogenum* often contained blue or green pigments. This fungus had septate hyaline simple hyphae with simple or branched conidiophores, metulae, phialides, and conidia were observed. Metulae were secondary branches that formed on conidiophores. The metulae carried the flask-shaped phialides. The organization of the phialides at the tips of the conidiophores was very typical. These fungi form brush-like clusters which were also referred to as "penicilli".

Pathogenecity: A case of necrotizing pneumonia has been reported due to *Penicillium chrysogenum* in a 57-year-old woman operated on for lung cancer. The residual right lower pulmonary lobe was infiltrated by *Penicillium chrysogenum*. It is rarely pathogenic except in extenuating circumstances such as people with severely suppressed immune systems, like those with Human Immunodeficiency Virus (HIV). Symptoms of infection include pulmonary infection including pneumonia, localized granulomas, fungus balls, and systemic infection.

The most common avenue for the implementation of infection by *Penicillium chrysogenum* in the eye is by penetrating trauma. *Penicillium chrysogenum* can also act as an allergen and an asthma inducer. It is an active allergen that triggers histamine responses in the epithelial cells of lungs.

Rhizoctonia solani

Morphology: The colonies were circular to irregular in form, produced thread-like hypha, with large masses of hyphae. Small, oval cells produced in branched chains or clusters were formed. These are called monilioid cells and had slightly thicker walls than the mycelium. Large aggregates of these cells are called sclerotia which are black to brown. The hyphae of *Rhizoctonia solani* have many nuclei (commonly 4 to 8) per cell. This distinguishes it from other fungi. The mycelium consisted of hyphae partitioned into individual cells by a septum containing a dough-nut shaped pore.

Pathogenecity: *Rhizoctonia solani* causes a wide range of commercially significant plant diseases viz. damping off in seedlings, black scurf of potatoes, bare patch of cereals, root rot of sugar beet, belly rot of cucumber, sheath blight of rice, etc. However, the reports on human diseases caused by *Rhizoctonia solani* are unavailable. Hence it is strictly a plant pathogen.

Rhizopus nigricans

Morphology: Colonies of *Rhizopus nigricans* were furry, initially white that turned grey to brown in time. The hyphae were broad, with few or no septa. Many stolons run among the mycelia, connecting groups of long usually unbranched sporangiophores. The sporangiophores terminated with a dark, round sporangium that contained a columella and several oval, colourless or brown spores. The rhizoids were produced (directly opposite) at the point where the stolons and sporangiophores met.

Pathogenecity: *Rhizopus nigricans* is responsible for opportunistic infections and hypersensitivity reactions such as symptoms of asthma and hypersensitivity pneumonitis in sensitised individuals and is an important occupational allergen. It has been postulated that fungi may contribute to increased severity of asthma. Rhizopus has been particularly associated with occupations involving wood. It has also been shown to grow on cut surfaces of wood, and is aerosolised by trimming of the wood into pieces, which may result in acute hypersensitivity pneumonitis.

Scopulariopsis brevicaulis

Morphology: The surface colony color was white initially becoming orange to light brown or buff tan in maturation. Septate hyaline hyphae, conidiophores, annellides, conidia, and chlamydospores were present. Conidiophores were dark, may be simple or branched, hyphae–like, and with annellides. Annellides may be solitary, appear in clusters, or may form a penicillus which was cylindrical and slightly swollen; and Conidia were hyaline or dark gray in color, unicellular, globose to pyriform with truncate bases, smooth or rough-walled, and appear in basipetal chains.

Pathogenecity: *Scopulariopsis brevicaulis* is the most frequent non-dermatophytic fungus causing infection of nails published in the literature. It is well established as an agent of onychomycosis [2-9]. Sekhon and Garg [2] also isolated *S. brevicaulis* from skin. It may cause various infections in humans. It is among the fungi that cause onychomycosis especially of the toe nails. Skin lesions, mycetoma, invasive sinusitis, keratitis, endophthalmitis, pulmonary infections, endocarditis, brain abscess and disseminated infections due to *Scopulariopsis brevicaulis* have been reported. Invasive *Scopulariopsis brevocaulis* infections are seen mainly in immunocompromised hosts, such as bone marrow transplant recipients. These infections are highly mortal. One of the most striking features of *Scopulariopsis brevicaulis* is its association with human deaths by producing arsine gas from arsenate dyes found in wallpapers. A garlic odor in some rooms with these wallpapers and the death of people who slept in these rooms. These people got sick and died secondary to tubular necrosis and renal failure. *Scopulariopsis brevicaulis* consumes the starch found in the wallpaper paste. Meanwhile, the fungus converts the arsenate found in the paper to trimethylarsine oxide. Finally, the oxide is reduced to trimethylarsine and the gas, which is toxic and causes human deaths is released.

Trichoderma harzianum

Morphology: Colonies were originally hyaline darkening to white with green tufts in most species. The form was irregular which rapidly grew and merged forming green carpet like appearance. The conidiophores were branched and hyaline. Phialides were divergent and flask-shaped. Conidia were generally green, smooth or roughened, ranged in shape from globose to ellipsoidal, and were produced in

slimy heads. Conidiophores were highly branched and demonstrated a pyramidal arrangement.

Pathogenecity: *Trichoderma harzianum* infections are opportunistic and develop in immunocompromised patients, such as neutropenic cases and transplant recipients, as well as patients with chronic renal failure, chronic lung disease, or amyloidosis. Peritonitis, pulmonary, perihepatic, and disseminated infections have so far been reported. A disseminated fungal infection was detected in the postmortem examination of a renal transplant recipient and confirmed in culture. The only other reported infection by this fungus caused peritonitis in a diabetic patient. *Trichoderma harzianum* were identified as causative agents of opportunistic fungal infections with increasing frequency. *Trichoderma harzianum* isolates are reported predominantly to cause health problems in humans ranging from localized infections to fatal disseminated diseases.

Trichothecium roseum

Morphology: Colonies were moderately fast growing, flat, suede-like to powdery, initially white but becoming rosy, pink or orange with age. The conidiophores were indistinguishable from the vegetative hyphae until the first conidium was produced. They were erect, unbranched, often septate near the base, more or less rough-walled, bearing basipetal zig-zag (alternating) chains of conidia at the apex. The conidiophore was progressively shortened with the formation of each conidium i.e. retrogressive conidial development. Conidia were two celled (didymoconidia), ellipsoidal to pyriform, with an obliquely truncate basal scar, hyaline, smooth to delicately roughened and thick-walled.

Pathogenecity: No human diseases due to *Trichothecium roseum* have been reported.

Results and Discussion

Fungi are widely distributed over the world and are affected by various environmental factors such as temperature, moisture, wind and geographical location. It has been reported that airborne fungi are the most common microorganisms that have adverse effect on human health causing asthma, rhinitis and dermatitis besides they are considered as a source of plant and animal pathogens [10-13]. The soil borne fungi however are transmitted through soil contamination only, but they can also be disseminated via dust, storms, water etc. In the present study pathogenecity of air borne and soil borne fungi has been studied on humans, along with the detailed fungal morphology. The spore survival in air is a fine balance between water loss and retention of metabolic activity.

A wide range of media can be used for growing fungi. Media affects colony morphology and color, and growth of fungus. Most fungi thrive on Potato Dextrose Agar (PDA), which is rich in nutrients for many fungi, and good mycelial growth is obtained along with wonderful sporulation. It consists of potato starch and dextrose as important utilizable carbon sources. Another important media constituent is agar which is a polymer made up of subunits of the sugar galactose, and is a component of the cell walls of several species of red algae. Dissolved in boiling water and cooled, laboratory agar looks gelatinous. Thus, it is utilised for solidification of the media.

In the present investigation, 17 fungal species were identified and isolated as fungal monocultures viz. Alternaria teunis, *Aspergillus flavus*, *Aspergillus fumigatus*, Aspergillu niger, Candida albicans, *Cladosporium sphaerospermum*, *Curvularia lunata*, *Fusarium culmorum*, *Fusarium oxysporum*, *Geotrichum indicum*, *Mucor mucedo*, *Penicillium chrysogenum*, *Rhizoctonia solani*, *Rhizopus nigricans*, *Scopulariopsis brevicaulis*, *Trichoderma harzianum* and *Trichothecium roseum*. Out of these, 3 spp. of *Aspergillus* and 2 spp. of *Fusarium* were obtained. Rest of the 12 fungi had single species each. Out of the total fungi one spp. was yeast, while the rest 16 were of mould category. Yeasts and moulds have been differentiated on the basis of microscopic structural morphology. Yeast reproduces by asexual budding. Molds reproduce both sexually and asexually with hyphae. Yeast is usually not colored. Molds are usually very colorful.

It was also investigated that out of the total 17 fungal spp. Two were totally harmless to humans viz. *Rhizoctonia solani* and *Trichothecium roseum*. These are thus restricted to pathogenecity in plants only. No effects by these two species on humans have been reported till now.

Treatment of fungal infections or mycoses begins with seeking regular medical care in humans. Diagnostic testing for fungal infections is required.

Fungal infection treatment includes:

1. Antiseptic mouth washes for oral thrush.

2. Diagnosing and treating any underlying diseases, such as HIV/AIDS and diabetes. Treating the high blood sugar levels of diabetes may resolve a current infection and is critical to minimizing the risk of developing recurrent fungal infections.

3. Eating yogurt or taking acidophilus supplements which can help to correct the abnormal balance of microorganisms in the mouth and digestive tract.

4. Medications.

In medications, antifungal drugs are used to treat mycoses. Depending on the nature of the infection, a topical or systemic agent may be used. Eg. Fluconazole, or Diflucan, however amphotericin B is more potent. It is used in the treatment of the most severe fungal infections that show resistance to other forms of treatment and it is administered intravenously. Drugs to treat skin infections are Tolnaftate (Tinactin), topical Ketoconazole and Griseofulvin, commonly used for infections involving the scalp and nails. Yeast infections in the vagina, caused by *Candida albicans*, can be treated with medicated suppositories and pessaries whereas skin yeast infections are treated with medicated ointments. 5 classes of antifungal agents are used orally or intravenously for the treatment of fungal infections in humans. These are as follows:

(i) Polyenes The polyenes are broad-spectrum antifungal agents produced by the bacterial genus *Streptomyces*.

(ii) Flucytosine (5-fluorocytosine; 5FC) is active against medically important yeasts such as *Candida* spp. and *Cryptococcus* spp., and against a limited number of moulds such as *Aspergillus* spp.

(iii) Phenethyl imidazole derivatives eg. Ketoconazole revolutionised the treatment of oral candidiasis, coccidioidomycosis, endemic mycoses and dermatophyte infections. Another example fluconazole is extensively used for the prevention and treatment of superficial and invasive Candida infections.

(iv) Allylamines Terbinafine, the only allylamine in clinical use, and is the agent of choice for many dermatophyte infections including onychomycosis .

(v) Echinocandins - The echinocandins are semi-synthetic cyclic

lipohexapeptides derived from fungi eg. Caspofungin, micafungin and anidulafungin are active against *Candida* spp. and *Aspergillus* spp., and few other fungi.

Conclusion

It has been stated in the present research work that fungi could be obtained easily from varied environmental conditions and different areas. They are very easy to culture and identify. Although, various researchers have carried out the utilization of fungi in the fields of biotechnology, microbiology and environment, but it should be well understood that these organisms are harmful also. The various pathogenic impacts of fungi have been reported in plants and animals, including humans. The pathogenecity of fungal species obtained in the present investigation has been detailed upon human population. Thus, this study gives concern on handling, prevention and treatment of various fungal diseases on humans. The 17 isolated species are very commonly reported in relation to diseases in human beings. There can be also a negative aspect in the case of scientific investigations, occupation, medical field etc where fungi can be transmitted among humans. Thus, this investigation alerts the society that fungi should be under the control of humans rather than its dominance over the society, so that it may be utilised for positive purposes.

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