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Some Studies of the Physico-chemical and Biological Properties of the Soil of Taluka Ratodero, District Larkana, Sindh, Pakistan

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Abstract: Studies of some physical, chemical and biological parameters of the soil of taluka Rattodero, District Larkana were undertaken to investigate the occurrence of mycoflora from 45 soil samples of different depths of various locations. The mycoflora/dermatophytes are the sources of skin infections in animals and humans. Data presentation revealed different values of the physical and chemical analysis of soil pH, moisture, organic matter, nitrogen content and Total Dissolved Salts (TDS). During biological studies, various mycoflora including dermetophytes were investigated which were reported to be the cause of infection in laboratory animal and humans, respectively.

Key words: Soil, physico-chemical properties, keratinophilic fungi

INTRODUCTION

Soil has long been recognized as a natural habitat for certain fungi. The fungi are the second population after bacteria in soil. They being chemo-organotrophic microbes live as saprophytes in soil; their occurrence in soil depends upon the physical and chemical parameters of soil which vary from place to place. More than 100 species of fungi which are generally recognized as pathogens of man[1]. They are scavengers and serve to break the complex organic compounds including the keratin containing materials such as skin, nail, hair, fur, feathers, horn etc. by producing extra cellular enzymes including the keratinase[2-4]. Most of the mould fungi are responsible to cause systemic mycotoxicosis and mycetismus in humans[1].

MATERIALS AND METHODS

Forty-five samples were collected from taluka Dokri of district Larkana. Each sample was placed in 4x6 inches polythene bags. The soil samples were collected from surface, 10 and 20 cm depths by using the soil sampler. These samples were investigated quantitatively for physical and chemical properties including the determination of pH[5], moisture[6,7] organic matter[6,7], nitrogen content and total dissolved salts[5]. Mycological studies of various depths of soil were carried out by the method[6].

Mycological investigations were undertaken by taking 2.5 g of soil samples in sterile petri dishes which were moistened with 15-30 mL. Sterile distilled water and baited by placing short filaments of autoclaved horse hairs on the surface of the soil and the plates were later incubated at room temperature for 2-3 weeks for the development of mycelial growth. The mycelia were separately cultured on the surface of Sabroud's Dextrose Agar (SDA) plates for isolation of pure culture of soil isolates which were later identified microscopically[5,8].

Pathogenicity test was done according to Soomro and Zardari[5], Dey *et al.*[9]. In this method two rabbits were used as laboratory animals. One rabbit was shaved at different sites and the other one remained unshaved. Both rabbits were inoculated with the isolates at the marked distance and were left in a room for 2-3- weeks. These were examined daily for their food and physical environment and also the pathological changes during the incubation period of the dermatophytes.

RESULTS AND DISCUSSION

The present study has been done extensively in the various parts of the world to come across the studies and awareness of the soil borne human and animal pathogenic fungi causing more or less severe systemic and superficial infections in the tropical and subtropical areas of the world. In this presentation physical and chemical properties including pH, moisture content, organic

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Table 1: Determination of total values of the physical and chemical properties of the soil of taluka Rato Dero, District Larkana

	Total values of physical and chemical properties of the soil of taluka Dokri				
		Total percentage (%)			
Depth of Soil	pH	Moisture content	Organic matter	Nitrogen content	TDS
Surface	8.02	8.04	3.37	0.0010	1158.56
10 cm	7.95	7.96	3.41	0.0020	912.01
20 cm	7.99	7.99	3.42	0.0020	805.11

Table 2: Determination of total percentage of various fungal isolates of the soil samples of taluka Rato Dero, District Larkana

	Total percentage (%) of keratinophilic fungi					
Depth of soil	*Aspergillus flavus*	*Aspergillus wentii*	*Microsporum nanum*	*Trichophyton equinum*	*Botrytis cinera*	*Aspergillus candidus*
Surface	0.00	0.0	2.20	0.00	0.00	0.00
10 cm	20.00	16.0	13.35	13.35	13.15	13.35
20 cm	2.00	2.0	0.00	0.00	0.00	0.00

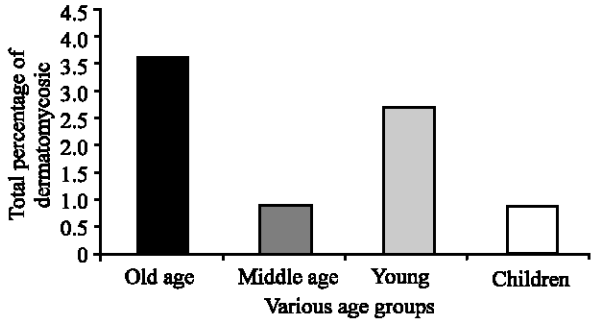

Fig. 1: Determination of total percentage of dermatomycosis in taluka Rato Dero

content, nitrogen content and Total Dissolved Salts (TDS) were undertaken of surface soil, 10 and 20 cm and six species belonging to four different genera were also isolated and tested for pathogenicity.

Present results while investigation of physical and chemical properties of various depths (surface, 10 and 20 cm) of soil at soil testing laboratories revealed pH 8.02, 7.95 and 7.99%, moisture content 8.04, 7.96 and 7.99%, organic matter 3.37, 3.41 and 3.42%, nitrogen content 0.0010, 0.0020 and 0.0020%, total dissolved salts 1158.56, 912.01 and 805.11%, respectively (Table 1).

Mycological investigations were carried out at Shah Abdul Latif University Khairpur, which revealed the total percentage of soil fungi in surface soil, 10 and 20 cm deep. Present results showed the highest percentage of *Aspergillus flavus* 0.00, 20 and 2% which is followed by *Aspergillus wentii* 0.00, 16 and 2%, *Microsporum nanum* 2.20, 13.35 and 0.00%, *Trichophyton equinum* 0.00, 13.35 and 0.00% and *Botyritis cinera* 0.00, 13.15 and 0.00%, *Aspergillus candidus* 0.00, 13.35 and 0.00% in surface soil, 10 and 20 cm deep soils, respectively (Table 2).

The pathogenicity test of all isolates revealed that, *Microsporum nanum* produced a large patch, white to brown in color with raised border, 2-3 cm in diameter at the shaved area of the rabbit and the *Trichophyton equinum* was also reported as pathogenic specie to cause mild type of hair infection with 5-7 cm, white patch of partially removed hairs after two weeks post incubation respectively in experimental animal. General survey of the occurrence of dermatomycosis, 4,1,3 and 1% cases were reported in old age (above 50), middle age (35-50), young (15-30) and children (0-14) years, respectively (Fig. 1).

District Larkana is consisting of seven talukas having a way of river Indus which passes through the taluka Rato Dero, Dokri and Larkana from the Eastern borders. It lies in north latitude 27-33 and east latitude 68-16 having the temperature range between 15-45°C (sometimes 48-51°C reported). Its fate of cultivation is the paddy (rice) crops, which require higher concentration of water and supports the optimum biological action required by the plants. Such cultivation is based on pH, moisture, organic matter and nitrogen content plus the total dissolved salts in soil. These environmental factors vary in soil from region to region and thus fluctuates the soil fertility, crop productivity and many biological activities, carried out by number of soil micro flora.

The pH influences on the availability of soil nutrients, solubility of toxic nutrient elements in soil, physical breakdown of root cells, cation exchange, capacity of soils whose clay/humus fraction for biological activity. The up and down of the pH range depends upon the available minerals/salts in the soil. e.g. sodium[10]. As for as District Larkana is concerned, the soil of this District is alkaline in pH i.e. above 7.0. The decomposition of organic residues will result in the formation of CO_2 that combines with water to form carbonic acid, which is also essential source of increased pH in soil. Use of fertilizers, presence of dissolved salts and less vegetation results the increased pH[11].

The fluctuation in moisture content in different talukas of Larkana district is due to the water holding

capacity of soils having different texture, structure and organic matter content, which may vary from less than 1 inch. The moisture content as recorded resulted due to fact that, water is used in transpiration, evaporation and precipitation (evapo-transpiration). Due to the excess of water provided to paddy crops in Larkana district affect the growth of many fungi resulting in in-adequate diffusion of oxygen required for aerobic metabolism and fungi being aerobic in nature require modest moisture content for the enzymatic activity and growth[12].

The total nitrogen content of soil is needed by heterotrophic soil microorganisms that decompose organic matter and for their rapid growth. In District Larkana there is very less concentration of nitrogen, which does not influence the growth of fungi, as required. The excess of nitrogen is converted to nitrous oxide by different bacterial actions, which in turn affect the keratinophilic fungi thus decreasing their soil activities and population. The soil microbes along with carbon and phosphorous require nitrogen source for their growth and physiological functions in the form of organic nitrogen, nitrates, nitrites, amino acids and peptides which release the nitrogen containing amino acids and utilize them as a nitrogen source[11].

Organic matter improves the fertility of soil which is obtained from remains of plant leaves and dead animal tissues. The variation in organic matter concentration in various depths of soil of District Larkana is due to the presence of various microorganisms including the bacteria, mould fungi, actinomycetes and various algae which are capable to decompose such organic matter for their cellular requirements and thus providing less availability in different depths (10 and 20 cm.) which create the microaerophilic conditions. The dissolved salts are directly proportional to pH. They are essential for cell physiology. The number of salts is dissolved in soil required by living organisms including calcium, magnesium, potassium, manganese etc. in varying concentrations. The fluctuation in dissolved salts is due to the absorbance by the plants, which are required for the growth and maintenance of crops. These dissolved salts reduce the bacterial as well as fungal growth beyond their optimum requirements by increasing the hypertonic conditions and less than minimum requirement affects the metabolic machinery resulting in the poor decomposition processes required for their growth and multiplication which results in the imbalanced growth thus reducing the number of keratinophilic fungi in soil[11]. Moreover, the variation in TDS in soils of District Larkana is due to soil texture, chemical composition, availability of water and the cultivation practices.

Our work reported the presence/occurrence of varying percentage of keratinophilic fungi in various talukas of District Larkana. It may be due to the variation in physical and chemical properties of soil. The soils, which are rich in organic matter, are rich sources of the occurrence of keratin loving fungi[13,14]. Soil is a home of all micro floras. The presence/occurrence of medically important keratinophilic fungi in the soils of various talukas of District Larkana. Majority of the fungi e.g. *Aspergillus* species are reported during the research work including the dermatophytes. This may be due to their habitat; as *Aspergillus flavus* and *Aspergillus wentii* is mainly found in tropical and subtropical, temperate regions. Their presence in the increased and decreased number in various depths of soils of various taluka is due to the growth in cultivated soil, tolerance to high salt concentration and also their occurrence in the rhizosphere and rhizoplane of wheat particularly after urea foliar sprays. Due to this their denitrification capability is enhanced which also promote the reduced osmotolerance activity in alkaline soils of various talukas of District Larkana.

The number (%) of *Aspergillus candidus* is lesser than the other Aspergilli. This is due to the greater distribution in un-cultivated soils, forests, lateritic soils, black clay and highly saline soil and also the hot season of District Larkana. They are potentially rapid grower in neutral and slightly alkaline habitats with strong competitive abilities at very low water potential. District Larkana is having preferentially the water holding land especially rice crop that's why that excess of water probably affects the growth and number of *Aspergillus candidus*

The dermatophytes comprise approximately 40 known species of three main genera viz., Trichophyton, Microsporum and Epidermophyton. They are common, ranging less than 10% of the world's population[15]. During this survey to various health units/laboratories, the highest percentage of *Microsporum nanum* and *Trichophyton equinum*. This may probably due to the fact that, all talukas of Larkana district have slight alkaline soil but the moisture, organic matter, nitrogen and total dissolved salts are variable from taluka to taluka. Since the dermatophytes require keratin which is organic compound in nature so they prefer to grow in the soils where the concentration of organic matter, nitrogen and TDS is little bit higher. These factors enable them to grow at varying depths in the arid and semi arid soils and also provide the maximum cellular growth.

Keratinophilic fungi and other geophilic dermatophytes of the class Deutermycotina (Fungi imperfecti) are known to be the human pathogens and also affecting higher animals.

During pathogenicity test the animal inoculation according to Deay *et al.*[9] it was observed that, the infection slowly developed in the experimental animal starting from one week and later the infected lesion became more severe after three weeks. Such infection resulted by *Microsporum nanum* which disseminated on the skin and give rise a large white patchy infection where as the *Trichophyton equinum* showed mild type of hair removal after 3 weeks. This may be due to the infection increased through the arthroconidia, which germinates proximal to the hair shaft through the external root sheath down the follicle and produce keratinase (a chymotrypsin-like) enzyme which is most active at an acidic pH[5]. General survey reported the less prevalence of the dermatomycosis. The highest range of infection in old aged and the youths is due to the less immune system, bare foot and carelessness in washing their hands and feet. Middle aged is bit careful in this regard. Majority of them were reported to wash their hands and feet after working in the lands. On the other hand children are less susceptible to this type of infection because they are less involved in cultivation practices, out side labour work and also their maintenance of personal hygiene.

Other mould fungi namely, *Aspergillus candidus* and *Aspergillus flavus* are reported as non-pathogenic to skin infections of the experimental animal but can cause various systemic infections of the human beings such as Aspergillosis of external ear, lungs through their disseminating spores and some of them cause serious ail ness through the secretions of their potent toxins. The pathogenicity of the pathogenic fungi may be due to some factors e.g. their growth at 37°C, production of proteolytic enzymes (during invasive and allergic diseases), production of elastase[15] .

Botyritis cinera is reported to grow in a wide range of host plants as parasite or saprophyte, having a little ability to disintegrates the keratin and cause infection in animals being having a geophilic nature.

REFERENCES

1. Batia, R. and R. Ichhpujani, 1994. Medical Mycology. In: Essentials of Medical Microbiology. Jaypee Brothers Medical Publishers, India, pp: 635-674.
2. Heinz, F.C., 1988. The Pathogenic Fungi. In: Medical Microbiology. 4th Edn. MacMillan Publishing Co. NY, pp: 341-347.
3. Chopra, H.L., 1985. Medical Mycology. In: The Text Book of Medical Microbiology 1st Ed. Seema Publications Delhi, pp: 714.
4. Robert, S.O.B. and D.W.R. Mackenzie, 1985. Text Book of Dermatology Vol I, Blackwell Scientific Publication, pp: 183-277.
5. Soomro, I.H. and M. Zardari, 1996. Isolation and Identification of pathogenicity of keratinophilic fungi from soils of District Khairpur Sindh Pakistan. M.Phil. Thesis, S.A.L. University, Khairpur.
6. Zardari, M., 1984. Autecological study in *Penicillium expansum*. Ph.D. Thesis, pp: 22.
7. Moor, P.D. and S.B. Chapman, 1986. Methods in in Plant Ecology. 2nd Edn. Blackwell Scientific Publication, London, pp: 291-292.
8. Soomro, I.H. and M. Zardari, H. Abro, S. Mangi, 1990. Isolation and Identification of dermatophytes and other keratinophilic fungi from the soil of Shah Abdul Latif University Khairpur Sindh Pakistan. Sci. Khyber, 3: 175-182.
9. Dey, N.C., T.K. Dey and D. Sinha, 1999. Animal Inoculation and Pathogenicity Test. In: Medical Bacteriology Including Medical Mycology and AIDS, 17th Ed. New Central Book Agency, Calcutta, pp: 114-118.
10. Rayon, J., E. George, A. Rashid, 1987. Soil and Plant Analysis Laboratory Manual. 2nd Edn., pp: 38-48.
11. Tisdale, S.L., W.L. Nelson and J. D. Beaton, 1985. Soil Fertility and Fertilizers. Macmillan Publishers NY., pp: 119.
12. Alexander, M., 1977. Introduction to Soil Microbiology. 2nd Ed. John Willey and Sons, NY., 56-57.
13. Randhawa, H.S. and R.S. Sandhu, 1965. A survey of soil inhibiting dermatophytes and other keratinophilic fungi of India. Sabouradia, 4: 71-79.
14. Rose, M., 1980. Investigation of keratinophilic fungi from soil in Western Australia. A preliminary survey. Mycopathologia, 72: 155-165.
15. Elias, J.A., R.M. Michael and A.P. Michael, 2003. *Aspergillus*. In: Clinical Mycology. Churchill Livingstone, pp: 273-296, 370-379.