$$y^t = f(t)$$

or,

$$y^t = \sum_{i=1}^{n-2} A_i \cdot e^{-B_i t}, \quad (1)$$

where y^t is the level of serum ferritin measured in ng/ml at time t, A_i and B_i are the reduction in serum ferritin level constants of the ith exponential term, which may be expressed in terms of the individual intercompartmental transfer rate constant and the degradation rate constant.

The results are shown in Figure 1, where we plot the level of serum ferritin versus time for patients taking DFP. Twenty patients were considered in the study. The present plot can be fitted to eq. (1), where $A_1 = 1400$ ng/ml, $A_2 = 2000$ ng/ml, $B_1 = 0.229$/month and $B_2 = 0.029$/month. Then it can be said that ferritin stays in two compartments in concentrations which are decreasing with time following the exponential law given by eq. (1). The initial decrease is due to the removal of that component of ferritin which is present in plasma and may have some particular nature. The delayed fall may be due to the removal of the intracellular component having a different nature, which comes out in a later phase of treatment.

1 McCaren, G D, *Curr Haematol Oncol*, 1988, **6**, 185.
2 Whitek, Mumro H N., *J. Biol. Chem*, 1988, **263**, 8938
3 Brittenham, G M, in *Haematology, Basic Principles and Practice* (ed Hoffman, R), Churchill Livingstone, New York, 1991, p 329
4 Weatherall, D J. and Clegg, J. B, *The Thalassaemia Syndrome*, Blackwell Scientific Publications, Oxford, 1981, 3rd edn
5 Agarwal, M B, *Indian J Paediatr*, 1993, **60**, 509–516

Received 24 March 1994, revised accepted 20 January 1995

Occurrence of superficial and cutaneous mycotic infections at Rourkela, Orissa

S. Das, P. Swain and B. K. Choudhury

Botany Research Laboratory, P G Department of Botany, Government College, Rourkela 769 004, India

From 250 clinically suspected cases of dermatomycoses, a mycological study was carried out on organisms causing superficial and cutaneous infections. The commonest cutaneous etiological agent detected to be prevalent at Rourkela was *Trichophyton rubrum* in 96 cases of patients. The superficial lesions were formed by the opportunistic fungus *Candida albicans*. The occurrence with respect to age, sex and period of year was also recorded.

TRICHOPHYTON, Microsporum and Epidermophyton generally attack integuments and their appendages like hairs and nails; they involve stratum corneum or deeper layers of the epidermis and hence are called dermatophytes. The superficial infections also occur in human beings due to other fungi, the most common of which are the species of *Candida*[1]. The *Candida* infection may be localized or widespread[2]. Superficial candidiasis may involve the epidermal and mucosal surfaces, including those of oral cavity, pharynx, oesophagus, stomach, intestines, urinary bladder and genital tract. These dermatomycoses are commonly seen in India due to the tropical climate and many other factors like hygiene and socioeconomic status. Greater population *drifts*, fast means of transport and tremendous advancement in industry and technology have resulted in certain pockets called urban areas. Under these circumstances, if these opportunistic fungi accidentally become pathogenic, they continue to spread freely.

In this paper, a detailed study of the incidence of superficial and cutaneous mycotic infections occurring at Rourkela, an industrially important town in Orissa, has been made. Also included were the frequency of occurrence of various species of mycoses and the correlation between the site of involvement and causative sites; and a survey of certain other predisposing factors was also made.

The samples were collected for a period of one year from the suspected patients who visited the Skin and Venereal Diseases Department of Ispat General Hospital, Rourkela. The scrapings were taken aseptically in sterile filter papers after applying 70% alcohol on the affected areas[3]. A part of the scrapings was mounted in 10% KOH and observed directly under the microscope to detect the occurrence of fungal elements (spores and hyphae). The remaining part of the materials was inoculated to Sabouraud's dextrose–agar media containing cycloheximide and chloramphenicol at 30°± 2°C. After an incubation period of 7 days, the fungal species were identified by studying macromorphology and micromorphology of the organisms. Also, some special tests like urease test, hair perforation test and chlamydospore formation tests were done using the appropriate media, depending on the suspected fungal organism. The identifications of the fungal organisms were further confirmed in the Mycology Division of the School of Tropical Medicine, Calcutta.

A record of the patients' habitat, age, sex and the presence of domesticated animals at home was also made.

Out of 250 cases of superficial dermatomycoses, a total number of 195 were observed to be culture-positive. Most of the cases were KOH-positive. Of these, 96, 84 and 15 collections were identified to be cases of dermatophytes, candidiasis and other fungal infections like *Aspergillus* and *Penicillium* (Table 1).

Table 1. The relation of clinical types to direct microscopic examination (KOH) and culture

Clinical types	Total no. of cases	Percentage	KOH-positive culture-negative	KOH-negative culture-positive	KOH-positive culture-positive	Total culture-positive
T. corporis	51	20 4	15	6	34	40
T cruiris	34	13 6	1	7	25	32
T. pedis	23	9 2	2	9	12	21
T menuum	16	6 4	3	3	11	14
T barbae	6	2 4	2	0	1	1
T unguium	5	2 0	2	0	2	2
T capitis	3	1 2	2	0	1	1
C intertrigo	74	29 6	11	19	38	57
C. paronychia	27	10 8	14	13	8	21
Mixed (C I + C P)*	11	4.4	8	2	4	6
Total	250	90 0	60	59	136	195

*C I *Candida intertrigo*
C P *Candida paronychia*

Table 2. Dermatophyte species isolated from different clinical types

Total (%)	Species	*T corporis*	*T. cruiris*	*T. pedis*	*T manuum*	*T barbae*	*T unouium*	*T. caoitis*	*Candida intertrigo*	*Candida paronychia*	Mixed
38 4	*Trichophyton rubrum*	36	29	18	12	–	1	–	–	–	–
33 6	*Candida albicans*	–	–	–	–	–	–	–	57	21	6
6	Other fungi *Aspergillus Penicillium*	4	3	3	2	1	1	1	–	–	–

Table 3. Age and sex relation in clinical types

Clinical types	Age in years						Sex	
	0–10	11–20	21–30	31–40	41–50	Above 50	Male	Female
T corporis	2	5	23	16	2	3	48	3
T cruiris	–	10	11	2	3	8	30	4
T pedis	–	1	6	13	2	1	3	–
T menuum	–	–	4	3	5	4	21	2
T barbae	–	–	1	3	2	–	6	–
T unguium	–	–	–	4	1	–	4	1
T capitis	2	1	–	–	–	–	10	6
C intertrigo	3	2	17	18	22	12	28	46
C paronychia	–	4	4	7	8	4	8	19
Mixed (C I. + C P)*	–	–	3	2	4	2	2	9

*C I *Candida intertrigo*
C P. *Candida paronychia*

For comparative purposes, the *t* test was performed yielding the following results. The calculated *t* value for the isolated *Tinea* and *Candida* samples was 1.856, for *Tinea* and mixed *Candida* infections it was 1.449, and for *Candida* and mixed *Candida* infections it was 0.306. It can hence be concluded that the former two results are significant at 10% level but in the case of *Candida* and mixed *Candida* samples it is not significant at all. The commonest clinical type among the dermatophytes were *Tinea corporis*, followed by *T. cruiris*, *T. pedis*, *T. manuum*, *T. barbae*, *Tiunguium* and *T. capitis*. Similarly, in candidiasis *Candida intertrigo* is followed by *C. paronychia* (Table 1).

The commonest etiological agent encountered was *Trichophyton rubrum*, followed by *Candida albicans*. The other fungi which were identified were *Aspergillus flavus*, *A. ficuum*, *A. niger* and *Penicillium* (Table 2). The male patients outnumbered females so far as dermatophytic infections are concerned and the reverse is true in the case of *Candidiasis* (Table 3). Also, there

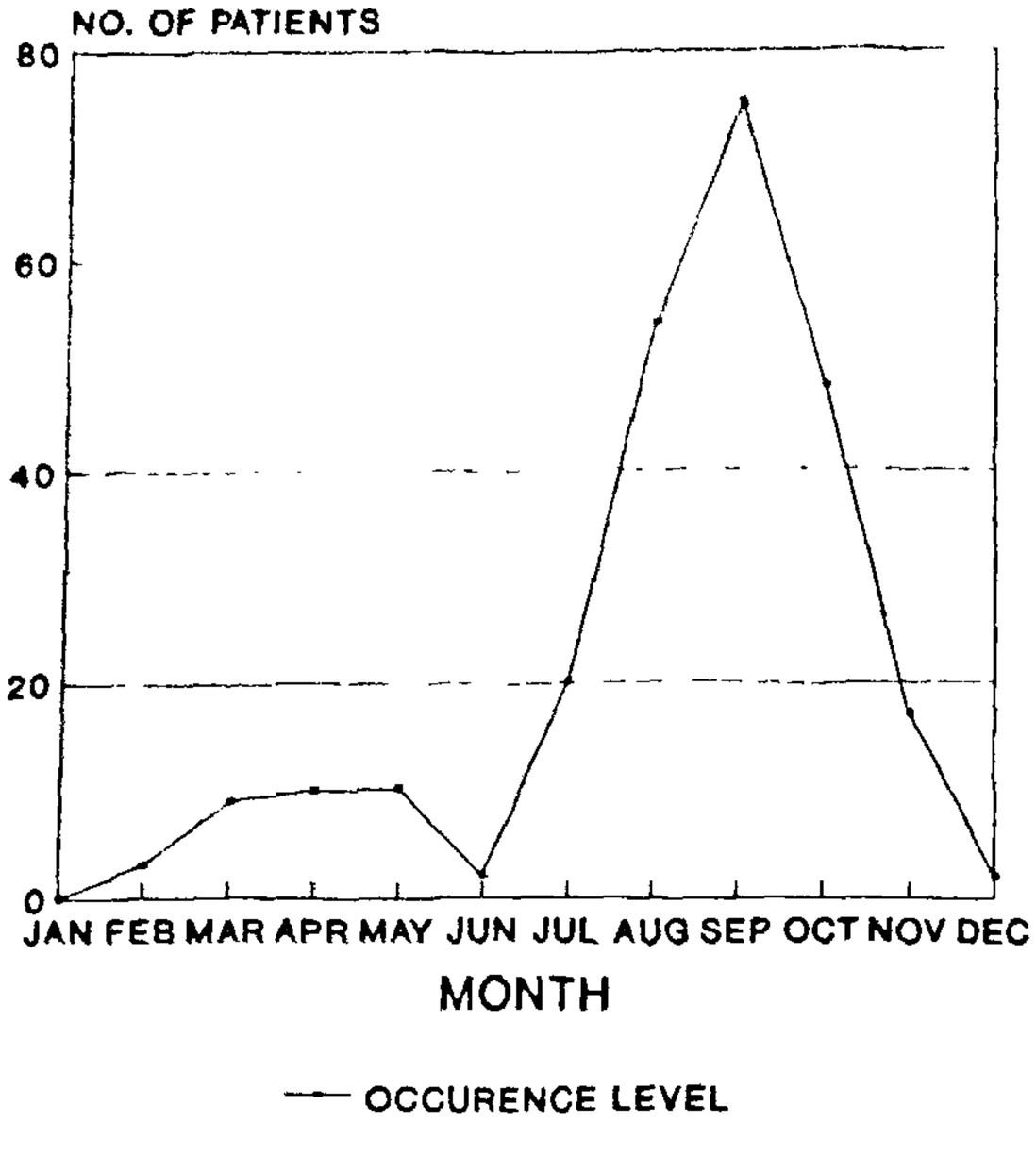

Figure 1. Superficial and cutaneous mycotic infections in the year 1993

was discernible fluctuation in the occurrence of the disease (Figure 1), depending on the climatic conditions like temperature and humidity.

It was observed that all the *Tinea* lesions were due to the fungus *T. rubrum* (Table 2), a predominantly anthropophilic dermatophyte[4,5]. This indicates that only *T. rubrum* causes dermatophytic infections at Rourkela. Incidence of dermatophytic infections in various regions of India has been studied by many workers[6–9] but they had observed other species of *Trichophyton*, *Microsporum* and *Epidermophyton* along with *T. rubrum*. A single species of dermatophyte may cause a variety of manifestations in different parts of the body. Dermatologists have employed terminology based on the part of the body involved. *Tinea corporis*, *T. cruiris*, *T. pedis*, *T. manuum*, *T. barbae*, *T. unguium* and *T. capitis* denote ringworm infection of the body, groin, face, hands, beard, nails and scalp, respectively. The results indicate that systemic ringworm infection of the body, i.e. *T. corporis*, is more prevalent at Rourkela. It may be a fact that since other forms of *Tinea* are restricted to only certain parts of the body, the patients might not have visited the hospital from where the data were collected.

Besides the clinical types of *C. intertrigo* and *C. paronychia*, some mixed infections of both were seen from the collected samples (Table 1). However, in all the cases the etiological agent determined was *C. albicans*. The lesions were observed in the epidermal and mucosal surfaces of the patients. It has been reported that *C. albicans* causes a variety of localized cutaneous candidiasis in healthy individuals to life-threatening systematic diseases in immunocompromised hosts[10]. Other species of *Candida* like *C. parapsilosis*, *C. tropicalis*, *C. stellatoides*, *C. guilliermodii*, *C. pseudotropicalis*, *C. glabrata*, *C. krusei* and *C. neylanoides* are saprophytic but cause infection very rarely[2].

It was further observed that patients in the age group of 11–20 to 31–40 years were more vulnerable to the dermatophytic infections and males outnumbered females in suffering from *T. rubrum* lesions (Table 3). This may be due to the greater mobility of these persons and the nature of their work. It predisposes healthy persons to such mycotic infections since the disease is a contagious one. Similar results were obtained by Khare[3]. However, it was observed that among patients in the age group of 20–40 years females outnumbered menfolk in having candidiasis infection. Candidal infection in the interdigital webs of the skin is seen most frequently following repeated prolonged immersion in water since most of the patients were housewives, cooks, vegetable and fish handlers and dairy workers[2,11]. But in the present study the complaint was found to be more in housewives; since the survey of other predisposed classes was out of the purview.

A study was undertaken for collecting samples from January 1993 to December 1993 and the frequency of fungal patients was found to be more in the month of September, which gradually decreased up to December (Figure 1). It may be due to the following reason. The Industrial town Rourkela experiences extreme weather conditions. The atmospheric temperature rises beyond 40°C during the summer months, i.e. from April to June and falls well below 20°C from the middle of November to the middle of March. However, the warm, humid conditions of the rainy season and temperatures above 30°C during the months of June to October help the appearance, growth and sporulation of the fungal disease, which reaches its peak durding the month of September. It has been observed that these organisms grow best at a temperature lower than the blood temperature[12].

1 Kobayashi, G S, *Disease Mechanisms of Fungi, Medical Microbiology* (ed Baron. S), Churchill Livingstone, New York, 1991, vol 3
2. Stewart, Wm D, *Symposis of Detmatology*, Julius L Danto Stuart Madden C. V. Mosby, Saint Louis, 1978, 2nd edn, p 445
3 Kite, J. H Jr, *Medical Microbiology* (eds. Milgram, F and Hanagar F H), Churchill Livingstone, New York, 1992, pp 748
4 Rippon, J W, *The Pathogenic Fungi and Pathogenic Actinomycetes, Medical Mycology*, 1982
5 Watanabe, S and Kudia, T., *Sabouraudia*, 1975, **B13**, 30–32
6 Kalra, S L., Mohapatra, L. N and Gugaani, H C, *Indian J Med Res*, 1964, **52**, 553

7 Mehta, J P , Dheodhar, K. P , Mehta, V. R and Chapekar, P. M , *Indian J Pathol Microbiol* , 1977, **20**, 23
8. Panda, G K., Mohanty, D , Mohanty, H C. and Nanda, C N , *Indian J Pathol. Bacteriol.*, 1967, **10**, 32
9 Murdia, P , *Indian J. Dermatol* , 1987, **32**, 5–11.
10 Datta, A , *Curr. Sci* , 1992, **62**, 400–404
11 Jawex, E , *Review of Medical Microbiology*, Melnick, J. W. and E A Adelbergy, Large Medical Publications, Los Altos, CA, 1978, vol 3, p 550.
12. Shukla, N P , Aggarwal, G. P and Gupta, D. K., *Indian J. Med Res* , 1984, **79**, 670
13 Khare, A K., *Indian J. Dermatol.*, 1983, **28**, 163

ACKNOWLEDGEMENTS. The scheme was supported by the Department of Environment and Forests, Government of India, and carried out in the Postgraduate Department of Botany, Govt College, Rourkela, Orissa The materials were collected from Ispat General Hospital, Rourkela, and identifications were confirmed at the School of Tropical Medicine, Calcutta, India.

Received 28 September 1994, revised accepted 1 February 1995

Studies on structure and organization of calcium carbonate deposits in algae

Vijaya Kerkar[†,*] and A. G. Untawale[§]

[†]Department of Botany, Goa University, Taleigao Plateau, Goa 403 203, India
[§]National Institute of Oceanography, Dona Paula, Goa 403 004, India

The structure and organization of calcium carbonate deposits is studied in species of *Halimeda*, *Udotea*, *Neomeris* (Chlorophyta) and *Padina* (Phaeophyta). It was found that in *Halimeda* aragonite deposition takes place outside the cell wall and in the intercellular spaces, while in *Udotea* aragonitic needles get arranged in layers parallel to the axis of filament within a sheath. In the case of *Neomeris*, crystallization takes place around the walls of sporangia. In *Padina*, aragonite crystals are randomly oriented on the surface of cells.

Almost all algal phyla have some genera which have the ability to accumulate various inorganic substances within or around the cell. However, the predominant mineral deposits of algae are either 'calcite' or 'aragonite'[1]. The way of lime deposition, and the type and amount of calcification vary from group to group and even from genus to genus[2]. A study of the structure and organization of calcium deposits is very much essential in the taxonomy of calcareous algae, which is possible by using SEM. Various studies have proved that this tool offers a great potential. Aragonitic deposition in the members of nemaliales and *Padina* is studied by Levy and Strauss[3]. McConnell and Colinvaux[4] studied the mineral components of Udoteacean forms.

*For correspondence

THE calcareous algae of India have been studied in the literature for their mineral deposits[5], but their structures and organization remain uninvestigated. In the present work an attempt is made to study the surface morphological features of some calcareous algae. The position, mode and orientation of aragonitic needles are studied in detail.

To study the structure and organization of calcium carbonate, species of *Helimed*, *Udotea* (Chlorophyta – Udoteaceae), *Neomeris* (Chlorophyta – Dasycladiaceae), *Padina cavonica* (Phaeophyta – Dictyotaceae) collected from Agatti, Lakshadweep Atoll (8°–12°13'N, 71–74°E) were dehydrated slowly through acetone grades. They were first coated with carbon and gold to avoid excessive charging, as suggested by Borowitzka *et al.*[2] The observations were carried out with camera CAMEBAX model 571 Probe Microanalyser.

Halimeda tuna, *H. opuntia* and *H. simulans* showed that needles of aragonite completely fill up the intercellular spaces of segments In *H. tuna* the crystals were 10 μm long and 0.3–0.6 μm in width (Figure 1 *a*), while in *H. simulans* and *H. opuntia*, mature crystals were of uniform size, about 0.08–0.3 μm wide and 4–4.5 μm long needles tapering slightly near the ends (Figure 1 *c*). The orientation of the crystals in all the three species appeared to be random. Deposition of these crystals was observed outside the cell wall but within the intercellular spaces (Figure 1 *b*).

In the case of *Udotea indica* and *U. flabellum* aragonite the needles were outside the cell wall but within the sheath. These needles were 0.07 × 0.4 μm in size and occurred in bundles (Figure 1 *d*). *Neomeris annulata* and *N. van-Bosseae* showed typical aragonite needles. Mature needles are 0.3–0.6 μm wide and 5–6 μm long in size (Figure 1 *e, f*). In both the species the orientation of the crystals was observed to be random. In younger parts of the thallus the crystals were found around the walls of sporangia (Figure 1 *g*). But in older parts of the thallus the intercellular spaces become filled with crystals.

Deposits in *Padina pavonica* showed aragonitic $CaCO_3$ outside the cell wall (Figure 1 *h*). Orientation of crystals was random (Figure 1 *i*). Needles were about 2–4 μm long and 0.3–0.4 μm wide. In the oldest part of thallus crystals lose their needle shape (Figure 1 *j*). These intercellular spaces are completely isolated from the external seawater by the outer layer of closely appressed utricles. The aragonite needles completely fill the intercellular spaces of the segment. Wilbur *et al.*[6] reported that in *H. monile* the needle-like crystals get formed in the fibrous material of the filament wall when the segments are 36–38 h old. Crystal formation seems to coincide with the development of chloroplast formation and with the fusion of the outer layer of filaments, which isolates the intercellular spaces from the outside[7,8]. According to Borowitzka[2], the process of calcification in the genus *Halimeda* may be a purely physical mechanism resulting from a combination of anatomical and physiological properties of this alga[2],