

INFECTIONS DUE TO TRICHOPHYTON RUBRUM

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Summary

Trichophyton rubrum is the most common dermatophyte encountered in our country. Infections due to *T. rubrum* are of a chronic and recurrent nature and do not respond satisfactorily to therapy. The clinical picture throughout the world shows a definite upward trend incidence of *T. rubrum* infections. This unique behaviour has led people to investigate the factors controlling host-parasite relationship and the finer mycological details of this fungus. The clinical, biochemical and histological studies reveal the superior invasive nature of *T. rubrum* as compared to the other dermatophytes. The role played by immunological factors also appear to be important and it is likely that we may find some of our answers here.

KEY WORDS: *Trichophyton rubrum*, Dermatomycoses

Among the dermatophytes, *Trichophyton rubrum* has undoubtedly attained notoriety. Isolated by Bang in 1910¹, *Trichophyton rubrum* in the course of time has emerged as the cause of the most stubborn of superficial mycotic skin infections. In general, *T. rubrum* infections are of a chronic nature, relatively asymptomatic and respond only slowly to therapy. The clinical picture is characterised by phases of waxing and waning, depending mainly on seasonal variations. The worldwide prevalence of *T. rubrum* and the nature of infections is a measure of the extreme adaptability of this fungus on human beings.

It is well known that *T. rubrum* has firmly entrenched itself as the chief

pathogen causing dermatomycoses in the Asian countries²⁻⁵. In the West, *T. rubrum* infections have been steadily rising during the past three decades and this has been attributed to global factors like the world wars and economic depressions, as well as poorly understood factors of host-parasite relationship^{6,9}. In short, the trend is a changing one where *T. rubrum* is gradually displacing the other dermatophytes and occupying a prominent place in dermatomycoses throughout the world. Certain salient observations which distinguish *T. rubrum* species are briefly highlighted.

1. *T. Rubrum* has an affinity for inhospitable and tough keratin like that of palms and soles as well as the hard keratin of the nail^{8,10}.

2. No age group is spared, infections having been reported in the very young and old^{4,11,13}.

3. *T. Rubrum* infections are highly communicable^{8,14,15} and outbreaks of

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infection occur in certain populations^{22,16}.

4. Comparative cultural analysis of specimens from microscopically positive and negative KOH preparations reveals the remarkable adaptability of *T. rubrum*¹⁷.

5. Defective immune states have been associated with recurrent *T. rubrum* infections^{18,20}.

Despite the few reports of isolation from animals^{21,22}, *T. rubrum* is essentially anthropophilic, and by virtue of the different strains it is a well adapted pathogen. Thus the 'downy strain'²³ which predominates in Europe is less virulent when compared to the 'granular' variety¹ which is widely prevalent in India. Strains resembling the 'granular' variant have been implicated in certain outbreaks¹² and this confirms the changing trend as pointed out earlier.

Unlike the typical clinical picture, associated with ringworm infection, that of *T. rubrum* infection of the skin show little tendency for central clearing¹⁷. Granulomatous and discoid lupus erythematosus like lesions of the skin due to *T. rubrum* are known and in certain diseases like pemphigus vulgaris, where immunity is impaired, deep granulomas in the groin have been described⁵. It has also been shown histologically that compared to other fungi *T. rubrum* occupies the deepest part of the nail plate^{24,25}. Experimental infections in cultured human skin have revealed the greater degree of invasiveness of *T. rubrum* as compared to *T. mentagrophytes* under similar conditions²⁶. The chronic nature of *T. rubrum* infections has resulted in lichenification and prurigo nodularis⁴ and on occasion even mycetomas²⁷. The problem is further aggravated by the lack of satisfactory response to oral griseofulvin, particularly

in cases of nail infection²⁸. The alarming incidence of griseofulvin resistance, which is of much higher degree in *T. rubrum* as compared to other dermatophytes²⁹ portends a gloomy picture for the future use of griseofulvin. Surprisingly, tinea capitis due to *T. rubrum* is uncommon, as against the readiness with which skin and nails are affected by this species. This may be due to the cuticular sheath which is said to protect the hair from keratinolytic enzymes³⁰. However, a more convincing reason is awaited. Variations in ethnic susceptibility is an interesting finding. *T. rubrum* peculiarly has a predilection for the skin of Asiatics^{31,32a&b} but susceptibility to *T. mentagrophytes* is higher than for *T. rubrum* in caucasoids, even when they reside in the Asian countries^{32,34}.

The unique behaviour of *T. rubrum* has intrigued many workers and several attempts have been made to study the factors predisposing to this infection. Increased glucose tolerance, disturbances of calcium metabolism and acrocyanosis have been suggested⁷, but none of these have proved convincing. Abnormal glucose tests have been reported in association with recurrent *T. rubrum* infections³⁵. A greater tolerance for hydroxyproline has been suggested as an explanation for the invasive nature of *T. rubrum*³⁶. Chemical analysis of material washed from the skin surface has not yielded sufficient information on the pattern of susceptibility³⁷. Though no significant correlation was drawn from a study of the fatty acid fractions of the three genera of dermatophytes³⁸, important differences in the reaction pattern between the antigens extracted from different species of dermatophytes and antisera raised in rabbits have been observed³⁹. The occurrence and metabolism of phospholipids in *T. rubrum* has been studied^{40,41}, but their role in pathogenicity has to be determined. Experimental studies have revealed

the presence of lipolytic enzymes⁴² and the occurrence of multiple proteases in *T. rubrum*⁴³. Using diverse isolates the proteolytic activity of *T. rubrum* towards egg albumen has been shown and the fungal extracts were seen to produce subepidermal splits when injected intradermally into excised human skin⁴⁴. Sophisticated techniques have revealed interesting differences between the cell walls of *T. rubrum* and *T. mentagrophytes*⁴⁵ and this aspect of the fungi has been recently reviewed⁴⁶.

Of late, studies in the immunology of dermatophytoses have attempted to explain the puzzling observation of negative trichophytin tests in cases of *T. rubrum* infections. A poor leucocyte migration was seen to correlate with a high incidence of immediate reaction to trichophytin skin test in *T. rubrum* infections⁴⁷ and those with recurrent attacks showed a uniformly low mitotic index⁴⁸. The multiple factors and their interplay in altering the immunological defenses have been discussed in detail⁴⁹ and the author has hypothesised the possible role of blocking antibodies which could effectively decrease the cellular immune response. Nevertheless, the last word on this has not been said and more sensitive and well designed studies will be more rewarding in future.

It is obvious from the above discussion that it is important to isolate the causal dermatophyte in cases of dermatophytoses. The causative agent has bearing on the treatment and the adoption of precautionary measures. *T. rubrum* infections have deceptive periods of quiescence and satisfactory results after treatment are measured by the absence of fungi on direct examination⁶⁰. Lack of sebaceous glands do not logically explain the affinity of *T. rubrum* for the the palms, soles and nails, as the other dermatophytes would also prefer similar

conditions. It is likely that at these sites, particularly on the nails, the fungus is practically safe from the immune system and the inhibitory serum factors. In addition, it is possible that certain inherent factors, the nature of which is as yet unclear, enable *T. rubrum* to compete and effectively occupy these sites, thus ensuring self preservation.

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