Antifungal Effect of Five Plant Extracts on the Variants of *Trichophyton rubrum*

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The synthetic drugs developed against dermatophytic infections caused by *Trichophyton rubrum* are not altogether free of side effects. The therapeutic measures sometimes become toxic to humans. With that in view, extracts from five plants, plentifully available in India, were tested under in vitro conditions upon the variants of *T. rubrum* causing cutaneous and superficial skin infections at Rourkela, Orissa, India. It was observed that oils of *Azadirachta indica*, *Pongamia glabra* and extracts from the rhizomes of *Curcuma longa* were highly effective in inhibiting the growth of the fungal variants in this part of the world. In this paper, the in vitro minimal inhibitory concentration of these plant extracts were determined against 4 variants of *T. rubrum*.

Key words : *Trichophyton rubrum* variants/Plant extracts/Antifungal activity.

The hot, humid conditions of the tropics provide an ideal environment for the development of superficial and cutaneous mycotic infections of the skin which are a fairly common dermatological problem in this area. Among several such mycoses, *Trichophyton rubrum* is predominantly anthropophilic (Kushida and Watanabe, 1975; Rippon, 1988). It has been determined by a survey (Das et al, 1995) that in Rourkela, Orissa, India, 4 variants of *T. rubrum* cause widespread dermatophytic skin ailments. Although drugs effective against such mycotic infections have already been developed, some plant extracts are of considerable interest because they are relatively free of side effects. The use of medicinal herbs in the treatment of infections is an age-old practice throughout the world (Irobi and Daramula, 1993). However, the knowledge of pharmacological properties and therapeutic value of plant extracts is still fragmentary (Caceres et al., 1993; Choumont and Burgeois, 1978; Garg and Muller, 1992; leven et al., 1979; Lemos et al., 1990; Mac Rea et al., 1988; Moore et al., 1977; Venugopal and Venugopal, 1994).

Out of 1230 patients who visited the Ispat General Hospital, Rourkela, Orissa, India, with superficial and cutaneous skin ailments, only 250 were suspected to be cases of dermatomycoses. Of these 96 cases were indentified to be dermatophytes due to the 4 variants of *T. rubrum*. The variants were classified as Downy, Dysgonic, Granular and a new variant was named here as A variant type.

Such cutaneous and superficial skin infections in were called tinea lesions. Depending on the site of infection this nomenclature varied as shown in Table 1. In this study, the minimal inhibitory concentration (MIC) of 5 natural plant extracts were determined against variants of *T. rubrum* in their most suitable growth medium, i.e., Sabouraud’s dextrose (SD) broth (the results should supplement the present knowledge on therapeutic methods for prevention of the disease).

The plant extracts were neem oil (*Azadirachta indica*, Juss), pongamia oil (*Pongamia glabra*, Vent), safflower oil (*Carthamus tinctorious*, Linn), mahul oil (*Madhuca indica*, J.f) and extract of turmeric (*Curcuma longa*, L). The oils were obtained from sponsored outlets of the Government of Orissa, India. The oils and extracts were tested for their antifungal effect on the in vitro growth of the variants of the organism at graded concentrations of 70, 140, 210,
TABLE 1. Number of *T. rubrum* isolates from different tinea lesions of 96 patients.*

<table>
<thead>
<tr>
<th>Species</th>
<th>Tinea corporis (glabrous skin)</th>
<th>Tinea cruris (groin)</th>
<th>Tinea pedis (foot)</th>
<th>Tinea manuum (palm)</th>
<th>Tinea barbae (beard)</th>
<th>Tinea unguium (nail)</th>
<th>Tinea capitis (scalp and hair)</th>
<th>Total no.</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Trichophyton rubrum</em></td>
<td>36</td>
<td>29</td>
<td>18</td>
<td>12</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
<td>96</td>
<td>38.4</td>
</tr>
<tr>
<td><em>Aspergillus</em> sp. and <em>Penicillium</em> sp.</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td>0.6</td>
</tr>
</tbody>
</table>

*Tinea stands for clinical name of the dermatophytic lesions.

*ND : Not Detected.

The oils of *A. indica*, *P. glabra*, *C. tinctorius*, *M. indica* and extract of *C. longa* rhizome exhibited in vitro fungistatic effects on the 4 variants of *T. rubrum* at various concentrations. Table 2 shows the MIC values of the plant extracts against the variants. Among the oils tested, *Azadirachta* and *Pongamia* oils were observed to have a strong effect in retarding in vitro growth. Some growth inhibition was detected at even 140 μg/ml and 210 μg/ml and complete inhibition of growth could be detected at 280 to 350 μg/ml. *Madhuca* and *Carthamus* oils did not produce a remarkable in vitro inhibitory effect on the fungal variants. Downy type was sensitive to the oils at as much as 500 μg/ml concentration at which no surface growth but very feeble traces of submerged growth was seen. In the case of other variants, growth retardation was observed at the concentration of 400 and 350 μg/ml of *Carthamus* and *Madhuca* oils, respectively. Complete inhibition of growth of Dysgonic, Granular and Avariant types by *Madhuca* oil was observed at 400, 450, 500 μg/ml, respectively, but such inhibition was seen at 500 μg/ml in the case of *Carthamus* oil. However *Curcuma* extracts had fungistatic effect on all four variants at 70 μg/ml and total inhibition of growth was noticed in all variants at 140 μg/ml. The determined MICs of the plant extracts were contrasted that of a well known antibiotic and antifungal agent is Clotrimazole (Maccura, 1993; Rippon, 1993). This antifungal agent is a patent drug which has used for mycological treatment in many cases including dermatophytes. Since the plant extracts used here are in a crude form in comparison to Clotrimazole, the variations in their respective MIC's were quite appreciable.

In spite of the tremendous advancement in the field of synthetic drugs in the present century, the adverse side effects of the drugs have prompted the investigators to probe the medicinal value of the plants which have been an important source of medicine from the beginning of the human civilisation. Since dermatophytes and humans are both eukaryotic, sometimes synthetic drugs used become toxic to the host (Dixon and Walsh, 1991). The essential oils extracted from plants of *Cinnamomum* sp., *Cymbopogon* sp., *Eugenia* sp., *Inula* sp., *Litsea* sp., *Mellissa* sp. and other plants and also some tea extracts had inhibiting effect against certain microorganisms and some of them were found to be effective even at low concentrations (Caceras et al; 1991; Girgune, 1978; Mishra et al; 1979; Okubo et al; 1991; Shukla and Shukla, 1992; Viollon and Choumont, 1994). A high growth-
retarding activity against some fungi as well as bacteria has been recorded in the oils extracted from the fruit of Coriandrum sativum, Foeniculum vulgare, Piper sp. (Rao and Nigam, 1976). Garg and Muller (1993) reported on the inhibition of the growth of dermatophytes by some Indian hair oils.

There are hundreds or thousands of plant materials which are used freely throughout India, particularly by people in rural areas, both knowingly and unknowingly, when such mycotic infections occur. The 5 plant extracts were specifically chosen here as it was determined by a survey that the native inhabitants in this part of the world use them when suffering from dermatophytic infections. The oils of A. indica and P. glabra had greater in vitro fungistatic activity than M. indica and C. tinctorius. The antimycotic properties of the latter two oils were observed here for the first time under the in vitro laboratory cultures. M. indica is indigenous to India and part of the natural vegetation in the tribal-dominated hilly areas of the Eastern India. C. tinctorius is also cultivated widely by tribal people in most parts of India. The oil of M. indica has emollient properties with high acidity which may inhibit the fungus at slightly higher concentrations. On the other hand, the component fatty acids in Carthamus oil are myristic, palmitic, stearic, arachidic, linoleic acids which, besides being used in culinary preparations, are also known for their medicinal value (Ambasta et al, 1986). A. indica oil is known to possess excellent entomopathic properties which seem to be largely based on the sesquiterpenoid, azadirachtin and nimbidin, etc., and the oil of P. glabra contains karanjin which contribute to its greater antimycotic properties. Venugopal and Venugopal (1994) found the ethanolic extract of neem leaves to be excellent inhibitors of Microsporum canis, M. audouinii, T. rubrum, T. mentagrophytes, T. violaceum, T. sirmii, U. verrucosum, T. souduanense and E. floccosom isolates at a concentration of 100 μg/ml. However, the use of A. indica oil under in vitro conditions here is new.

Further, the extracts from the rhizomes of C. longa, which contains phenolics and curcumins, showed greater fungistatic properties than the other oils tested against T. rubrum variants. Garg and Muller (1993) noted that the oils and extracts of Curcuma can be utilized against a broad of spectrum of pathogenic fungi.

Since the variants of the organism were determined to be anthropophilic, the efficacy of plant extracts could not be tested in vivo on human beings by inducing artificially created infections on them. Further more, in the in vitro MIC dosages of compounds could not be prescribed for use upon the lesions of people visiting hospitals due to obvious legal and ethical grounds. Hence, in vitro experimental results will, no doubt, stimulate in vivo tests to strengthen the assumptions regarding the therapeutic value of the plant extracts.

**ACKNOWLEDGMENTS**

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**REFERENCES**


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**TABLE 2.** MIC values of 5 plant extracts against in vitro growth of variants of T. rubrum.

<table>
<thead>
<tr>
<th>Variant of T. rubrum</th>
<th>MIC (μg/ml)</th>
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<tbody>
<tr>
<td></td>
<td>Azadirachta indica (oil)</td>
</tr>
<tr>
<td>Downy</td>
<td>140</td>
</tr>
<tr>
<td>Dysgonic</td>
<td>210</td>
</tr>
<tr>
<td>Granular</td>
<td>210</td>
</tr>
<tr>
<td>Avariant</td>
<td>140</td>
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vis a vis de sept champignons phytopathogens. 

Lloydia, 41, 437-441.


