

Original Research Article

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Antifungal Activity of *Solanum xanthocarpum* Sch and Wend and *Picrorhiza kurroa* Royle ex Benth against Some Clinical Dermatophytes

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ABSTRACT

Keywords

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Antifungal activity of fruit and root of *Solanum xanthocarpum* and rhizome of *Picrorhiza kurroa* were investigated against *Candida albicans*, *Candida tropicalis*, *Trichophyton rubrum*, *Penicillium marneffi* the clinical dermatophytic fungal isolates. The 5% and 10% alcoholic solvent extracts showed varied effectiveness when compared to the control. Among these, the extract of *S. xanthocarpum* fruit was found to be more effective in suppressing the dermatophytic fungi than other two viz, *S. xanthocarpum* root and rhizome of *P. kurroa*. However, 10% of all alcoholic solvent extracts were effective in inhibiting against the clinical fungal isolates.

Introduction

In India, Ayurveda system evolved over 5,000 years ago and is still in practice. The Rig Veda and Atharvana Veda have included more than 700 medicinal prescriptions (Mnimh, 1996). Others systems of medicine such as Chinese, Unani and Siddha traditions have their roots in Ayurveda. All the medicinal system is mostly based on the plant and its products that are available in Indian medicine. These have household remedies (Yadav and Kumar, 2003). The use of plants and its products has a long history that began with folk medicine and through the years it has

been incorporated into traditional and allopathic medicine (Dubey *et al.*, 2011).

The World Health Organization (WHO) estimated that about an 80% population of developing countries relies on traditional medicines, mostly plant drugs for their primary health care needs (WHO, 2008). Particularly in rural India, uses of raw plant products as well as some concoction of Ayurvedic medicines are sought after to a great proportion, because of cheap availability, and in urban areas too these are popular (Tuley *et al.*, 2009). Despite the

advent of modernism in medicinal system in the 21st century, poverty stricken and marginalized aborigine-folks (tribal's) of India, living in forest patches, particularly, are still practicing the art of the use of crude herbal products as medicines (Ignacimuthu *et al.*, 2008; Panda and Panda, 2008; Prasad *et al.*, 2008; Singh and Singh, 2009). In tribal- India, the clandestine knowledge of medicinal plants and their uses are transmitted down the generations, which sometimes, becomes a risky.

It has been estimated that in the Indian subcontinent, about 45,000 species of medicinal plants are used in tribal health care needs, and only about 1,500 plants are in use in Indian Ayurveda, Unani and Siddha System, largely for elite mass (Tuley *et al.*, 2009). Since antiquity, many plants species are reported to have pharmacological properties as they are known to possess various secondary metabolites like glycosides, saponins, flavonoids, steroids, tannins, alkaloids, terpenes which can therefore, be utilized to combat the disease causing pathogens (Kamali and Amir, 2010; Lalitha *et al.*, 2010; Hussain *et al.*, 2011).

Infectious diseases represent a critical problem to health and they are one of the main causes of morbidity and mortality worldwide (WHO, 1998). During the past several years, there has been an increasing incidence of fungal infections due to a growth in immunocompromised population such as organ transplant recipients, cancer and HIV/AIDS patients. This fact coupled with the resistance to antibiotics and with the toxicity during prolonged treatment with several antifungal drugs (Giordani *et al.*, 2001). This has been the reason for an extended search for newer drugs to treat opportunistic fungal infections in immunosuppressed patients (Fostel and Lartey, 2000).

Materials and Methods

Fresh disease free root and fruit of *S. xantocarpum*. Sch & Wend were collected in and around the Mysore district, Karanataka, India. They were washed thoroughly 2-3 times with running water and once with sterile water, and dried in shade. Rhizome of *P. kurroa*. Royle ex Benth was obtained from the Himalayan drug Company, Bangalore. The Taxonomic identification of these two plants species was determined at National Ayurved Dietetics Research Institute, Bangalore, Karanataka, India. (*S. xantocarpum* Sch & Wend. Voucher no. RRCBI-3721 and *P. kurroa* Royal ex Benth Voucher no. RRCBI/Mus-117). Both the plant materials were powered to 100-120 mesh in an apex grinder (Apex constructions, London) and stored in air tight bottles.

Test Microorganism

The clinical isolates viz., *Candida albicans*, *Candida tropicalis*, *Trichophyton rubrum*, *Penicillium marneffi* were obtained from Department of Microbiology, Mysore Medical College, Mysore. The fungal cultures were maintained on Seaboards Dextrose Agar (SDA).

Preparation of Solvent Extract

Twenty grams of the powered plant viz., fruit of *S. xantocarpum* was loaded in the thimble of Soxhlet apparatus. It was fitted with appropriate round bottom flask and the plant material was extracted with 150ml alcohol (Merck, Darmstadt) (Khan *et al.*, 1988). Constant heat was provided by Mantox heater for recycling the solvent. After complete extraction, the extract in the round bottom flask was transferred into sterile dry Petri plate and solvent was evaporated. The sediments was scrapped off, weighed and dissolved in Dimethyl sulfoxide (DMSO) solution and tested for

antifungal activity. The same procedure was adopted for the remaining plant materials i.e. root of *S. xanthocarpum* and rhizome of *P. kurroa*.

Antifungal Screening by Poisoned Food Technique

SDA was amended with the alcohol extracts (mother extracts) to make 5% and 10% concentrations. The solidified agar plates in triplicates were inoculated at the centre with 5 mm diameter mycelia disc of the pathogen viz., *C.albicans*, *C.tropicalis*, *T.rubrum*, and *P.marneffi*. The Petri plates were incubated at 27±1°C for seven days. The plates without extract served as control (Nene and Thapliyal, 1979). The colony diameter was measured and percent inhibition of radial growth was calculated by using the formula given by Vincent (1927).

$$I = \frac{C-T}{C} \times 100$$

Where, I-percent inhibition
 C-Colony diameter in control
 T- Colony diameter in treatment

Results and Discussion

Alcoholic extracts of the plants tested in the present study has shown the significant antifungal activity but the inhibition of the dermatophytic fungi is found to be varied with respect to the specific plant extract.

Ethanol Extract of *S. xanthocarpum* Root

5% extract showed 70% inhibition of

C.albicans followed by 32.14% of *C.tropicalis* and 25% of *P.marneffi* and *T.rubrum* showed least of 15.4% inhibition. Where as in 10% extract exhibited maximum inhibition of *C.albicans* by 75% and moderately *C.tropicalis*, *T.rubrum* and least with *P.marneffi* by 46.4%, 46.2% and 33.3% respectively. Table (1), Fig 1.

Ethanol Extract of *S. xanthocarpum* Fruit

5% extract inhibited *C.albicans* by 72.5% moderately inhibited *P.marneffi* by 41.66% and least inhibition was observed in *T.rubrum* and *C.tropicalis* by 38.46% and 28.7% respectively. However in 10% solvent extract, highest inhibition was observed in *C.albicans* of 80%. Moderate inhibition of *C.tropicalis* by 46.4% and minimum inhibition of *T.rubrum* and *P.marneffi* by 46.15 and 45.8% respectively. Table (2), Fig 2

Ethanol Extract *P. kurroa* Rhizome

5% rhizome solvent extract has shown highest inhibition of *C.albicans* by 65% followed by *T.rubrum* 23% and least was seen in *C.tropicalis* and *P.marneffi* by 21.4% and 20.8% respectively. However in 10% highest, inhibition was observed in *C.albicans* by 72.5% followed by *P.marneffi* 50% and minimum in *C.tropicalis* and *T.rubrum* by 46.4% and 38.46% respectively. Table(3), Fig 3.

Table.1 Growth of Mycelium (in millimeter) of Alcoholic Solvent Extracts of *S. xanthocarpum* Root against the Test Fungal Organism by Poisoned Food Technique

Fungal Isolates	<i>S. xanthocarpum</i> root alcoholic extract		
	Control	5%	10%
<i>C.albicans</i>	40	12mm	10mm
<i>C.tropicalis</i>	28mm	19mm	15mm
<i>T.rubrum</i>	13	11mm	7mm
<i>P.marneffi</i>	24	18mm	16mm

Table.2 Growth of Mycelium (in millimeter) of Alcoholic Solvent Extracts of *S. xantocarpum* Fruit against the Test Fungal Organism by Poisoned Food Technique

Fungal Isolates	<i>S. xantocarpum</i> fruit alcoholic extract		
	Control	5%	10%
<i>C.albicans</i>	40	11mm	8mm
<i>C.tropicalis</i>	28mm	20mm	15mm
<i>T.rubrum</i>	13	8mm	7mm
<i>P.marneffi</i>	24	14mm	13mm

Table.3 Growth of Mycelium (in millimeter) of Alcoholic Solvent Extract of *P. kurroa* against the Test Fungal Organism by Poisoned Food Technique

Fungal Isolates	<i>P. kurroa</i> alcoholic extract		
	Control	5%	10%
<i>C.albicans</i>	40	14mm	11mm
<i>C.tropicalis</i>	28mm	18mm	15mm
<i>T.rubrum</i>	13	10mm	8mm
<i>P.marneffi</i>	24	19mm	12mm

Fig.1a Antifungal Activity of *S. xantocarpum* Root

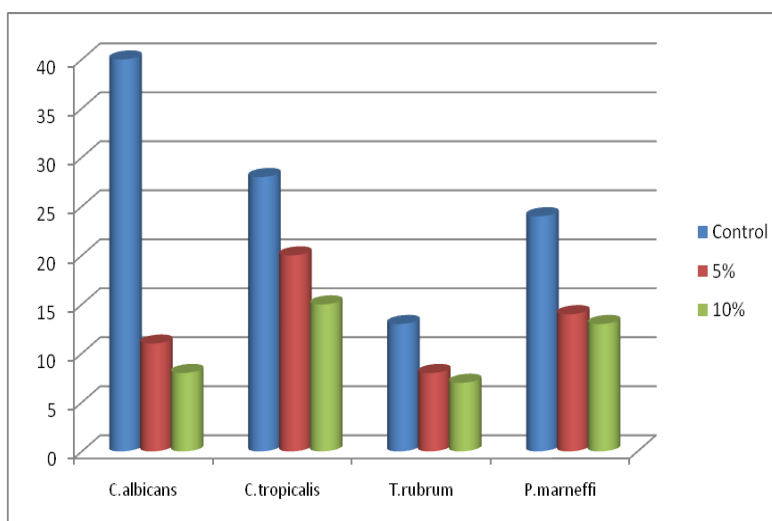


Fig.1b Antifungal Activity of *S. xanthocarpum* Root at 5% and 10% Alcoholic Extract

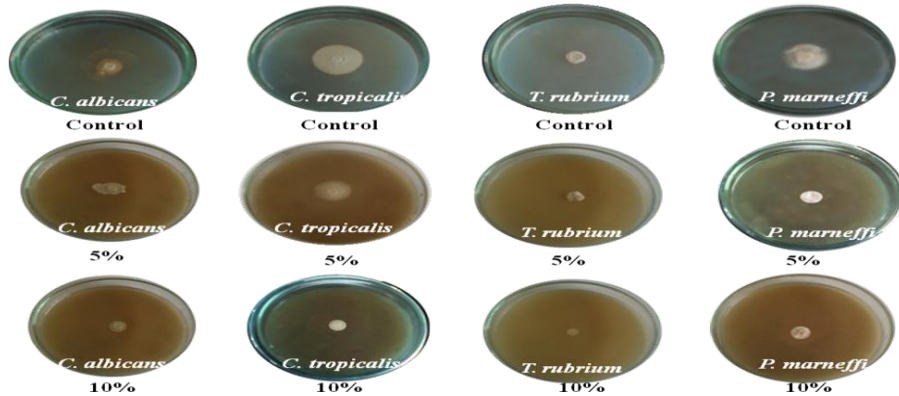


Fig.2a Antifungal Activity of *S. xanthocarpum* Fruit

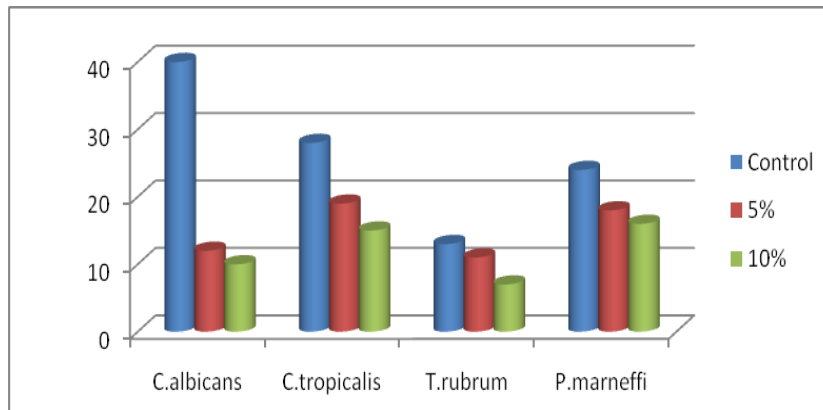


Fig.2b Antifungal Activity of *S. xanthocarpum* Fruit at 5% and 10% Alcoholic Extract

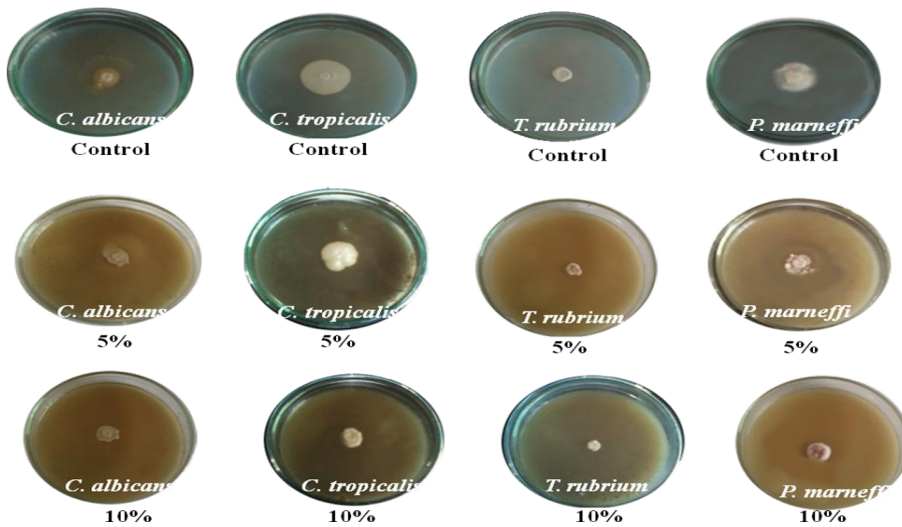


Fig.3a Antifungal Activity of *P. kurroa*

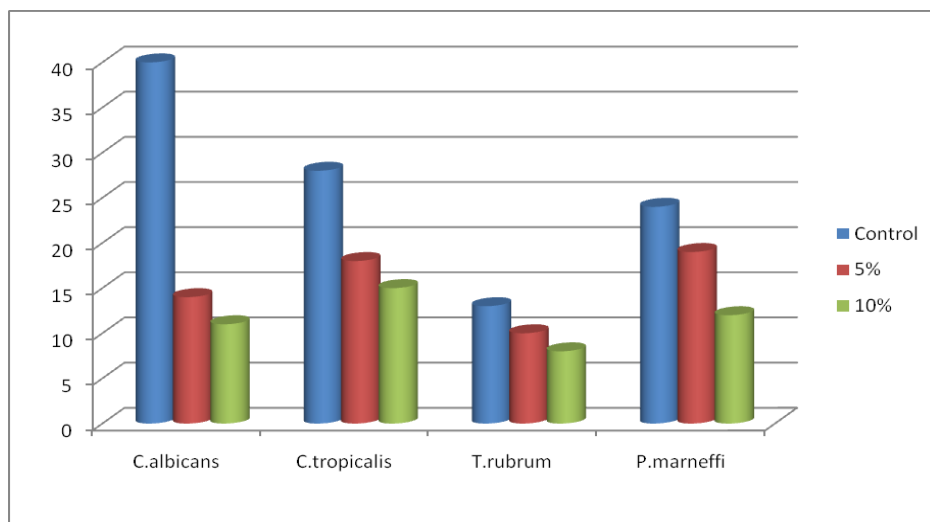
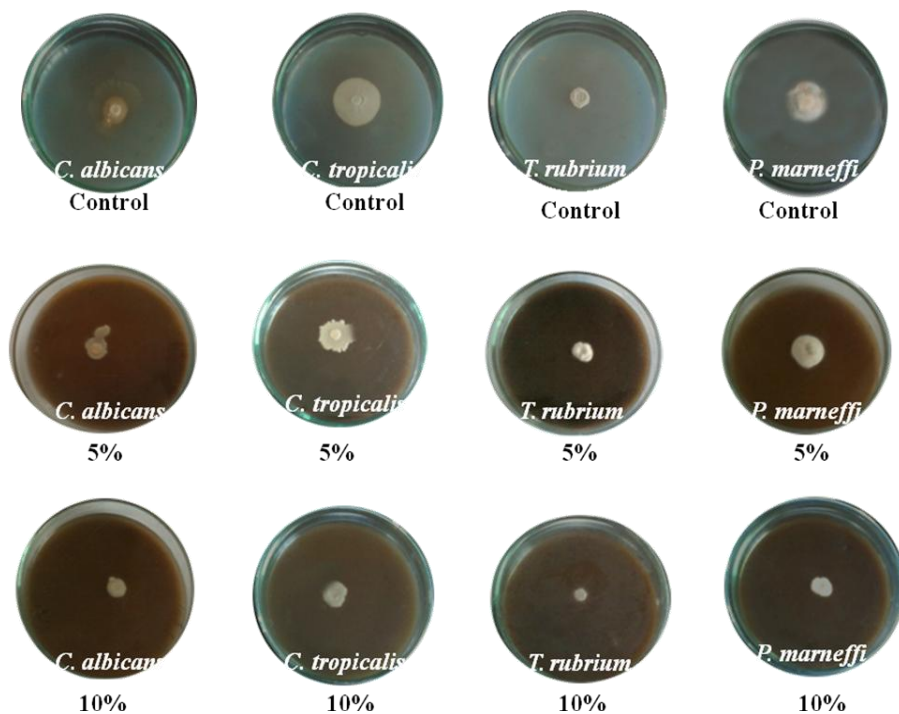


Fig.3b Antifungal Activity of *P. kurroa* Rhizome at 5 and 10% Alcoholic Extract



S. xantocarpum is an herb used in Indian medicinal system which is known to have repellent and antipyretic property. The dry fruit of *S. xantocarpum* contains isochlorogenic, neochromogenic, chromogenicaffic and acid (source: WWW.

Herbalscure india. Com/ herbs/ solanum). The other plants part contains coumarins, scopoletin, scoplin, scopoletin, esculin and esculetin. The chemical component lupeol, solamargine, apigenine (Chaturvedi *et al.*, 2008., Siddiqui *et al.*, 2008., Kuo *et al.*,

2000) are known to have anticancer property. The fruit extract has antifungal activity against *Alternaria sps*, *Aspergillus sps*, *Trichoderma sps* (Guleriaa *et al*, 2010; Singh *et al*, 2007; Dabur *et al*, 2004). Research related to the antifungal activity of the fruit and root against of *S. xantocarpum* many fungi namely *Alternaria*, *Aspergillus spp* and *Trichoderma* has been carried out by researchers and were successful in estimating the antifungal activity (Salar and Suchitra, 2009). In our study the alcoholic extract of *S. xantocarpum* fruit has exhibited the maximum inhibition of *C. albicans* (80%), *C. tropicalis* (46.4%), *T.rubrum* (48.15%), and *P.marneffi* (45.8%). Alcoholic root extract (10%) of *S. xantocarpum* effective in inhibiting the dermatophytic clinical fungal isolates namely *C. albicans* by 75% followed by *C. tropicalis* (46.4%), *T.rubrum* (46.2%) and *P.marneffi* (33.3%).

Previous studies of antifungal activity of *P. kurroa* has been demonstrated against *A. niger* and *C. albicans* by was tested by Mandloi *et al.*, (2010) and Tiwari *et al.*, (2011) and found that it plays a significant role in suppressing the fungi. According to the earlier reports that *P. kurroa* has a phenolic compound which may act as antifungal agent (Kokubun and Harborne., 1995; Aoyama *et al.*, 1997). Similarly 10% alcoholic extract has exhibited 72.5% inhibition of clinical isolates of *C. albicans*. This was followed by *P.marneffi* (50%), *C. tropicalis* (46.4%) and *T.rubrum* (38.46%).

In conclusion, *C. albicans* has showed susceptibility to the plant extracts compared to *C. tropicalis*, *T.rubrum* and *P.marneffi* tested. In the present study the alcoholic extract of *S. xantocarpum* fruit has shown 80% inhibition at 10% concentration indicates the effectiveness of the extract against the pathogen. All the other fungi

have showed varied inhibition percentages against the plant extract. Comparatively, 10% of the extracts have shown inhibition than 5% extracts.

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