Antifungal activity of ethanolic extract of *Sphaeranthus indicus* Linn. against Dermatophytes and Candida species

Preeja K. Sundaresan¹*, Kala P. Kesavan²

¹Department of Pharmacology, Government Medical College, Thiruvananthapuram, Kerala, India
²Department of Pharmacology, Government Medical College, Aleppey, Kerala, India

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*Correspondence:
Dr. Preeja K. Sundaresan,
Email: drpreeja79@rediffmail.com

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ABSTRACT

**Background:** *Sphaeranthus indicus* as an entire plant or the specific parts like roots, leaves, flowers are used for treating helminthiasis, jaundice, diabetes, dyspepsia, fever, cough, hernia, gastritis, hemorrhoids, migraine, leprosy and skin diseases. The objective of this study was to evaluate the antifungal activity of ethanolic extract of the whole plant *Sphaeranthus indicus* Linn.

**Methods:** The antifungal activity of ethanolic extract of the whole plant *Sphaeranthus indicus* Linn was evaluated by incorporating the extract in Sabourauds dextrose agar. This property was studied in vitro using the ethanolic extract on *Candida albicans*, *Microsporum gypseum*, *Trichophyton mentagrophytes* and *Epidermophyton floccosum* by using Clotrimazole as standard drug.

**Results:** This study revealed that the ethanolic extract of *Sphaeranthus indicus* is having good antifungal activity against Dermatophytes and Candida species.

**Conclusions:** This study demonstrates the promising antifungal action of ethanolic extract of whole plant of *Sphaeranthus indicus* Linn. This feature can be exploited in the development of a newer antifungal agent from plant.

**Keywords:** *Sphaeranthus indicus* Linn, *Candida albicans*, *Microsporum gypseum*, *Trichophyton mentagrophytes*, *Epidermophyton floccosum*, antifungal action

INTRODUCTION

Infections induced by pathogenic fungi are increasingly recognized as an emerging threat to public health.¹,² The epidemiological data point out that that the prevalence and incidence of fungal infection is a major public health issue. The increase in occurrence of fungal infections during recent years is due to a growth in the immune compromised population, such as organ transplant recipients and cancer and HIV patients.³ Antifungal agents are being widely used and this had resulted in the rapid development of resistance to these class of drugs. Certain commensal fungi, such as Candida species, cause infections when their human hosts become immune compromised.⁴ These problems are also associated with resistance to antibiotics and toxicity during prolonged treatment with several antifungal drugs.⁵ In several researches, extracts of various plants have been reported to exhibit antifungal properties under *in vitro* laboratory trials.⁶-¹⁰ It has been pointed out that there is a relationship between the antifungal activity of the extracts and its bioactive compounds.¹¹ *Sphaeranthus indicus* Linn is a herb commonly known as Mundi, 30 cm or 1 foot high with spreading branches, found all over the Indian plains, especially in hills, as weed in the rice-fields. All parts of the plant are used as medicine.¹² This study was done to evaluate the antifungal properties of ethanolic extract of whole plant *S. indicus*. 
METHODS

Plant collection

*Sphaeranthicus indicus* as a whole plant was collected locally in January from Thiruvananthapuram district, Kerala, India and it was authenticated by the pharmacognosy unit in Ayurveda Research Institute, Poojappura, located in Thiruvananthapuram, Kerala, India. It was cleaned with distilled water. They were cut into small pieces, shade dried and ground to coarse powder form in an electric blender.

Preparation of ethanolic extract

Petroleum ether was used for pre extraction in order to defatten the material. After that soxhlet extraction was done using 90% ethanol. In the next step, the extract was distilled and then dried up in a previously weighed beaker for getting rid of the solvent. The filtration was done using Whatman No.1 filter paper. For further use they were stored at 4°C. The ethanolic extract was prepared in three serial concentrations so that the effective concentration was 5 mg/ml, 10 mg/ml and 15 mg/ml, based on a previous study.13

Antifungal strains

*Candida albicans*, *Microsporum gypseum*, *Trichophyton mentagrophytes* and *Epidermophyton floccosum* were the antifungal strains obtained from the microbiology department of Government medical college, located in Thiruvananthapuram, Kerala, India.

In vitro antifungal activity

The ethanolic extract of whole plant of *S. indicus* was incorporated in sabourauds dextrose agar (SDA) and in vitro antifungal activity was studied in *C. albicans*, *M. gypseum*, *T. mentagrophytes* and *E. floccosum*. The SDA medium was sterilised by autoclaving at 121°C for 15 minutes. To 5 ml of molten medium in test tubes, the extract was added in serial concentrations so that the concentration was 5 mg, 10 mg and 15 mg/ml of the medium and allowed to slant. Clotrimazole 100 mcg/ml which showed scanty growth. Test tubes containing dimethyl formamide (DMF), the vehicle and sabourauds dextrose agar (SDA), the culture media which acted as controls showed profound growth of the fungi at the end of 4 weeks.

RESULTS

The antifungal activity was done in test tubes for greater ease of performance, reproducibility and convenience. The rate of growth of fungi could not be measured quantitatively or in terms of zone of inhibition. Hence at the end of 4 weeks as shown in the figures the experimental observation of absence of growth, or presence of growth was recorded.

As evident from (Figure 1 to 4) and as summarized in (Table 1), the study revealed that the ethanolic extract of *S. indicus* showed inhibition of growth of Dermatophytes and Candida strains in the three doses tested at the end of four weeks. As shown in figures, there was no growth of *C. albicans*, *M. gypseum*, *E. floccosum* and *T. mentagrophytes* in the test tubes with serial dilutions of extract 5 mg/ml, 10 mg/ml and 15 mg/ml as compared to clotrimazole 100 mcg/ml which showed scanty growth. Test tubes containing dimethyl formamide (DMF), the vehicle and sabourauds dextrose agar (SDA), the culture media which acted as controls showed profound growth of the fungi at the end of 4 weeks.

**Figure 1:** Effect of *S. indicus* on the growth of *C. albicans* in SDA medium compared with clotrimazole.

**Figure 2:** Effect of *S. indicus* on the growth of *M. gypseum* in SDA medium compared with clotrimazole.

**Figure 3:** Effect of *S. indicus* on the growth of *E. floccosum* in SDA medium compared with clotrimazole.
Table 1: Effect of S. indicus on the growth of fungus in SDA medium compared with clotrimazole.

| Fungal strain     | Extract 5 mg/ml | Extract 10 mg/ml | Extract 15 mg/ml | Clotrimazole 100 mcg/ml | Dimethyl Formamide | Control |
|-------------------|-----------------|------------------|------------------|-------------------------|--------------------|---------|
| C. albicans       | -               | -                | +                | +                       | +                  | +       |
| M. gypseum        | -               | -                | +                | +                       | +                  | +       |
| E. floccosum      | -               | -                | +                | +                       | +                  | +       |
| T. mentagrophytes | -               | -                | +                | +                       | +                  | +       |

Figure 4: Effect of S. indicus on the growth of T. mentagrophytes in SDA medium compared with clotrimazole.

DISCUSSION

This study can be used to justify the use of S. indicus in traditional practice as a therapeutic agent as it exhibited significant antifungal properties causing inhibition of growth Candida and Dermatophytes. The antifungal properties may be due to tannins and saponins.

Hexane extract of S. indicus flowers possessed antifungal activity against C. albicans. The flower extract showed minimum inhibitory concentration (MIC) at 0.15 mg/ml and aerial parts showed MIC at 1.25 mg/ml against C. albicans and it is the first report on antifungal activity of S. indicus per the available literature. The antifungal activity against T. mentagrophytes and E. floccosum was reported in thiophene compound isolated from Tagetes patula (Asteraceae). Antifungal activity was also reported for the ethanol extract of underground parts of Leueca carthamoides (Asteraceae) and Centaurea hermanni (Asteraceae) against C. albicans, A. fumigatus.

Juice of Garcinia mangostana contains polyphenolic compound such as flavonoid and tannin. It also contains α-mangostin compounds which are proven to have potential antifungal and antibacterial activity. Xanthone is the major compound of G. mangostana showed high antifungal activity (against C. albicans and Aspergillus niger). In a study evaluating the antifungal activity of pomegranate peel extracts (PPE) and application of PPE aerosol as sanitizer agent against exhibited potent antifungal activity against C. albicans strains compared with standard fungicides in both susceptibility techniques used. Methanol, ethanol and water extracts were the most effective for inhibiting C. albicans growth. PPE aerosol was an efficient method for complete sanitizing of semi-closed places against C. albicans growth.

Limitations

Since the study was a quantitative one and done in test tube we could not measure the zone of inhibition and hence statistical evaluation could not done. More studies need to be conducted with disc diffusion method for the tested fungal species. We did not identify the active principle. However, to obtain a novel drug chemical nature of active principle should be isolated and standardized and tested in more species of fungi.

CONCLUSION

S. indicus whole plant ethanolic extract can be used as a potential antifungal agent against Dermatophytes and Candida species. As whole plant was used, various phytochemicals could probably have contributed to antifungal activity. There is paucity of scientific data about the mechanism of action of the extracts. So further studies should be done to find out the molecular actions as well as pre clinical studies done to establish antifungal action of S. indicus extracts. The results of this study give a scientific proof for the traditional use of S. indicus against common fungal pathogens. This study reveals that the ethanolic extracts can be used as a potential lead to discover newer antifungal agents.

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REFERENCES

1. Wu TC. On the development of antifungal agents: perspective of the US Food and Drug Administration. Clin Infect Dis. 1994;19:554-8.
2. Walsh TJ, Gonzalez C, Lyman CA, Chanock SJ, Pizzo PA. Invasive fungal infections in children:
recent advances in diagnosis and treatment. Adv Pediatr Infect Dis. 1996;11:187-290.

3. Portillo A, Vila R, Freixa B, Ferro E, Parello T, Casanova J, et al. Phenylethanoid glycosides from Cistanches salsa inhibit apoptosis induced by 1-methyl-4-phenylpyridinium ion in neurons. J Ethnopharmacol. 2005;97:49.

4. Cannon RD, Holmes AR, Mason AB, Monk BC. Oral candida: clearance, colonization or candidiasis?. J Dent Res. 1995;74:1152-61.

5. Giordani R, Trebaux J, Masi M, Regli P. Enhanced antifungal activity of ketoconazole by Euphorbia characias latex against Candida albicans. J Ethnopharmacol. 2001;78:1-5.

6. Terzi V, Morcia C, Faccioli P, Valè G, Tacconi G, Malnati M. In vitro antifungal activity of the tea tree (Melaleuca alternifolia) essential oil and its major components against plant pathogens, Letters in Applied Microbiology. 2007;44(6):613-8.

7. Parekh J, Chanda S. Evaluation of antibacterial activity and phytochemical analysis of Bauhinia variegata L. bark. Afr J Biomed Res. 2006;9(1):53-6.

8. Afolayan AJ, Afolarin AO. Antimicrobial activity of Solanum tomentosum. African J of Biomed Res. 2006;5(4):369-72.

9. Buwa LV, Staden JV. Antibacterial and antifungal activity of traditional medicinal plants used against venereal diseases in South Africa. J Ethnopharmacol. 2006;103(1):139-42.

10. Ergene A, Guler P, Tan S, Mirici S, Hamzaoglu E, Duran A. Antibacterial and antifungal activity of Heracleum spondylium subsp. Artvinense. African J Biomed Res. 2006;5(11):1087-9.

11. Abdelghani SB, Weaver L, Zidan ZH, Hussein MA, Keevil CW, Brown RCD. Microwave-assisted synthesis and antimicrobial activities of flavonoid derivatives. Bioorganic & Medicinal Chemistry Letters. 2008;18:518-22.

12. Duraipandiyiyan V, Kannan P, Ignacimuthu S. Antimicrobial activity of Sphaeranthus indicus. Ethnobotanical Leaflets. 2009;13:320-5.

13. Farahmand S, Rasooli A, Saffarpour M. Antifungal activities of methanolic extract of plants. Electronic Journal of Biology. 2016;S1:42-4.

14. Romagnoli C, Mares D, Sacchetti G, Bruni A. The photodynamic effect of 5-(4-hydroxy-l-butylnyl)-2,2'-bithienyl on dermatophytes. Mycol Res. 1998;102:1519-24.

15. Chobot V, Buchta V, Jahodarova H, Pour M, Opletal L, Jahodar L, Harant P. Antifungal activity of a thiophene polynie from Leuzea carthamoides. Fitoterapia. 2003;74:288-90.

16. Sur-Altiner D, Gurkan E, Sarioglu I, Tuzlaci E, Ang O. The antibacterial and antifungal effects of Centaurea hermannii. Fitoterapia. 1997;68:374.

17. Izzati NN, Diniatik D, Rahayu WS. Aktivitas antioksidan ekstrak perasan daun manggis (G. mangostana) berdasarkan metode DPPH (2,2-Diphenyl-1-phycryl hydrazil). Pharmacy. 2012;9:111-21.

18. Ibrahim MY, Hashim NM, Mariod AA, Mohan S, Abdulla MA, Abdelwahab SI, et al. α-Mangostin from G. mangostana Inn: An updated review of its pharmacological properties. Arab J Chem. 2016;9:317-29.

19. Narasimhan S, Maheshwaran S, Abu-yousef IA, Majdalawieh AF, Rethavathi J, Das PE, et al. Anti-bacterial and anti-fungal activity of xanthones obtained via semi-synthetic modification of α-mangostin from Garcinia mangostana. Molecules. 2017;22:E275.

20. Tayel AA, El-Tras WF. Anticandidal activity of pomegranate peel extract aerosol as an applicable sanitizing method. Mycoses. 2010;53(2):117-22.

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