Antimicrobial activity of Striga hermonthica

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ABSTRACT

Crude extracts from different morphological parts of Striga hermonthica (Scrophulariaceae) were prepared and screened for antimicrobial activities. For antibacterial activity, the extracts are tested against the growth of Gram positive (Bacillus subtilis and Staphylococcus aureus) and Gram negative (Pseudomonas aeruginosa and Escherichia coli) bacteria. For antifungal activity, the extracts are tested against Aspergillus niger, A.flavus and Candida albicans. Most of the extracts showed good antibacterial activity against the growth of Gram positive bacteria, and some of them exhibited positive antibacterial activity against the growth of Gram positive as well as Gram negative bacteria; at concentrations of 1-5 mg/ml extract. This as compared with 4 mg/ml Ampicillin or Neomycin. The petroleum ether extracts were found to be devoid of any antibacterial activity. The methanol and ethyl acetate extracts of the flowers showed a fungicidal activity against cultures of A. niger and A. flavus at concentration 1 mg/ml. With C. albicans, the same extracts showed a fungistatic and fungicidal activity at concentrations 1 mg/ml and 5 mg/ml, respectively. This as compared with 3-5 mg/ml Ketoconazole.

KEYWORDS

Striga hermonthica; Extracts; Antibacterial; Antifungal activity.

INTRODUCTION

In the last few years, the antimicrobial properties of plants have been investigated by a number of researchers world wide.

Striga hermonthica (Del.) Benth. (Scrophulariaceae) is an obligate parasite which attacks the roots of a wide range of field cereal crops. It is widely distributed in tropical and subtropical regions. In the Sudan, it thrives on sorghum and millet[1].

The herb is used traditionally for treatment of skin diseases, vitiligo, leprosy, wounds and to relieve headache[2-4] and for diabetes[5].

In West Africa the plant is traditionally used in dermatosis, leprosy and jaundice treatments[6]. Contraceptive[7], a weak antiplasmodial[8] and antioxidant[9] activities of S. hermonthica have been reported. The insecticidal potentialities of the species has also been reported[10].

These folkloric uses initiated our study on the anti-
microbial activity of this plant.

Phytochemical investigations revealed the presence of flavonoids from the whole plant extracts\(^{[11,12]}\). In Sudan, no investigations on this species are carried for antimicrobial activities.

**MATERIALS AND METHODS**

**Plant material**

The plant material was separately collected from different plots at Shambat area (Khartoum North), in July 2008, and authenticated by the Department of Agronomy, Faculty of Agriculture, University of Khartoum. Voucher specimens have been deposited in the Herbarium of Pharmacognosy, Faculty of Pharmacy, University of Khartoum.

**Extraction and preparation of extracts**

The plant material consisting of flowers, roots, and stems (aerial parts) was separately air-dried and ground. 10 g of each morphological part from *Striga hermonthica* plant was extracted separately and successively with petroleum ether (60-80\(^{\circ}\)), chloroform, and 70% methanol using Soxhlet apparatus. The floral methanolic extract was concentrated and re-extracted with ethyl acetate. The extracts were evaporated under vacuum and the residues were separately dissolved or suspended in the same extracting solvent (10 ml) and kept in refrigerator till use. Aqueous extracts were prepared by maceration with distilled water for 24 hours. The residue was then filtered and the final volume was adjusted to 10 ml with distilled water and the solution used immediately.

**Tested bacteria**

Six standard bacterial strains were obtained from the National Collection Type Culture (NCTC). They were Gram positive: (*Bacillus subtilis* NCTC 8236, and *Staphylococcus aureus* NCTC 6447) and Gram negative bacteria (*Pseudomonas aeruginosa* NCTC 6796 and *Escherichia coli* NCTC 8196).

The bacteria were activated and cloned three successive times in nutrient agar and stored on nutrient agar slants at 4 \(^{\circ}\)C. Subsequent cultivation and tests were done on nutrient agar medium.

**Tested fungi**

The tested fungi, *Aspergillus niger*, *A. spergillus flavus* and *Candida albicans* were obtained from the National Health Laboratory, Sudan. The fungal cultures were maintained on Sabouraud and dextrose agar medium incubated at 25\(^{\circ}\)C for 7 days. The fungal growth was harvested and washed with sterile normal saline, and finally suspended in 100 ml of sterile normal saline and the suspension was stored in refrigerator till used.

**Antibacterial activity**

Bacteria were cultured in nutrient agar at 37\(^{\circ}\)C for 24 hrs. The cup plate agar diffusion method\(^{[12]}\) was adopted, with some minor modifications, to assess the antibacterial activity of the prepared extracts. Simultaneously, solvent controls involving the addition of the respective solvent instead of the extracts were carried out.

Ampicillin and neomycin were used as reference antibacterial agents in concentrations that gave an inhibition zones comparable to those of the tested extracts. After incubation, the diameters of the resultant growth inhibition zones were measured, averaged and the mean values were recorded.

**Antifungal activity**

Agar Diffusion method\(^{[12]}\) was used. 0.5 ml sample of each extract and 0.1 ml of each fungal suspension were mixed thoroughly with 20 ml of pre-sterilized Sabouraud dextrose agar medium, which was maintained at 45\(^{\circ}\)C. The inoculated medium was poured into sterile petri dishes, allowed to solidify, and incubated at 25\(^{\circ}\)C for 7 days. In the controls petroleum ether (60-80\(^{\circ}\)), chloroform, 70% methanol, ethyl acetate and sterile water were used in place of the test extracts. Each extract sample was tested in four replicates. Amphotericin C and ketoconazole were used as positive controls.

**RESULTS AND DISCUSSION**

**A- Antibacterial**

The results of antibacterial activities of different extracts at different concentrations are presented in TABLE 1. The con-
centrations of the extracts are calculated on basis of plant material (i.e. 10 g).

The aqueous extracts of flowers and aerial parts possessed antibacterial activity against the tested organisms, but no activity was shown by the aqueous extract of the roots. The petroleum ether extracts were found to be devoid of any antibacterial activity.

As shown from the table, the methanol extracts of flowers and aerial parts possessed more pronounced activity than those of the roots as compared with ampicillin and neomycin. The highest activity was noticed against B. subtilis and E. coli.

The flowers chloroform extract showed moderate activity against Gram negative bacteria at concentrations 5 and 10 mg/ml, while the chloroform extracts of roots and aerial parts were not active against the same organisms at the same concentrations.

The flowers ethyl acetate and methanol extracts possessed nearly the same antibacterial activity.

It can be inferred from the results that most of the extracts showed good antibacterial activity against Gram positive and Gram negative bacteria. In the present investigation the flowers extracts showed potential antibacterial activity compared with other morphological parts.

The water extract showed relatively low antibacterial activity as compared with the methanol, ethyl acetate, and chloroform extracts.

B-Antifungal

Unlike the antibacterial screening results of S. hermonthica, which gave pronounced activity, the results of the antifungal activity of different morphological parts of the same species revealed a lower antifungal activity. See TABLE 2.

The petroleum ether extracts of different morphological parts showed no activity against all tested organisms.

Flower extracts were found to be the most active plant extracts. They exhibited a fungicidal activity against A. niger and A. flavus. With C. albicans, the same extracts showed a fungistatic and fungicidal activity at concentrations 1 mg/ml and 5 mg/ml, respectively.

Roots extracts at different concentration showed a fungistatic activity against A. niger at 10 mg/ml and no activity against C. albicans.

The aerial parts extracts exhibited a fungicidal activity against A. flavus and A. niger and a fungistatic activity against C. albicans at 5 mg/ml concentration.
TABLE 2: Antifungal activity of *Striga hermonthica* extracts

<table>
<thead>
<tr>
<th>Plant parts</th>
<th>Extracts</th>
<th>Conc. mg/ml</th>
<th>An.igon Aflavus</th>
<th>Calbicans</th>
</tr>
</thead>
<tbody>
<tr>
<td>pet. ether</td>
<td>1,5,10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>chloroform</td>
<td>5,10</td>
<td>±</td>
<td>±</td>
<td>+</td>
</tr>
<tr>
<td>ethyl acetate</td>
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<td>+</td>
<td>+</td>
<td>+</td>
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<td>Flowers</td>
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<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>5,10</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
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<td>200</td>
<td>+</td>
<td>+</td>
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<tr>
<td></td>
<td>pet. ether</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>chloroform</td>
<td>10</td>
<td>±</td>
<td>±</td>
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<td>-</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>-</td>
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<td>-</td>
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<tr>
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<td>methanol</td>
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<td>-</td>
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<tr>
<td></td>
<td>10</td>
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<td>aqueous</td>
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<tr>
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<td>pet. ether</td>
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<td>chloroform</td>
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<td>10</td>
<td>+</td>
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<tr>
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</table>

(+) Fungicidal (±) Fungistatic (-) No activity

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REFERENCES


CONCLUSION

This study has revealed the antimicrobial activity of *Striga hermonthica*. It has further confirmed that the plant extracts could be used for the treatment of various infections. Further work is recommended to study the possible utilization of the plant in applied microbiological uses.