Introduction

*Cassia alata* Linn., belonging to family Caesalpiniaeae is a Pantropical, ornamental shrub, distributed from tropical America to India\(^1\), \(^2\). It is commonly known as Ringworm Senna. The leaf extracts of the plant have been reported to possess medicinal properties and used against ringworm, scabies, ulcers and other skin diseases such as pruritis, eczema and itching\(^3\), \(^4\). Many reports are also available on antimicrobial activity of its leaves\(^5\)–\(^10\). The aim of the present work was to evaluate the antifungal activity of its crude flower extract on three varied groups of fungi namely aflatoxin producing fungi (*Aspergillus flavus* and *A. parasiticus*), plant pathogenic fungi (*Fusarium oxysporum* and *Helminthosporium oryzae*) and human pathogenic fungi (*Candida albicans* and *Microsporum audouinii*).

Materials and Methods

**Plant Materials:** The flowers of *C. alata* were collected from the College greenhouse, washed initially with 2% aqueous NaCl solution followed by sterile distilled water, air dried under sterile conditions in shade, powdered and used for the experimental work.

**Fungi strains:** The toxigenic strains of aflatoxin producing fungi, *Aspergillus flavus* (NCBT 101), *A. parasiticus* (NCBT 128); plant pathogenic fungi, *Fusarium oxysporum* (NCBT 156) and *Helminthosporium oryzae* (NCBT 165); and human pathogenic fungi *Candida albicans* (NCBT 140) and *Microsporum audouinii* (NCBT 173). Total inhibition (100%) of growth was seen at 10 and 15 mg/ml concentrations for aflatoxin producing fungal strains. Whereas for plant and human pathogenic fungi total inhibition was at 15mg/ml concentration. The minimum inhibitory concentration (MIC) values of the extract varied from 5.75 to 8.00mg/ml for these fungi. Thus, aqueous flower extract of *C. alata* can be used as a potential antifungal agent for these three varied groups of fungi.

**Abstract**

The aqueous flower extract of *Cassia alata* Linn. (Family-Caesalpiniaceae) was investigated for antifungal activity by agar diffusion method against three distinct groups of fungi, viz. aflatoxin producing fungi, *Aspergillus flavus* (NCBT 101) and *A. parasiticus* (NCBT 128); plant pathogenic fungi, *Fusarium oxysporum* (NCBT 156) and *Helminthosporium oryzae* (NCBT 165); and human pathogenic fungi *Candida albicans* (NCBT 140) and *Microsporum audouinii* (NCBT 173). Total inhibition (100%) of growth was seen at 10 and 15 mg/ml concentrations for aflatoxin producing fungal strains. Whereas for plant and human pathogenic fungi total inhibition was at 15mg/ml concentration. The minimum inhibitory concentration (MIC) values of the extract varied from 5.75 to 8.00mg/ml for these fungi. Thus, aqueous flower extract of *C. alata* can be used as a potential antifungal agent for these three varied groups of fungi.

**Keywords:** Antifungal activity, *Cassia alata*, Ringworm Senna, Aflatoxin, Plant pathogenic fungi, Human pathogenic fungi.

**IPC code; Int. cl.**—A61K 36/00, A61K 36/482, A61P 31/10

**Twig of Cassia alata**
petridish (9cm) containing the medium alone (control a), medium with bavistin (control b), medium with griseofulvin (b1), and flower extract mixed with medium was inoculated with 0.5 ml spore suspension prepared from 10 days old culture and incubated for 6 days at 28 ± 2°C temperature and kept in dark. Three replicates were prepared and inoculated for each treatment.

**Determination of the Minimum Inhibitory Concentration (MIC)**

MIC was determined by the liquid dilution method\(^1\). Dilution series were set up with 0.25 to 15.0mg/ml of Sabourand glucose broth medium. To each tube, 0.1 ml of standardized suspension of fungal spores (4 x 10^6 spores/ml) were added and included at 27±1°C for 24 hours. The lowest concentration which did not show any growth of the tested fungi after microscopic evaluation was determined as MIC.

**Results and Discussion**

The aqueous extract of dried powder of *C. alata* flower has shown good antifungal properties for all the three groups of fungal strains tested in this work.

The growth of aflatoxin producing toxigenic *Aspergillus flavus* (NCBT 101) and *A. parasiticus* (NCBT 128) fungi were totally inhibited at 10 and 15mg/ml concentrations (Table 1). The total inhibition rate for *A. flavus* can be comparable to control (b), a standard antifungal test with bavistin treatment (5mg/ml). Whereas 75 per cent of inhibition is comparable with control (b) and that of *A. parasiticus* (Fig.1).

<table>
<thead>
<tr>
<th>Fungus</th>
<th>Control (a)</th>
<th>Control (b)</th>
<th>Flower extract concentration (mg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aspergillus flavus</em></td>
<td>+++</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td><em>Aspergillus parasiticus</em></td>
<td>+++</td>
<td>+</td>
<td>10</td>
</tr>
<tr>
<td><em>Fusarium oxysporum</em></td>
<td>+++</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td><em>Helminthosporium oryzae</em></td>
<td>+++</td>
<td>Control (b1) 5 mg/ml</td>
<td></td>
</tr>
<tr>
<td><em>Candida albicans</em></td>
<td>+++</td>
<td>+</td>
<td>5</td>
</tr>
<tr>
<td><em>Microsporum audouinii</em></td>
<td>+++</td>
<td>+</td>
<td>10</td>
</tr>
</tbody>
</table>

++++= Normal growth; ++= 50% growth inhibition; += 75% growth inhibition; -= Total inhibition

Control (a) = Medium without flower extract; Control (b) = Medium with bavistin; Control (b1) = Medium with griseofulvin

![Fig. 1: Antifungal effect of crude flower extract of *Cassia alata*](image)

(A) *Aspergillus flavus*, (B) *Aspergillus parasiticus*, (C) *Fusarium oxysporum*, (D) *Helminthosporium oryzae*, (E) *Candida albicans*, (F) *Microsporum audouinii*

(a) Control without flower extract, (b) Control with bavistin 5mg/ml, (b1) Control with griseofulvin 5mg/ml, (c) Flower extract 5mg/ml, (d) Flower extract 10mg/ml, (e) Flower extract 15mg/ml

Table 1: Antifungal activity of flower extract of *Cassia alata* at 28°C ± 2°C
For plant pathogenic fungi *Fusarium oxysporum* (NCBT 156) and *Helminthosporium oryzae* (NCBT 165) a 100 per cent total inhibition of growth was noticed at 15mg/ml concentration of aqueous extract (Table 1). This total inhibition is comparable to control (b) with bavistin treatment (5 mg/ml) for both *F. oxysporum* and *H. oryzae* (Fig.1).

The human pathogenic fungal strains, *Candida albicans* (NCBT 140) and *Microsporum audouinsi* (NCBT 173) were subjected to a 100 per cent of inhibition of growth at 15 mg/ml concentration of extract (Table 1). Whereas 75 per cent of inhibition can be seen for 10 mg/ml concentration of extract and this is comparable with the control (b1) of griseofulvin treatment (Fig.1).

The study revealed that a total inhibition of growth of all the three groups of fungi tested for this work fall at two levels of concentration of aqueous extract i.e. 10 and 15mg/ml. Traditionally leaf extract of this plant has been used to treat fungal infections. The results support the traditional usage of its flowers against varied groups of fungi. Earlier report suggested that *C. alata* leaves at 500mg/ml concentration of ethanol showed antifungal activities against *Aspergillus, Penicillium, Microsporum* and *Trichophyton* spp. The present work shows that lower concentration (15mg/ml) of aqueous flower extract is more effective in controlling the aflatoxin producing, plant and human pathogenic fungi. According to the earlier work the leaf extract has no antifungal activities against *Candida albicans* and *Cryptococcus neoformans*, but the present work proved that the flower aqueous extract at 15mg/ml conc. has good antifungal activities against *C. albicans*.

Methanol extracts of flowers at 4mg/ml has been reported to inhibit many types of bacteria, but not moulds like *Aspergillus niger, Candida albicans* and *Trichophyton mentagrophytes*. Anthraquinones, chrysophenol and flavonoid glycosides have been isolated from *C. alata* and *C. italic* of which the compound anthraquinones have been known to possess antimicrobial properties. *C. alata* bark extract is also reported to possess antifungal activities especially towards *C. albicans*. The present report is also evidence that the aqueous flower extract has antifungal activity against *C. albicans*.

The MIC values of the aqueous extract of flower varied from 5.75mg/ml to 8.00 mg/ml for the fungi tested. The MIC value of *F. oxysporum* (NCBT 156), *A. parasiticus* (NCBT 128), *H. oryzae* (NCBT 165), *A. flavus* (NCBT 101), *M. audouinsi* (NCBT 173) were 5.75, 6.25, 6.50, 7.25 and 8.00 mg/ml, respectively. Further investigation was performed to demonstrate the action of the extract on these fungi at different concentrations. The growth of these fungi correspondingly decreased with increasing concentrations of the extract and the growth was completely inhibited at their MIC values. The reduction of growth was possibly due to the interference by active principles of the flower extract. Such interference may be at the biosynthetic level. Therefore, the MIC determination is important in giving a guideline to the choice of an appropriate and effective concentration of a antifungal therapeutic substance.

**Conclusion**

The aqueous flower extract of *C. alata* is a significant inhibitor of growth of aflatoxin producing, plant and human pathogenic fungi tested during this investigation. Therefore, the identification of this potential herb as antifungal agent will help in replacing some commercial antifungal drugs.

**Acknowledgements**

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**References**

1. Singh Umarao, Wadhawani AM and Johri BM, Dictionary of Economic Plants in India, ICAR, New Delhi, 1990, p.44.


6. Crockett CO, Grede-Gunia F, Pugh D and Vangah–Manda M, *Cassia alata* and the...


8. Ranganathan S and Balajee SA, Anti-*Cryptococcus* activity of combination of extract of *Cassia alata* and *Ocimum sanctum*, *Mycoses*, 2000, **43**(7-8), 299-301.


