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Antifungal activity of *Kedrostis foetidissima* (Jacq.) Cogn.

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Abstract: In the present study, petroleum ether, hexane, chloroform, acetone and methanol extracts of leaf, stem and tuber of *K. foetidissima* were investigated for antifungal activity against *Candida albicans*, *C. tropicalis*, *Aspergillus niger*, *A. flavus* and *A. versicolor* by disc diffusion method. Among the various extracts, methanol extract of the investigated plant parts of *Candida albicans*, *C. tropicalis*, *Aspergillus niger*, *A. flavus* and *A. versicolor* were found to be more effective against all the tested fungi. Hence, this plant can be used to discover bioactive natural products that may serve as leads in the development of new pharmaceuticals that address unmet therapeutic needs.

Key words: Antifungal activity, *Kedrostis foetidissima*, methanol extract.

Introduction

Infectious diseases caused by bacteria, fungi, viruses and parasites remain a major threat to public health, despite tremendous progress in human medicines. Their impact is particularly great in developing countries because of the relative unavailability of medicines and the emergence of widespread drug resistance[1]. Over the past few decades, there has been much interest in natural materials as source of new antimicrobial agents. Different extracts from traditional medicinal plants have been tested. Many reports show the effectiveness of traditional herbs against microorganisms as a result plants have become one of the bases of modern medicine[2]. Plants have been used for the treatment of disease all over the world before the advent of modern clinical drugs. Natural phytochemicals are known to contain substance that can be used for therapeutic purposes or as precursor for the synthesis of novel useful drugs. Total of 50% modern drugs are of natural products origin and as such these natural products play an important role in the drug development pharmaceutical industry. Use of plant as a source of medicine has been inherited and is an important component of the health care system[3].

Kedrostis foetidissima (Jacq.) Cogn. (Cucurbitaceae) which is very effective in the treatment of asthma, chest pain and urinary tract infection[4], diarrhoea, HIV[5], small pox and skin diseases[6]. With this background, the present study was carried out to evaluate the antifungal activity of hexane, petroleum ether, chloroform, acetone and methanol extracts from leaf, stem and tuber of *Kedrostis foetidissima.*

Materials and methods

Plant materials

Different parts of leaf, stem and tuber of *Kedrostis foetidissima* were collected during Nov 2009-Feb 2010 from Maruthamalai Hills, Coimbatore, Tamilnadu, India. The collected plant materials were identified and their authenticity was confirmed by Mathew[7]and Gambel[8] respectively. The voucher specimens were deposited in the Department of Botany, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu, India.

Extraction of plant material

Various organic solvents were used for the extraction of bioactive compounds. The root and tuber powders (10g) of *Kedrostis foetidissima* were first extracted with petroleum ether for defatting in a Soxhlet apparatus. The defatted powdered sample of *Kedrostis foetidissima* were dried and successfully extracted with hexane, petroleum ether, chloroform, acetone and methanol in a Soxhlet apparatus. The extracts obtained were completely evaporated by using vacuum rotary evaporator. The concentrated extracts were used for antibacterial activity.

Tested microorganisms

Antifungal activity of crude extracts was tested against fungi *Candida albicans*, *C. tropicalis*, *Aspergillus niger*, *A. flavus* and *A. versicolor*. All the microbial cultures were procured from the Microbiology Laboratory, K.G Hospital, Coimbatore-641018. The stock cultures of bacteria were maintained on nutrient agar slants and fungi on potato dextrose agar slants at 4º C.

Antifungal assay

Antifungal assay was performed using disc diffusion method[9]. The extracts of the plant parts used were tested for their antifungal activity. The respective fungal spores were inoculated on the surface of the Potato Dextrose Agar plates and incubated at 25°C for 3 days. The different plant extracts were used to saturate the disc and placed on the seeded plates. Respective solvents act as a control. After incubation period, the antifungal activity was evaluated by measuring the zone of inhibition against test organisms.

Statistical analysis

Statistical analysis was performed using statistical software package WINSAT 2007 in Microsoft Excel. The data were presented as Means ± S.E. Statistical analysis was performed using one way ANOVA, DMRT test was used for calculating for 5 % level of significance.

Results and Discussion

Table 1 and 2 depicts that, *K. foetidissima* leaf showed moderate activity against most of the fungal strains. Among them 100% concentration of methanol extract displayed strong activity against *Aspergillus flavus* (17.87mm), followed by *A. versicolor* (16.00 mm), *A. niger* (15.47mm and plate 5f), *Candida albicans* (15.47mm) and *C. tropicalis* (13.17mm) while chloroform extract displayed excellent activity against *A. versicolor* (15.70mm), *A. flavus* (14.00mm), *A. niger* (12.00mm), *C. tropicalis* (10.17mm) and *C. albicans* (10.00mm). Hundred percentage concentrations of acetone extracts showed significantly activity against most of the microorganisms. *C. albicans* and *C. tropicalis* showed no zone of inhibitions against petroleum ether and hexane extracts whereas *A. niger*, *A. flavus* and *A. versicolor* showed significant activity at all concentration. The results depicted that most of the antifungal activity linearly increased with increasing concentration of extracts.

Table 1 and 2 demonstrate that, all the extracts (except petroleum ether and hexane) obtained from *K. foetidissima* stem showed mild activity against most of the fungi. Among the extracts only methanol extract was found to be strongly active against all the fungal strains. Next to methanol, chloroform extract displayed significant activity against *A. niger*, *A. flavus*, *C. tropicalis* at all concentration whereas *C. albicans* show inhibition only at 75% and 100% concentration. A. *versicolor* chloroform extract showed an increase in concentration of extract increased zone of inhibition upto 75% concentration afterwards there was a decline of inhibition of zone was noted at 100% concentration. Similar observation was noted in acetone extract against *A. niger* (Table 1 and 2). Other extracts showed increased zone of inhibition at all concentrations against the fungal strains tested.

Sample tested	Diameter zone of inhibition in mm														
	Aspergillus niger					*Aspergillus flavus*					*Aspergillus versicolor*				
Leaf	**C**	**25%**	**50%**	**75%**	**100%**	**C**	**25%**	**50%**	**75%**	**100%**	**C**	**25%**	**50%**	**75%**	**100%**
Petroleum ether	1.00^{f}	3.00^{e}	3.57^{g}	4.20^{i}	5.00^{i}	1.33^{e}	1.27^{g}	2.00^{i}	3.57^{g}	4.00^{g}	1.13^{f}	2.00^{g}	4.67^{e}	0.00	0.00
Hexane	1.06^{f}	1.50^{g}	2.00^{i}	3.17^{j}	4.83^{j}	1.00^{e}	2.60^{f}	2.80^{h}	3.17^{h}	4.13^{g}	1.00^{f}	3.00^{f}	4.20^{f}	5.10^{f}	6.00^{e}
Chloroform	2.67^{c}	8.83^{a}	9.67^{a}	10.67^{b}	12.00^{b}	3.17^{b}	6.07^{b}	8.67^{b}	10.69^{b}	14.00^{b}	1.57^{e}	6.70^{b}	8.58^{b}	12.30^{b}	15.70^{b}
Acetone	1.60^{e}	5.23^{c}	6.53^{c}	8.33^{d}	9.90^{d}	2.10^{d}	4.33^{d}	5.69^{e}	6.17^{f}	10.70^{c}	2.20^{d}	4.00^{d}	5.73^{d}	7.43^{c}	6.67^{d}
Methanol	3.17^{b}	7.00^{b}	9.93^{a}	12.10^{a}	15.47^{a}	3.00^{b}	10.97^{a}	11.33^{a}	13.50^{a}	17.87^{a}	2.50^{c}	8.60^{a}	10.73^{a}	13.10^{a}	16.00^{a}
Stem															
Petroleum ether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	2.30^{d}	5 .20^{c}	5.33^{e}	6.67^{e}	7.10^{h}	3.50^{a}	6.10^{b}	7.90^{c}	8.09^{d}	9.07^{e}	3.00^{b}	5.00^{c}	6.80^{c}	7.23^{c}	4.40^{i}
Acetone	1.00^{f}	2.00^{f}	2.83^{h}	4.67^{h}	2.17^{l}	2.00^{d}	2.93^{f}	4.07^{g}	0.00	0.00	3.67^{a}	2.00^{g}	3.07^{g}	3.20^{h}	5.77^{f}
Methanol	3.00^{b}	3.50^{d}	4.82^{f}	6.00^{f}	9.18^{e}	3.17^{b}	5.03^{c}	6.00^{d}	8.67^{c}	9.67^{d}	3.67^{a}	3.60^{e}	4.73^{e}	6.07^{e}	7.93^{c}
Tuber								I							
Petroleum ether	1.80^{e}	2.07^{f}	2.27^{i}	2.60^{k}	3.00^{k}	0.00	0.00	0.00	0.00	0.00	1.25^{f}	1.00^{h}	3.40^{g}	1.05^{i}	1.07^{k}
Hexane	1.07^{f}	1.00^{h}	2.10^{i}	2.57^{k}	3.16^{k}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00^{i}	2.57^{j}
Chloroform	3.00^{b}	3.43^{e}	5.50^{d}	6.63^{e}	8.53^{f}	3.33^{b}	3.00^{e}	4.87^{f}	6.77^{e}	9.97^{d}	3.46^{b}	0.00	2.63^{h}	3.80^{g}	4.93^{h}
Acetone	1.67^{e}	2.17^{f}	4.60^{f}	5.03^{g}	7.73^{g}	2.33^{d}	0.00	0.00	0.00	5.43^{f}	3.23^{b}	0.00	2.90^{h}	3.80^{g}	5.00^{g}
Methanol	5.67^{a}	7.03^{b}	8.50^{b}	9.00^{c}	10.60^{c}	2.67^{c}	5.47^{c}	6.13^{d}	8.00^{d}	10.90^{c}	3.56^{a}	5.33^{c}	4.87^{e}	6.77^{d}	7.60^{c}

Table 1: Antifungal activity of *Kedrostis foetidissima*

Values are expressed as Mean of 3 replicates. Means followed by a common letter aren't significantly different at the 5% level by DMRT

Table 2: Antifungal activity of *Kedrostis foetidissima*

Sample tested	Diameter zone of inhibition in mm									
	Candida albicans					*Candida tropicalis*				
Leaf	**C**	**25%**	**50%**	**75%**	**100%**	**C**	**25%**	**50%**	**75%**	**100%**
Petroleum ether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	2.60^{d}	3.77^{b}	7.20^{b}	9.77^{b}	10.00^{b}	2.00^{b}	3.17^{c}	5.00^{c}	8.50^{b}	10.17^{b}
Acetone	1.60^{f}	3.57^{b}	4.03^{d}	5.20^{d}	7.73^{d}	1.90^{c}	2.10^{e}	4.25^{d}	5.07^{e}	6.33^{d}
Methanol	4.30^{a}	7.10^{a}	10.45^{a}	11.01^{a}	15.47^{a}	3.33^{a}	6.73^{a}	8.60^{a}	10.10^{a}	13.17^{a}
Stem										
Petroleum ether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	0.00	0.00	0.00	4.35^{f}	5.43^{f}	2.67^{b}	3.43^{c}	4.27^{d}	5.20^{e}	5.70^{e}
Acetone	1.00^{g}	0.00	0.00	0.00	1.48^{h}	1.30^{d}	1.04^{g}	2.75^{f}	3.25^{f}	3.48^{f}
Methanol	3.27^{c}	1.00^{e}	2.30^{f}	4.10^{f}	6.77^{e}	3.33^{a}	2.53^{d}	3.90^{e}	5.93^{d}	6.05^{d}
Tuber										
Petroleum ether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hexane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	3.80^{b}	3.30^{c}	3.67e	4.13^{f}	5.43^{f}	1.01^{d}	0.00	0.00	5.20^{e}	6.33^{d}
Acetone	1.90^{f}	2.00^{d}	2.37^{f}	4.80^{e}	2.07^{g}	1.40^{d}	1.73^{f}	2.57^{f}	1.17^{g}	1.60^{g}
Methanol	2.00^{e}	3.67^{b}	5.43^{c}	6.50^{c}	8.80^{c}	2.47^{c}	5.40^{b}	6.07^{b}	7.00^{c}	8.17^{c}

Values are expressed as Mean of 3 replicates. Means followed by a common letter aren't significantly different at the 5% level by DMRT

From the Table 1 and 2, it is evident that the extracts (except petroleum ether and hexane) of *K. foetidissima* tuber showed mild to moderate activities against most of the tested fungi. Methanol extract exhibited comparatively higher activity against most of the tested fungi than that of the other four. Petroleum ether and hexane extract showed inhibitory effect only the fungi *A. niger* and *A. versicolor*. When concentration increases, the decline of zone of growth inhibition was noted against *C. albicans* and *C. tropicalis* by acetone extract.

Based on our results, it is concluded that, plant extracts have great potential as antimicrobial compounds against fungal organisms and they can be used in the treatment of infectious diseases caused by resistant microorganisms. Therefore, *K. foetidissima* can be selected for further analysis. It can be used to discover bioactive natural products that may serve as leads in the development of new pharmaceuticals that address unmet therapeutic needs. Such screening of various natural organic compounds and identification of active agents is the need of the hour because successful prediction of lead molecules and drug-like properties at the onset of dry discovery will pay off later in drug development.

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