
General abstract

GENERAL ABSTRACT

Hermannia incana Cav. (Sterculiaceae), known as sweet yellow bells, is a medicinal plant used by the people of the Eastern Cape for the treatment of stomach-ache and diarrhoea. It has purgative and diaphoretic effects. It is a prostrate herb with yellow flowers and sparsely hairy and slightly glandular leaves, occurring in grassland and marshes in the Eastern Cape Province of South Africa. Based on the ethnomedical uses of this plant, the research project was designed to evaluate its antidiarrhoeal and toxicological properties.

An ethnobotanical study of plants used for the treatment of diarrhoea in the Eastern Cape Province was carried out, using a questionnaire which was administered to herbalists, traditional healers and rural dwellers. This survey indicated a total of 17 plant species from 14 families. *Elephantorrhiza elephantina* (Burch.) Skeels, *Hermannia incana* Cav., *Pelargonium reniforme* Curt., *Alepiea amatymbica* Eckl. & Zeyh. and *Bulbine latifolia* (L.f.) Roem. et Schult. were the most frequently mentioned and highly recommended plants for the treatment of diarrhoea by both the traditional healers and rural dwellers. The root, bark and leaves are the common parts of plants used, while decoctions and infusions are the main methods of preparation.

The agar dilution method was used to study the antimicrobial activity. The methanol extracts of the plant showed appreciable activity against Gram-positive and Gram-negative bacteria at concentrations ranging from 0.5 to 7.0 mg/ml. The acetone and water extracts of both the leaves and the roots showed moderate activity against Gram positive bacteria and less activity against Gram negative bacteria. All the extracts inhibited the growth of the fungi *Aspergillus flavus*, *Aspergillus niger*, and *Mucor hiemalis* with growth inhibition ranging from 54.31% to 96.67% at 0.1-10 mg/ml. None of the extracts suppressed the growth of *Candida albicans* at the maximum concentration (10 mg/ml) tested.

In the *in vivo* antidiarrhoeal evaluation using Wistar rats, the aqueous extract at all the doses tested, significantly prolonged the time of induction of diarrhoea and also reduced the frequency of diarrhoeal episodes and fecal parameters (total number, number of wet, fresh and dry weight and water content of the faeces). The percentage inhibition of defecation and intestinal content (enteropooling) were increased in dose dependent manner. The doses also reduced the intestinal transit time of charcoal, masses and volumes of intestinal fluid (gastrointestinal motility). These results are indications of antidiarrhoeal property of *H. incana* leaf extract with the 600 mg/kg body weight of the extract being the most effective.

In the toxicological evaluation using Wistar rats, the oral administration of the extract did not produce any significant effect on the liver and kidney body weight ratios, RBC, HB, PCV, MCV MCH, MCHC, RCDW, WBC, neutrophils, monocytes and basophils cholesterol, triacylglycerol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and atherogenic index. The extract also did not affect the levels of sodium, potassium, chloride, inorganic phosphorus, urea, creatinine, total protein, globulin, albumin, total and conjugated bilirubin. The activities of alkaline phosphatase, gamma glutamyl transferase and alanine aminotransaminase in the serum were increased by the extract whereas aspartate aminotransaminase was decreased. The levels of LUC, platelets, lymphocytes and eosinophils were significantly affected at 600 mg/kg body weight. The available evidence in this study suggests that the extract of *H. incana* leaf is mild, parameter and dose specific.

The structure and distribution of foliar appendages on the leaves of this plant were investigated with the JEOL (JSM-6390LV) scanning electron microscope (SEM). Both glandular and non-glandular trichomes were observed. Long stalked glandular trichomes were present on both the abaxial and adaxial surfaces while short stalked glandular trichomes were present only on the adaxial surface. Glandular trichomes were capitate while non-glandular trichomes were stellate with many arms. Energy dispersive X-ray spectroscopy-

SEM showed that Al, Ca, K, Na, Ti and Si were the major constituents of the crystals analyzed from the leaf surfaces.

The phytochemical screening of *H. incana* revealed the presence of bioactive antidiarrhoeal agents such as alkaloids, tannins, saponins, phenolics, triterpenes, cardiac glycosides, flavonoids, cardenolides and dienolides. Two flavonoids, epicatechin and 3, 5, 7, 2' tetra-hydroxy flavone-3- O- β -D-glucopyranoside were isolated from the leaves of the plant through bio-active guided fractionation. Both these compounds were screened against diarrhoea causative organisms (*Echerichia coli*, *Shigella flexneri*, *Bacillus cereus* and *Staphylococcus aureus*) and exhibiting minimum inhibitory concentrations ranging from 12.5 to 100 μ g/ml.

The findings from this research have generally justified the traditional use of this plant for the treatment of diarrhoea in this province.

INTELLECTUAL PROPERTY AGREEMENT STATEMENT

All the elderly and the traditional healers who contributed one information or the other during the preliminary investigation on the folkloric use of *Hermannia incana* were adequately financially rewarded with further verbal agreement and understanding that this research shall not be for commercial purposes but to serve as an enlightenment information to the community and the entire Eastern Cape Province on the efficacy, safety and toxicity of this plant.

ETHICAL COMMITTEE APPROVAL

The study involving the use of animals in this project was carried out following the approval of the Ethical Committee on Animal Use and Care of the University of Fort Hare.

COMPLIANCE STATEMENT

No part of this study in any form has been commercialized. The thesis is meant to be used for information dissemination on the medicinal potentials of *Hermannia incana* to the immediate community and the entire Eastern Cape Province of South Africa.

Supervisor signature

Student signature