



Research Article

PHYTOCHEMICALS AND ANTIMICROBIAL BEHAVIOR OF PLANT *SWERTIA CHIRAYITA*, A MEDICINAL PLANT FROM RANGPUR, BANGLADESHRishikesh^{1*}, Md. Mofizur Rahman¹, Md. Zakaria Faruki¹, Md. Chhanaur Rabbee², Drishti Rani Ghosh², Sk-Moynul Hasan²¹Department of Pharmacy, Bangladesh University, Dhaka-1207, Bangladesh²Department of Pharmacy, University of Asia Pacific, Dhaka-1209, Bangladesh

(Received: 14 December 2012; Accepted: 24 December, 2012; Published: 29 December, 2012)

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Abstract: *Swertia chirayita* is an essential medicinal plant from Rangpur, Bangladesh with anti-diabetic, anti-pyretic, anti-malarial and anti-inflammatory potential and used in therapeutic herbal preparations in parts of South Asia. Ethanolic extracts of fresh stem of *Swertia chirayita* collected from rangpur region of Bangladesh. Antibacterial activities against 8 pathogenic bacteria, 4 Gram positive and 4 Gram negative, by disc diffusion method. The produced zone of inhibition for ethanolic extract against *Staphylococcus aureus*, *Bacillus megaterium* and *Escherichia coli* were 8mm, 9mm and 9mm at 30µg/disc dose respectively. At 90 µg/disc dose, the produced zone of inhibition against the same bacteria was 15mm, 13mm and 12mm respectively

Key words: *Swertia chirayita*, antimicrobial, phytochemicals

INTRODUCTION:

Medicinal plants always played a important role in the health development of mankind. In developing countries, 80% of populations are totally dependent on plants for their primary health care. Over 25% of prescribed medicines in industrialized countries derive directly or indirectly from medicinal plants. A multidisciplinary approach combining botanical, ethnobotanical, phytochemical and biological techniques led to Drug discovery from plant (Newman et.al, 2000). Plants provide us new lead molecules for the development of drugs against various pharmacological targets.

Swertia chirayita is an important medicinal plant endemic to the Himalayan regions. It is found growing in moist hillsides of temperate forests between the altitudes of 1200-3000 m and is indiscriminately collected from its wild habitat for trade and local medicinal use. *S. chirayita* is utilized extensively in Eastern traditional medicine such as Ayurveda, Unani, Siddha and also in traditional Chinese and Tibetan medicine as well as in local healing in India, Nepal, Bangladesh. *S. chirayita* is used in traditional medicine for chronic fever, malaria, anemia, bronchial asthma, liver disorders, hepatitis, gastritis, constipation, dyspepsia, skin diseases, worms, epilepsy, ulcer, scanty urine, hypertension, melancholia and certain type of mental disorder, secretion of bile, blood purification and diabetes 1.

It is an important ingredient in many Ayurvedic health tonics, supplements, anti-diabetic and anti-

cancer preparations, liver tonics, skin creams, soaps and even in hair oils. This species was first introduced in the Edinburgh Pharmacopoeia in 1839 and is reported in British and American Pharmacopoeias to be used as an infusion or a tincture. *Swertia chirayita* belongs to the Gentianaceae family and contains many of the compounds that are responsible for its therapeutic properties such as xanthones, flavonoids, terpenoids, iridoids and secoiridoid glycosides².

MATERIALS AND METHODS:

Collection of the plant: Dried stems of *Swertia chirayita* (locally known as Chirata) were collected from rangpur region of Bangladesh.

Preparation of plant materials: The stems along with the leaves of the plant were cut into small pieces by a sharp knife and dried in the sun for three days. This was further dried in the oven for 24 hrs at a temperature below 40°C. About .5 kg of the dried plant materials were weighed by an electric balance and grinded with a grinding machine.

Extraction of plant materials: The crushed materials were taken in a clean flat bottomed glass container (3L) and macerated with sufficient amount of ethanol and with sporadic shaking. After 15 days the solvent was decanted and filtered by Tincture filter press and then filtered through fresh cotton. The filtrate thus obtained was taken in a beaker.

Evaporation of the solvent: The solvent of the extract was evaporated under temperature and pressure to obtain a gummy mass, which was preserved in a refrigerator at 4°C for chemical investigation.

PHYTOCHEMICAL COMPOUNDS RESIDE IN CHIRAYITA:

Amarogentin (chirantin):

It is secoiridoid glycoside, and is the most acerbic substance found³. It acquires Topoisomerase inhibition, chemo-preventive and antileishmanial effects⁴.

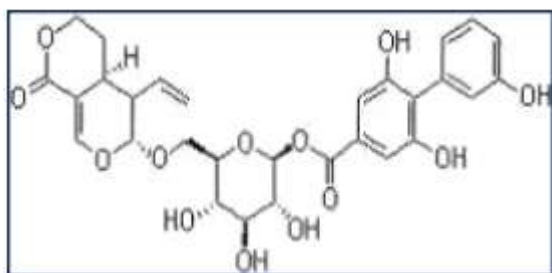


Figure-1: A biphenylcarboxylic acid moiety; biosynthesized by a polyketide-type pathway, with three units of acetyl-CoA and one unit of 3-hydroxybenzoyl-CoA

Mangiferin: This compound, which is isolated from chirayita species possesses strong anti-inflammatory activity in arthritic mice, and accounted for lowering down TNF-alpha, IL-1beta, IL-6, and IFN-gamma and up regulation of IL-10 in the joint homogenates of mice⁵.

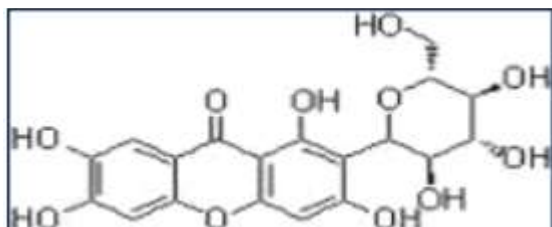


Figure-2. A natural phenol having molecular formula C₁₉H₁₈O₁₁

Swertiamarin : A Secoiridoid glycoside obtained from *Swertia chirayita* (Roxb ex. Flem) Karst; having analgesic property⁶.

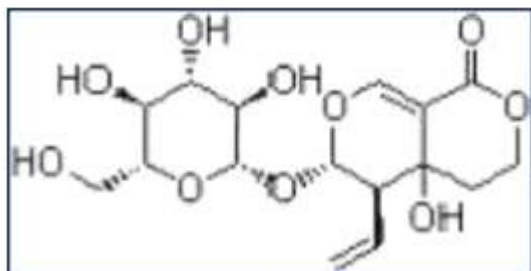


Figure-3. Swertiamaroside having molecular formula C₁₆H₂₂O₁₀

Swerchirin: A medicinally foremost xanthenone, obtained from several plants of family Gentianaceae including *Swertia chirayita*; having antimalarial, hypoglycemic³.

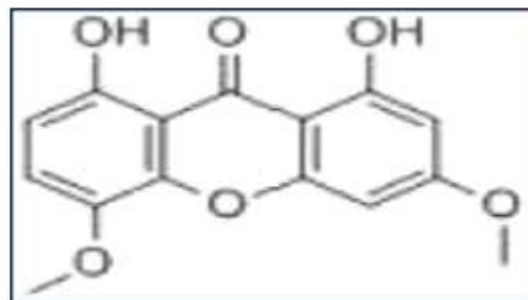


Figure-4. Methylbellidifolin; 1,8- Dihydroxy- 3,5-dimethoxy-9H-xanthen-9-one

Amaroswerin: It is a Secoiridoid glycoside collected from *Swertia chirayita* and found to be gastro-shielding⁷.

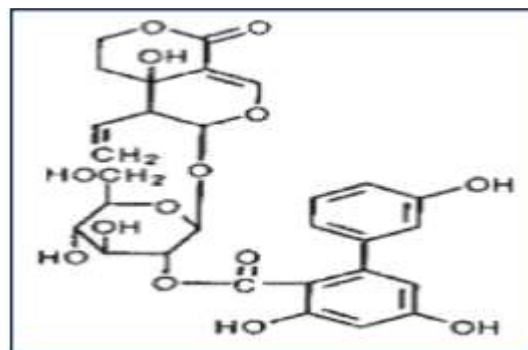


Figure-5: An iridoidal glycoside having molecular formula C₂₉H₃₀O₁₄

Gentianine: A sullen, translucent monoterpene alkaloid, obtained from several plant species of family Gentianaceae including *Swertia chirayita*⁸. It possesses anti-inflammatory, anesthetic antihistaminic, anticonvulsant properties⁹.

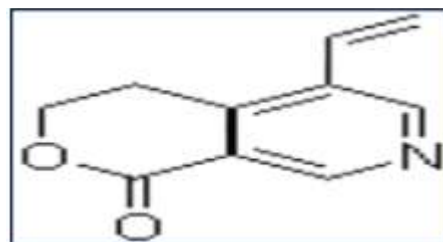


Figure-6. A pyridine alkaloid having molecular formula C₁₀H₉NO₂

RESULTS AND DISCUSSION:

Antibacterial activity of ethanolic extract:

Antibacterial activity of ethanolic extract was tested against eight bacteria at concentrations of 30µg/disc and 90µg/disc. Standard antibiotic disc of chloramphenicol (30µg/disc) was used for comparison. The results obtained were shown in

Table 1 and Fig. 7. The produced zone of inhibition for ethanolic extract against *Staphylococcus aureus*, *Bacillus megaterium* and *Escherichia coli* were 8mm, 9mm and 9mm at 30 μ g/disc dose respectively. At 90 μ g/disc dose, the produced zone of inhibition against the same bacteria was 15mm, 13mm and 12mm respectively. It was apparent that the antibacterial activity of ethanolic extract against the above bacteria showed decrease dose dependency. Plants are important source of

potentially useful structures for the development of new antimicrobial agents. The first step towards this goal is the *in vitro* antibacterial activity assay. Many reports are available on the antiviral, antibacterial, antifungal and anti-inflammatory properties of plants. Some of these observations have helped in identifying the active principle responsible for such activities and in the developing drugs for the therapeutic use in human beings^{10, 11}.

Table 1. *In vitro* antibacterial activity test of the crude extract of *Swertia chirayita* Values indicate zone of inhibition (diameter in mm)

Test organisms	Crude extract		Standard Chloramphenicol (30 μ g/disc)
	30 μ g	90 μ g	
1. <i>Staphylococcus Aureus</i>	8	15	35
2. <i>Bacillus subtilis</i>	8	14	31
3. <i>B. megaterium</i>	9	13	30
4. <i>Sarcina lutea</i>	7	12	28
5. <i>Salmonella typhi-A</i>	8	11	26
6. <i>Escherichia coli</i>	9	12	27
7. <i>Salmonella paratyphi-A</i>	8	13	29
8. <i>Vibrio mimicus</i>	8	11	31



Figure 7: Clear Zone of Inhibition

CONCLUSION:

All phytochemicals i.e., mangiferin, swertiamarin, amarogentin were present in ethanolic extracts. Therefore, this plant part could be used for medicinal preparations. After measuring the diameter of the zones of inhibition in millimeter with a transparent scale, the ethanolic extract exhibited high antimicrobial activity against gram positive and gram negative bacteria. So, the purification and characterization of the phytochemicals that would be obtained with a view to obtaining useful chemotherapeutic agent.

ACKNOWLEDGEMENTS:

The authors are thankful to Bangladesh University, University of Asia Pacific and University of Dhaka

for their supports and cooperation. We would like to thank the tribal people of Rangpur District, Bangladesh; who have provided valuable ethnobotanical information's.

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