



# INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare &amp; Pharmascope Foundation

Journal Home Page: [www.pharmascope.org/ijrps](http://www.pharmascope.org/ijrps)

## Hepatoprotective potential of *Indigofera tirunelvelica* Sanjappa: *in vitro* and *in vivo* studies on CCl<sub>4</sub> induced wistar albino rats

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### Article History:

Received on: 09 Jun 2020

Revised on: 10 Jul 2020

Accepted on: 16 Jul 2020

### Keywords:

*Indigofera tirunelvelica*,  
Antioxidants,  
Hepatotoxicity-CCl<sub>4</sub>,  
Hepatoprotective activity

### ABSTRACT

The hepatoprotective efficiency of *Indigofera tirunelvelica* Sanjappa whole plant against CCl<sub>4</sub> induced hepatotoxicity was examined. Rat hepatocyte monolayer culture and wistar albino rats were exercised as *in vitro* and *in vivo* screening models of protective agent for liver. In *in vitro* analyses, the whole plant ethanolic extract of *Indigofera tirunelvelica* Sanjappa were inspected. Silymarin was chosen as a standard treatment drug. *In vitro*, free radical scavenging property was also evaluated. In animal studies, hepatotoxicity was produced in Wistar albino rats by dispensing CCl<sub>4</sub>. The degree of hepatotoxicity was examined by determining the ranges of serum enzyme. The antioxidant parameters such as superoxide dismutase, catalase, reduced glutathione, and malondialdehyde of the hepatocytes were also evaluated. In *in vitro* studies, ethanol extract of *I. tirunelvelica* whole plant was identified to be the most active than other assessed extracts. Besides, whole plant ethanol extract of *I. tirunelvelica* was noticed to be rich in phenolic and flavonoids. It exhibited expressive free radical scavenging property versus diphenylpicrylhydrazyl (DPPH) and superoxide ion radicals. In the animals studies, whole plant ethanolic extract of *I. tirunelvelica* at a ranges of doses (100, 200 and 400 mg/kg body weight) revealed considerable amount of protection against CCl<sub>4</sub> induced hepatotoxicity as evident by the protection of CCl<sub>4</sub> induced changes biochemical parameters. The results of the present study suggested that the significant hepatoprotective property of whole plant ethanol extract of *I. tirunelvelica* against CCl<sub>4</sub> induced hepatotoxicity and intimates its use as a potential medicinal drug for liver diseases.



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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i4.3432>

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### INTRODUCTION

Oxidative stress has been linked in the acute and chronic development of diseases in liver injury in a variety of pathophysiological conditions such as alcoholic liver injury, intrahepatic cholestasis, hepatotoxin exposure, viral liver disease and also liver ischemia (Stehbens, 2003); (Jaeschke, 2003); (Serafini et al., 1998). Excessive synthesis of reactive oxygen species (ROS) and reactive nitrogen species (RNS), together with a substantial decline of antioxidant defence in these diseased conditions, hinders numerous cell performances throughout the





## EVALUATION OF HEPATOPROTECTIVE EFFECT OF *INDIGOFERA TIRUNELVELICA* SANJAPPA AGAINST $\text{CCl}_4$ INDUCED HEPATOTOXICITY IN RATS

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### ABSTRACT

**Objective:** The present investigations were undertaken to evaluate the hepatoprotective of the ethanolic extract of *Indigofera tirunelvelica* Sanjappa (Et-It) against  $\text{CCl}_4$ -induced hepatotoxicity in rats. **Methods:** Hepatoprotective effect of ethanolic extract of *Indigofera tirunelvelica* (EtL-It) was determined by using carbon tetrachloride ( $\text{CCl}_4$ ) intoxication of rats as experimental models. The range of liver impairment and effect of the extract of medicinal plant was evaluated by assorted biochemical markers like aspartate aminotransferase (AST), alkaline phosphatase (ALP), alanine aminotransferase (ALT), total protein (TP) and total bilirubin (TB) in blood serum and concentration of Lipid peroxidation (LPO), superoxide dismutase (SOD), catalase (CAT), reduced glutathione (GSH), glutathione-S-transferase (GST) and glutathione peroxidase (GPx), in liver were determined. Histopathological changes in the liver of different groups were also studied. **Results:** The administration of Et-It at dose levels of 100, 200 and 400 mg/kg/b.w., orally had decreased the rise of ALT, AST, ALP, TB and TBRAS levels and the effects were comparable to standard drug (Silymarin 20 mg/kg/b. w.) the GSH, SOD, CAT, GPx, GST and TP levels were significantly increased in the animals received EtL-It. The histopathological studies show decreased necrosis and hepatocellular degeneration when compared to the  $\text{CCl}_4$  intoxicated liver. **Conclusion:** This study demonstrates that the hepatoprotective of *Indigofera tirunelvelica* therefore scientifically supports the use of this plant in traditional medicine for treatment of liver disorders.

### KEY WORDS

*Indigofera tirunelvelica*, Liver regeneration,  $\text{CCl}_4$ , Hepatoprotective

### INTRODUCTION

The liver is the most important metabolic organ. The incessant exposure and a numerous toxic environmental agent, certain chemical drugs induce hepatic injury, identified as a toxicological problem [1]. Most of the toxic chemicals damage the liver cells mainly by inducing lipid peroxidation and other oxidative damages in liver [2]. The choice of treatment

for common liver diseases such as cirrhosis, fatty liver, and chronic hepatitis is problematic [3]. In spite of amazing development in modern medicine no effective drugs are available, which activate liver functions and often protect the liver from the damage or helps to reconstruct hepatic cells [4]. In the lack of reliable liver protective drugs in modern medicine, Plants traditionally used in the relief of liver dysfunction might,





# Molecular Docking Studies of *Indigofera Tirunelvelica* Sanjappa against Hepatocarcinoma Receptors

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Received: 10 Oct 2018 / Accepted: 8 Nov 2018 / Published online: 1 Jan 2019  
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## Abstract

**Objective:** Hepatocarcinoma keeps on being an overall executioner, in spite of the huge measure of research and quick advancements seen amid the previous decade. Since it is normally trusted that many are preventable, there is dire need to recognize regular meds as viable hepatoprotective specialists. Normal items recognized and disengaged from plants have assumed an imperative job in disclosure of medications against liver infections. **Methods:** *In silico* docking systems are being utilized to explore the correlatively at the sub-atomic dimension of a ligand and a protein target. In the present investigation, four ligands which have been disengaged and distinguished from the ethanolic concentrate of the entire plant of *Indigofera tirunelvelica* Sanjappa are docked with two novel hepatocarcinoma receptors, Hepatitis B X and Heme Oxygenase I. **Results:** Out of the four phytochemical constituents separated and distinguished from the ethanolic concentrate of the entire plant of *Indigofera tirunelvelica*, phytol ligand uncovered the best wellness score contrasted and the other three ligands. **Conclusion:** This present examination induced that phytol could be a viable potential inhibitor against Hepatitis B X and Heme Oxygenase I receptor and could be assessed as hepatoprotective medication particle.

## Keywords

*Indigofera tirunelvelica*, *In silico*, Autodock, Hepatocarcinoma receptors

\*\*\*\*\*

## INTRODUCTION

The liver plays a bewildering exhibit of fundamental capacities in the support, execution and controlling homeostasis of the body. It has extraordinary ability to detoxicate dangerous substances and integrate helpful standards [1]. Liver sicknesses stay one of the

significant dangers to general wellbeing and are an overall issue [2]. They are mostly caused by synthetic substances like acetaminophen, overabundance utilization of liquor, diseases and immune system issue. The vast majority of the hepatotoxic synthetic compounds harm liver cells for the most part by

## A TOXICITY STUDY OF ETHANOLIC EXTRACT OF INDIGOFERA TIRUNELVELICA SANJAPPA IN ALBINO RAT

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### ABSTRACT

**Objective:** The present investigations were undertaken to evaluate the toxicity of the whole plant ethanolic extract of *Indigofera tirunelvelica* Sanjappa (ItW-Et) in rats. **Methods:** Toxicity effect of ItW-Et was determined by administered the dose levels of 500, 1000, 2000 and 4000 mg/kg/bw, orally to Wistar albino rats as experimental models. The range of liver and kidney impairment were evaluated by bodyweight, organ weights (Liver and Kidney), hematological parameters, biochemical markers, hepatic enzyme markers and histopathological studies. **Results:** The administration of different doses of ItW-Et had no significant changes in the bodyweight, organ weights, hematological parameters, biochemical markers, hepatic enzyme markers. The histopathological studies showed no abnormal cell architecture in liver and kidney cells with ItW-Et. The extracts caused no significant acute or chronic mortality as compared to controls during this investigation. The extracts failed to show hepatotoxic and nephrotoxic effects. **Conclusion:** This study demonstrates that the whole plant ethanolic extract of *Indigofera tirunelvelica* has no toxic effects which has proven scientifically and support this plant use for treatment of liver disorders.

**Keywords;** *Indigofera tirunelvelica*, Toxicity Study, Ethanolic Extract, Medicinal Plant.

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## PHYTOCHEMICAL AND ANTIMICROBIAL SCREENING OF INDIGOFERA TIRUNELVELICA SANJAPPA: AN IMPORTANT HERB

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Article Received on  
23 August 2017,

Revised on 13 Sept. 2017,  
Accepted on 03 October 2017

DOI: 10.20959/wjpps201711-10368

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### ABSTRACT

The therapeutic value of *Indigofera tirunelvelica* Sanjappa (Fabaceae) has been recognized as a component of traditional medication for the treatment of various human ailments. The plant is being highly explored, still lacks sufficient evidences for the best variety possesses the highest degree of medicinal values. The present study is focused on phytochemical screening of aqueous and ethanolic leaf extracts of *I. tirunelvelica*. The crude extracts of *I. tirunelvelica* revealed the presence of several biologically active phytochemicals with the high degree of alkaloids, flavonoids and phenols. The antibacterial efficacy was investigated against pathogenic bacterial strains and the highest inhibitory activity of aqueous extract was obtained

against *Staphylococcus aureus*, *Salmonella typhi* and *Actinomyces* whereas ethanolic extract was found to be most potent against *Klebsiella*, *Pseudomonas auroginsoa*, *Staphylococcus aureus* and *E.coli* at 50 µg/ml concentration. The preliminary phytochemical screening revealed the presence of many bioactive metabolites such as flavonoids, terpenoids, phenolics, and steroids that can be postulated for antibacterial activity.

**KEYWORDS:** *I. tirunelvelica*; Ethanol extract, medicinal plant, and antimicrobial activity.

### INTRODUCTION

Novel drug discoveries have budged attention from synthetic models and compounds to natural derivative of medicinal plants because it is understood that drugs from medicinal plants are safe, free from side effects. WHO (2002) proclaimed that the 80% of world people



## Physicochemical and Phytochemical analysis of *Indigofera tirunelvelica* Sanjappa

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### Abstract

The healing worth of *Indigofera tirunelvelica* Sanjappa (Fabaceae) has actually been identified as an element of typical medicine for the treatment of numerous human disorders. The plant is being much explored, still lacks adequate proofs for the best variety has the greatest level of medical worths. The here and now research is focused on phytochemical screening of liquid and also ethanolic stem extracts of *I. tirunelvelica*. The unrefined essences of *I. tirunelvelica* exposed the existence of several biologically energetic phytochemicals with the high level of flavonoids phenols, alkaloids, as well as tannins. The initial phytochemical screening exposed the presence of numerous bioactive metabolites such as flavonoids phenols, alkaloids and tannins that can be screen for antioxidant studies.

**Key words:** *Indigofera tirunelvelica*; Stem, Herb and Secondary Metabolites.

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Published by JK Welfare &amp; Pharmascope Foundation

Journal Home Page: [www.pharmascope.org/ijrps](http://www.pharmascope.org/ijrps)

## Estimation of flavonoids and screening of *in vitro* antioxidant activity of various extracts of aerial parts of *Blepharis maderaspatensis* by hydroxyl radical and total antioxidant activity

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### Article History:

Received on: 20 Jul 2020

Revised on: 15 Aug 2020

Accepted on: 18 Aug 2020

### Keywords:

Blepharis  
maderaspatensis,  
hydroxyl radical,  
total antioxidant activity,  
flavonoids

### ABSTRACT

Antioxidants are substances that hamper or inhibit the oxidation of oxidizable substrates in the cells. The aerial parts of *Blepharis maderaspatensis* dry powder was extracted with various solvents (PE, EA and methanol) through Soxhlet extractor. The aerial parts of different concentrates (Pet.ether, ethyl acetate and methanol) of *Blepharis maderaspatensis* was evaluated for its *in vitro* antioxidant potential by hydroxyl radical, total antioxidant activity taking ascorbate used as standard for the both methods and total flavonoids content was estimated as equivalent to rutin. The methanolic concentrates of *Blepharis maderaspatensis* & standard exhibited antioxidant potential possessing IC<sub>50</sub> 210 µg/ml & 62 µg/ml (hydroxyl radical) 200 µg/ml & 57 µg/ml (Total antioxidant activity) respectively. An IC<sub>50</sub> value was originate that methanolic concentrates of *Blepharis maderaspatensis* more efficient in hydroxyl radical, total antioxidant activity compared EA & PE concentrates. The methanolic and EA concentrates of *Blepharis maderaspatensis* showed the total flavonoids content (11.230±0.22 and 2.858±0.56 mg of rutin equivalent/g of powder) respectively. The difference in scavenging potential of the extracts can be due to variation in the percentage of bioactive compound flavonoids present in methanolic extracts. *In vitro* antioxidant studies obviously show methanolic concentrates of *Blepharis maderaspatensis* have better antioxidant activity due to the presence of total flavonoids content.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11iSPL4.4266>

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### INTRODUCTION

Antioxidants are substances that hamper or inhibit the oxidation of oxidizable substrates in the cells. They resist the onslaught of free radicals ROS by triggering a battery of detoxifying enzymes or quenching the generation of ROS (Halliwell *et al.*, 1992). The human body is continuously bombarded with an array of free radicals (ROS, RNS) and non-radical entities. Radicals are more reactive and less stable compared to non-radical Oxidants. Free radicals can also be generated from these non-radical derivatives and Oxidants via biochemical responses in the living system (Diplock *et al.*, 1998). Hydroxyl



# FARMERS FACING PROBLEMS AND COMMERCIAL OPPORTUNITIES OF TINNEVELLY SENNA IN INDIA

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Article Received on 22/07/2019

Article Revised on 12/08/2019

Article Accepted on 02/09/2019

## ABSTRACT

Senna or Nila avarai or avuri (*Cassia angustifolia* (Vahl.) belongs to the family fabaceae, Senna is a largest genus of flowering and important medicinal plants in india and it is drought tolerant. Hence it is cultivated under rainfed condition in rich clay rise fields of drained soils by small and marginal farmers in tamilnadu, south india. Senna is a small, perennial, branched under-shrub grown for its medicinal value of leaves and pods which contain sennosides A,B,C,D, rhein, aloë-emodin, khempferi and iso-rhein in free and glycosides forms. it is one of the most useful purgatives, especially in case of habitual constipation. Besides being a laxative, senna is in splenic enlargements, anemia, thypoid enlargements, anaemia, typhoid, cholera, jaundice, rheumatism, tumours, foul breath and bronchitis, and probably in leprosy. The ease of cultivation and high price for the leaves is attracting farmers for large scale cultivation. The future is excellent for extending its cultivation and production of numerous value-added products from it's leaves and pods. The challenges for Senna cultivation and business are: Market exploitation of farmers by middlemen, price fluctuations of leaves, demand-supply fluctuations of leaves, limited exports, the indian domestic market is not support to the senna based herbal products.

**KEYWORDS:** Cultivation, Senna, farmers, facing challenges, south india.

## INTRODUCTION

In India, Tinnevely Senna (*C. angustifolia*) Andhra Pradesh and Karnataka, Pune (Maharashtra), Gujarat (Anand and Mehsana), Rajasthan (Kodhpur), Delhi and dry coastal districts of Tamil Nadu in Thoothukudi, Tirunelveli, Ramanathapuram and Madurai are the major states are concentrating on the cultivation of Senna. The total annual production of senna herbage is estimated to be around 8600 tonnes. The leaves and pods of a few other species of Cassia also possess laxative properties similar to those of *C. angustifolia*. Alexandrian senna is found growing in the wild in North African countries, including Ethiopia and Sudan. The international market receives leaves and pods of Alexandrian senna obtained from the North African countries in substantial quantities, accounting for about 25% of the international trade.<sup>[1,2]</sup>

Tirunelveli is a place in south India where senna was introduced in India for the first time in the mid-eighteenth century and it is extensively cultivated, processed, and exported to various countries through traditional port tuticorin under the brand name "Tirunelveli senna" hence the name. The drug senna is widely used as a purgative, laxative, expectorant, wound dresser,

antidysenteric, and carminative. Senna leaves are commonly used as natural laxative both in modern as well as in traditional systems of medicine.

The calcium sennoside is a popular form of dispensation useful in habitual constipation in modern medicine.<sup>[3]</sup> However, leaves are having international demand and preferred as ingredient of herbal tea in Europe.<sup>[4]</sup>

## Chemical constituents

The principal active constituents of senna are dimeric glycosides called Sennosides A, B, C, and D. The aglycones are composed of aloë-emodin + rhein for A and B and rhein + rhein for C and D. Other Phytochemicals sennoside C, sennoside D, rhein, chrysophanol, aloë-emodin, kaempferol, myricyl alcohol, salicylic acid, palmitic acid, stearic acid.

## Medicinal uses

Senna is a powerful cathartic used in the treatment of constipation, working through a stimulation of intestinal peristalsis. Senna also used as an expectorant, a wound dressing, an antidysenteric, and a carminative agent. It is useful in the treatment of gonorrhea, skin diseases, dyspepsia, fevers and hemorrhoids. The herb is used in



# SUSTAINABLE PEST MANAGEMENT SYSTEMS: BALANCING ECOLOGICAL AND ECONOMIC NEEDS IN AGRICULTURE – A REVIEW.

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DOI: 10.63001/tbs.2025.v20.i03.pp369-372

## KEYWORDS

Sustainable Pest Management, Integrated Pest Management (IPM), Biological Control, Eco-friendly Pesticides, Agricultural Sustainability.

Received on:

23-05-2025

Accepted on:

18-06-2025

Published on:

29-07-2025

## ABSTRACT

Sustainable pest management is a crucial aspect of modern agriculture, aiming to protect crops while minimizing environmental impact and ensuring economic viability. Traditional pest control methods, primarily relying on chemical pesticides, have raised concerns due to their adverse effects on ecosystems, human health, and biodiversity. This review explores sustainable pest management systems that integrate ecological principles and economic considerations. Approaches such as Integrated Pest Management (IPM), biological control, and the use of eco-friendly pesticides are examined for their effectiveness in reducing pest populations while maintaining environmental balance. The review emphasizes the importance of using diverse strategies tailored to specific agricultural contexts, including crop type, pest species, and local environmental conditions. Additionally, it addresses the economic benefits of sustainable pest management, including cost savings, improved crop yields, and long-term soil health. The paper concludes by highlighting the need for continued research and innovation to develop and implement pest management systems that are both ecologically sound and economically feasible, promoting the long-term sustainability of agricultural practices.

## INTRODUCTION

Sustainable pest management is a holistic approach to pest control that emphasizes the use of environmentally friendly methods while maintaining agricultural productivity. It seeks to achieve an equilibrium between managing pest populations and promoting ecological and economic stability. The growing reliance on traditional chemical pesticides has raised significant concerns due to their negative impacts on ecosystems, soil health, and human well-being. Pesticides, although effective in controlling pest populations, often lead to unintended consequences such as the loss of non-target species, the disruption of beneficial organisms (e.g., pollinators, natural predators), and contamination of water sources (Goulson, 2013). These chemicals not only harm the immediate agricultural

environment but also persist in the ecosystem, leading to long-term ecological imbalances.

One of the major challenges posed by conventional pesticide use is the development of pest resistance. Over time, pests exposed to chemicals evolve resistance, rendering the pesticides less effective and leading to the need for stronger, more toxic chemicals (Pimentel, 2005). This "pesticide treadmill" can lead to escalating costs and further environmental degradation. In addition, pesticides contribute to the loss of biodiversity, as they indiscriminately affect both harmful and beneficial organisms (Van der Weijden, 2018). The long-term impacts of pesticide use on soil health, water quality, and biodiversity have prompted a shift toward more sustainable alternatives. The rise in pesticide resistance and the increasing awareness of its environmental consequences have underscored the importance of exploring



# Evaluation of Anticancer Potential of *Mimosa diplotricha* Ethanolic Leaf Extract on N-Methyl-N-Nitroso Urea Induced Colorectal Carcinogenesis in Wistar Albino Rats

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## ABSTRACT

**Background:** Colorectal Cancer, (CRC) ranks third among global cancer incidence statistics and occupies fourth position as far as cancer related death is concerned and the aim of the study is to evaluate the therapeutic potential of *Mimosa diplotricha* ethanolic leaf extract in chemically induced colorectal carcinogenesis in Wistar albino rats. **Materials and Methods:** CRC was induced by intrarectal instillation of N-Methyl-N-Nitrosourea (MNU), 2mg per rat in 0.5ml of distilled water three times a week for five weeks. Rats were grouped as control, induced, induced and standard drug treated (15mg/kg.bw), induced and plant extract treated (in two doses 200mg/kg.bw and 400mg/kg.bw) and normal rats with respective plant extract treatment (200mg/kg.bw and 400mg/kg.bw). Treatment were carried out for 60 days followed which animals were euthanized and serum markers, oxidative stress, microbial enzymatic, histological and immunohistochemical parameters were analysed. **Results:** *M. diplotricha* was found to be effective in the down regulation of serum inflammatory and tumour markers like tumour necrosis factor alpha, transforming growth factor beta, carcinoembryogenic antigen and colon cancer specific antigen-4 levels. Oxidative stress parameters and histological data also supported the therapeutic efficacy of *M. diplotricha*. Expression of anti-apoptotic protein Bcl-2 was also found to be downregulated in induced animals treated with *M. diplotricha* as evident from immunohistochemical data. **Conclusion:** The results of present research suggest that *M. diplotricha* ethanolic leaf extract showed a significant therapeutic potential against chemically induced colorectal carcinogenesis.

**Key words:** CRC, Wistar rats, MNU, *Mimosa diplotricha*, Serum markers, Bcl-2.

Submission Date: 02-12-2020;  
Revision Date: 23-12-2021;  
Accepted Date: 28-01-2022

## INTRODUCTION

Cancer constitutes to be the second leading cause of death globally next to cardiovascular disease and characterized by the expression of a normal cellular phenotype into a transformed one. The whole process of transformation is mediated by both extrinsic and intrinsic factors accompanied by a cascade of molecular events resulting in cellular proliferation, tumor formation and progression of malignancy. Colorectal cancer (CRC) is a frequently encountered gastrointestinal malignancy and as per estimates of American Cancer Society based on National

Centre for Health Statistics data about 147,950 people would be diagnosed with colorectal cancer and 53,200 patients would die of the malignancy in 2020 of which 17,930 case registries and 3,649 individuals in both sexes would be below age 50.<sup>1</sup> Increase in CRC incidence is mainly due to change in dietary habits that contribute to elevated level of free radicals, changed life style and environmental conditions. CRC initiates as small out growths called polyps or aberrant crypt foci in inner lining of colonic mucosa which gradually progress into invasive adenoma and transforms into

DOI: 10.5530/IJper.56.2.69  
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# Phytotherapeutics in Colorectal Cancer with Emphasis on Target Molecular Signaling Pathways: A Review

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Madathil *et al.*: Phytotherapeutics in Colorectal Cancer

Colorectal cancer is a major global health concern in terms of incidence and mortality. Treatment strategies constitute conventional surgery, radiation, chemotherapy and innovative measures like targeted and immunotherapy. All these treatment options are associated with considerable side effects which demand an alternative regime with enhanced therapeutic efficacy, specificity and less toxicity. Phytomedicine or herbal therapeutics is an emerging trend, as medicinal alternative and botanicals constitute an immense treasure of bioactive principles in the form of secondary metabolites with significant pharmacological attributes. Phytochemicals like curcumin, resveratrol, quercetin, lycopene, organosulphur compounds etc., are few among isolated herbal constituent proved to be effective against colorectal carcinogenesis in both *in vitro* and *in vivo* trials. These bioactive ingredients exert apoptotic, antimetastatic, antiangiogenic and antiproliferative properties by targeting various signaling pathways like Wnt/ $\beta$ -catenin, nuclear factor-kappa B, phosphoinositide 3 kinase/protein kinase B, epidermal growth factor receptor, vascular endothelial growth factor, epithelial-mesenchymal transition, resulting in up regulation and down regulation of associated target genes and proteins. Consolidation of the information in the present review highlights the significance of phytomedicine or herbal medicine in oncology therapeutics as conventional and innovative treatment options are associated with serious health hazards.

**Key words:** Colorectal cancer, anticancer, phytotherapeutics, bioactive compounds, chemoprevention, signaling pathways

Colorectal cancer is a gastrointestinal malignancy affecting parts of large intestine and rectum and occupies third position with respect to incidence and ranks fourth among overall cancer related mortality worldwide<sup>[1]</sup>. As per estimates of American Cancer Society based on National Centre for Health Statistics data about 147 950 people will be diagnosed with colorectal cancer and 53 200 patients will die of the malignancy in 2020 of which 17 930 case registries and 3649 individuals in both sexes will be below age 50 y<sup>[2]</sup>. Colorectal cancer initiates as small outgrowths called polyps in inner lining of colon or rectum which gradually transforms into a malignant growth of colonic epithelium as a result of cumulative genetic and epigenetic mutations<sup>[3]</sup>. About 60 % of colorectal malignancy is of sporadic phenotype without any family background, 30% is familial and 10% belongs to hereditary phenotype with inherited genetic mutations<sup>[4]</sup>. Colorectal cancer is designated into three genetic variants; Chromosomal Instability (CIN) leading to deletion of wild allele of tumor suppressor genes (Adenomatous Polyposis Coli (APC), p53 etc), Microsatellite Instability (MSI)

due to incorporation incorrect bases during Deoxyribonucleic Acid (DNA) replication as result of mutation in DNA (Mismatch Repair genes (MMR): MutL Homolog (MLH)-1, MLH2, Mismatch Repair Endonuclease (PMS2) etc.,) and aberrant DNA methylation with hyper methylation at Genetic phenotype of colorectal malignancy (CpG) island sequence. p53, APC, p27, Loss Of Heterozygosity (LOH) 18q, MSI, deletion 5 q allele constitute tumour suppressor genes and Kirsten Rat Sarcoma (K-RAS) virus oncogene homolog, Transforming Growth Factor(TGF)- $\beta$  1, Erb-B2, TGF- $\alpha$ , Epidermal Growth Factor Receptor (EGFR) (Erb-B1) are oncogenes mainly associated with colorectal cancer. Molecular signaling pathways like Wnt/APC/ $\beta$ -catenin, TGF- $\beta$ /Signaling molecules (Smad), Nuclear Factor Kappa B (NF- $\kappa$ B), Phosphoinositide 3-Kinase (PI3K)/Protein

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## Review Article

# Molecular genetics involved in the pathogenesis of colorectal cancer: a review

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Received: 11.11.20, Revised: 04.12.20, Accepted: 07.01.21

## ABSTRACT

Colorectal Cancer, (CRC) is the third most frequently diagnosed neoplasm globally and found to be a major cause of mortality in terms of gastrointestinal malignancy. Risk factors associated with CRC development include hereditary factors, age, lifestyle, defective alimentary habit and chronic gastric inflammation. Molecular genetics of CRC is highly heterogeneous and involves accumulation of genetic and epigenetic mutation. Genetic variants of CRC include Chromosomal Instability (CIN), Microsatellite Instability (MSI) and CpG Island Methylation Phenotype (CIMP) involving crosstalk between various molecular signaling pathways like Wnt/ $\beta$ -catenin, PI3K/AKT pathway, NF- $\kappa$ B pathway etc and a consortium of genes and proteins contributing in whole process of neoplasm onset and progression. An understanding of genetic mechanism will help in developing novel biomarkers for better diagnosis and effective treatment strategies by targeting genes and molecular signaling pathways involved in evolution of carcinoma. Upgrading molecular genetics will help in developing novel approaches in targeted therapy employing monoclonal antibodies. Following review provides a basic overview of genetic mechanism involved in colorectal carcinoma.

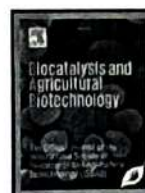
**Keywords:** Colorectal cancer, Genetics, Signaling pathways, Genes.

## INTRODUCTION

Colorectal cancer (CRC), constitute to be a common type of gastrointestinal malignancy affecting parts of large intestine and rectum, which occupies third position with respect to incidence and fourth leading cause of cancer related mortality worldwide [1]. Incidence of CRC is found to be increasing in the present scenario and as per the estimates based on National Centre for Health and American Cancer Society Statistics data about 147,950 people will be diagnosed with colorectal cancer and 53,200 patients will die of the malignancy in 2020 [2]. Colorectal malignancy usually initiates as small polyps or benign lesions called adenoma of colonic epithelium which in course of time become malignant, invade colonic mucosa, gradually proliferate and become metastatic [3]. The whole process of carcinoma initiation and progression harbor a cascade of genetic and epigenetic mutation that results in the transformation of a normal colonic mucosa into hyperproliferative phenotype. Based on the nature of origin 70% of CRC is classified to be of

sporadic type without any genetic background and 25% as hereditary/familial phenotype [4]. Innovation in molecular biology results in elucidation of molecular signaling pathways involved in CRC. Generally CRC is found to be genetically heterogeneous and involves varied signaling pathways and gene mutations. The first genetic model of CRC was proposed by Fearon and Vogelstein in 1990. According to their model colon malignancy proceeds through premalignant polyps or adenoma-carcinoma sequence (Fig: 1). Mutation in Adenomatous polyposis coli (APC) gene results in adenoma formation followed accumulation of mutation in genes like KRAS, TP53, DCC resulting in inhibition of tumour suppressor genes and upregulation of oncogenes which manifests as colon malignancy [4,5]. Later various carcinogenic models were proposed for CRC which helps in better understanding of colon neoplasm and helps in employing more effective diagnosis and treatment strategies in clinical practice.





## Antidiabetic and antilipidemic effect of *Clerodendrum paniculatum* flower ethanolic extract. An in vivo investigation in Albino Wistar rats

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### ARTICLE INFO

#### Keywords:

Antidiabetic activity  
*Clerodendrum paniculatum*  
Anti-hyperglycemic activity  
Antioxidant activity  
Lipid profile

### ABSTRACT

**Background and purpose of the study:** The goal was to evaluate the effects of ethanolic extract of *Clerodendrum paniculatum* flower (CPF) on antidiabetic and antilipidemic tests indices of experimentally-induced hyperglycemic rats.

**Methods:** High Fat Diet (HFD) treated Streptozotocin (STZ) induced diabetic rats were used for this study. The acute toxicity of ethanolic extract of *C. paniculatum* flower (2000 mg/kg body weight) and antidiabetic effect of CPF (200 mg/kg body weight) were studied in rats. Glibenclamide (1.25 mg/kg body weight) was used as a reference drug. For antihyperglycemic evaluation, glucose, C-peptide, Insulin, Haemoglobin and glycosylated haemoglobin (HbA1c) levels were analyzed. Low density lipoprotein (LDL), High density lipoprotein (HDL), triglycerides and total cholesterol were analyzed in rats. The enzymic antioxidant activity (super oxide dismutase (SOD), glutathione peroxidase (GPx), glutathione S transferase (GST) and Catalase) and non-enzymic antioxidant activity (vitamin C, vitamin E and reduced glutathione) of *C. Paniculatum* flower were evaluated. Important carbohydrate metabolizing enzymes like Glucose 6-phosphatase, Fructose 1 and 6 diphosphatase and hexokinase were determined in experimental rats.

**Results:** After the oral administration of CPF extract significantly reduced glucose levels and cholesterol values. Extract improved enzymic and non enzymic antioxidant levels.

**Conclusion:** CPF extract is useful in controlling blood glucose level as well as improving lipid metabolism and body weight in rats with induced diabetic rats.

### 1. Introduction

Diabetes Mellitus (DM) is a complex metabolic disorder characterized by chronically elevated blood sugar level (Cho et al., 2018). Type 2 DM is characterized by hyperglycemia in the dysfunction of insulin resistance and lack of insulin. Diabetes can cause many other complications such as renal failure, ketoacidosis, skin complications, retinopathy and increasing cardiovascular disease (Katulanda et al., 2020).

Practitioners of different branches of medicine such as Ayurveda, Homeopathy and Allopathy have been employing various methods of treatment to effectively curtail DM. The management of diabetes is a challenge to modern medicine as Allopathic medicine has limited application in the alleviation of pancreatic ailments. The abiding challenge faced by traditional herbal medicines is the lack of scientific validation (Pang et al., 2019).

Ayurveda, the most popular branch of medicine among thousands of villagers in India, and similar traditional systems of the world such as the Chinese medicine depend to a large extent on the use of herbal drugs for the treatment of DM (Liu et al., 2017). India is a country with a rich history of natural and traditional medicine. The antihyperglycemic activity of these drug formulations is due to the ability to restore the action of the pancreas by either an increase in insulin output or inhibition of the intestinal absorption of glucose. All these highlight the importance of an alternative therapy with plant-derived drugs (Tran et al., 2015). An ideal oral treatment for diabetes is a drug that controls the glycemic level and prevents the development of micro-angiopathy and macro-vascular complications in cardiovascular and renal systems associated with diabetes mellitus.

In a recent report, the World Health Organization (WHO) cited that a major chunk of the world population (70–80%) depends on herbal treatment as their primary medicines. In the present study, *Cleroden-*

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<https://doi.org/10.1016/j.bcab.2021.102095>

Received 17 February 2021; Received in revised form 14 June 2021; Accepted 7 July 2021

Available online 13 July 2021

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# Toxicological Evaluation of the Repeated Dose Administration of the Ethanolic Extract of *Azolla microphylla* in Wistar Albino Rats

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History: Received 2020-09-30; Accepted 2020-10-06; Published 2021-05-24

## Abstract

*Azolla microphylla* is an easily cultivable aquatic plant with the commendable nutritious property. Recent reports on *Azolla* species emphasize the therapeutic potential of the plant extracts. Moreover, the same genus of plant also had displayed antioxidant potential owing to its free radical scavenging tendency. Although these attributes were identified, a study investigating the toxicological property of different dosages of ethanolic extract of *A. microphylla* (EAM) is not yet reported. Thus the present study aims for the *in vivo* toxicological evaluation of the EAM in Wistar strain of rats. Daily doses of 0, 250, 500, 1000 and 2000 mg/kg body weight of EAM were administered orally to group-I, group-II, group-III, group-IV & group-V rats, respectively for 14 days. Biochemical and histopathological studies were established through standard methods. The acute toxicity results suggest the non-toxic nature of the extract supported with the absence of mortality and toxic symptoms until 72 h of observation. The results of sub-acute toxicity study in the extract-treated rats (group-II to group-IV) indicate non-significant changes to the biochemical (total protein, AST, ALT, LDH, albumin, globulin, urea, creatinine, cholesterol, & triglycerides), hematological (Hemoglobin, RBCs, WBCs, platelets, monocytes, lymphocytes, & neutrophils), and histopathological observations when compared to the control group of rats. However, group-V rats were treated with 2000 mg/kg b.w. exhibited statistically significant variations to most of the biochemical and hematological parameters although no mortality/physical toxic signs were reported till the end of the experimental period. Thus, the sub-acute toxicity results suggest that the extracts were non-toxic and safe to rats between 250-2000 mg/kg b.w. concentration under 14 days observational period. Moreover, as there was no mortality upto 2000 mg/kg b.w., 50% lethal dose ( $LD_{50}$ ) could not be determined, and hence it is considered to be greater than 2000 mg/kg/day.

**Keywords:** *Azolla microphylla*, Hematology, Lethal Dose, Toxicology

## 1. Introduction

Although a complex paradigm of allopathic drugs are available in the market for treating chronic diseases like Coronary Heart Disease (CHD), type-2 diabetes and multiple types of myeloma, there is growing interest among the patients to choose folklore-based treatment due to its cost-effectiveness and lessened side effects. The following factors such as economy, swift availability and decreased post-treatment complications are attractive factors in the choice

of folklore medicines against numerous diseases<sup>1</sup>. Previous studies indicate that a significant number of Indian populations living in tribal zones and rural areas are dependent on medicinal plant therapy for their primary health care requirement<sup>2</sup>. Accordingly, medicinal plant researchers have leveraged their research in the exploration of the phytochemicals excelling in therapeutic potential against various diseases and disorders. It is to be emphasized that the therapeutic efficiency of the extracts are linked to the antioxidant properties of phytonutrients present in plants.

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## RESEARCH ARTICLE

# Hepatoprotective Effect of *Azolla microphylla* on Isoproterenol-induced Rats and the Identification of Active Compound through HPTLC and GC-MS Analysis

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**Abstract: Aim:** To study the pretreatment effect of ethanolic extract of *Azolla microphylla* (EAM) on rat liver induced with Isoproterenol (ISO) and to identify the phytochemicals present in EAM using HPTLC and GC-MS techniques.

**Materials and Methods:** 42 male Wistar rats were divided into 7 groups. Rats were pre-treated with EAM (250 and 500 mg/kg bw) orally for 28 days and induced with ISO (85 mg/kg; intra-peritoneal) on the 29<sup>th</sup> and 30<sup>th</sup> days. Blood and liver samples were collected from all the rats on the 30<sup>th</sup> day for biochemical and histopathological observations. HPTLC and GC-MS analyses of EAM were done using the standard protocols.

**Results:** The ISO-induced group of rats displayed a significant decrease in the hepatic tissue level and activities of total protein and aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP) enzymes, respectively. Moreover, a significant decline in enzymatic and non-enzymatic antioxidants levels was spotted in the same group. However, EAM pretreatment for 28 days significantly protected the rat liver from the aforementioned alterations. Nevertheless, histopathological analysis revealed central vein dilation, necrosis, and infiltration of inflammatory cells in the ISO-induced group, wherein, EAM pretreatment significantly protected the hepatocytes from the above-mentioned changes indicating its antioxidant and cytoprotective potential. HPTLC analysis displayed the presence of flavonoids. The GC-MS analysis confirmed the presence of quercetin in EAM.

**Conclusion:** The overall results suggest that EAM pretreatment possesses an ameliorative effect against the ISO-induced oxidative damage in the rat hepatocytes.

**Keywords:** *Azolla microphylla*, GC-MS analysis, isoproterenol, liver, necrosis, quercetin.

## 1. INTRODUCTION

Generally, the liver is one of the vital organs exposed to numerous varieties of exogenously harmful substances, as it is the major site of the biotransformation. Hence, it is quintessential to safeguard the liver against the toxic substances for retaining normal metabolism. Indeed, many allopathic drugs are known for the generation of free radicals, which ultimately culminates in oxidative damage to the cell [1]. ISO is a sympathomimetic allopathic drug commonly used to treat congestive heart failure, arrhythmia and other cardiac disorders. However, administration of the ISO at supraphy-

siological concentrations can mimic cardiac and hepatic pathologies in rats and it has been used extensively in the phytochemical research. Enhanced generation of reactive oxygen species (ROS) and lipid peroxidation has been reported as one of the probable mechanisms for the physiological damage caused by ISO. Nevertheless, there exist some limitations in the usage of allopathic medicines during acute hepatotoxicity owing to the reduced ability of the liver to metabolize the therapeutic compounds. Plant-based drug/extract is the ideal prospective remedies to counter such challenging situations. *Azolla* species coming under the division pteridophyta is an aquatic water fern with the potential nitrogen-fixing ability and acts as a biofertilizer. Moreover, the plant contains appreciable amounts of nutritional as well as phytochemical components [2, 3]. Recent reports on *Azolla* species reported that the plant possesses antioxidant [4], antimi-

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# INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

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Journal Home Page: [www.pharmascope.org/ijrps](http://www.pharmascope.org/ijrps)

## Acute and Sub chronic Toxicological evaluation of ethanolic leaf extract of *Sida acuta* Burm.f in Wistar albino rats by analyzing biochemical, hematological and histochemical parameters

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### Article History:

Received on: 01 Mar 2020  
 Revised on: 25 Apr 2020  
 Accepted on: 09 May 2020

### Keywords:

*Sida acuta* Burm.f,  
 Toxicity,  
 Lethal dose

### ABSTRACT

*Sida acuta* burm.f belongs to *Malvaceae*, the mallow family and enjoys tropical and pantropical distribution. The plant is usually known as wireweed in the countryside, and it is highly medicinally valued traditionally and ethnobotanically promised. The species have literature reports on scientific attributes like abortifacient, anthelmintic, diuretic, anti-rheumatic, antipyretic and wound healing properties. The present study is concerned with acute and sub-chronic toxicity evaluation of ethanolic extract of *Sida acuta* Burm.f leaves in Wistar albino rats. Acute toxicity evaluation was conducted for 14 days. Acute doses of 100, 250, 500, 1000 and 2000 mg/kg BW were administered to test groups of animals under consideration on the first day of experimental evaluation with three animals in each of total six groups along with control. For the remaining 13 days, animals were observed for noted behavioural changes and body weight were recorded respectively for 7<sup>th</sup> and 14<sup>th</sup> day of experimental analysis. At the end of the trial period, all the animals were euthanised, and various biochemical parameters and histopathological examination were carried out to assess the toxicity of extract. The present study revealed that the ethanolic extract of *Sida acuta* Burm.f leaves is non-toxic up to 2000mg/kg body weight. Subchronic toxicity evaluation was conducted for 28 days with several doses 100, 200, 300, 400 and 500mg/kg BW. Control rats without any treatment were maintained during the entire period of experimental analysis. The results of subchronic toxicity parameters indicate no significant changes to the biochemical parameters (glucose, urea, uric acid, creatinine, AST, ALT and Cholesterol) haematological and histopathological observation in comparison to the control groups. Based on subchronic toxicity parameters data, effective doses (200 and 400mg/kg BW) is determined for further cancer (colon) study in Wistar albino rats.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i3.2614>

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### INTRODUCTION

Herbal medicines and medicinal herbs are receiving considerable importance worldwide. According to the report of the WHO (World Health Organization), about 80% of people in developing countries depend on herbal medicine for their preliminary health care due to its easy availability, low cost and convincing results. In developed countries also, the public interest in herbal prescription has dramatically increased (WHO, 2002). The bioactive principles of medicinal plants constitute the essen-



## Research Article

# The effect of *Sida acuta* on bacterial enzymes in azoxymethane-induced experimental colon cancer

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Received: 19.01.20, Revised: 14.02.20, Accepted: 29.03.20

## ABSTRACT

Colon cancer constitutes as a serious global menace in incidence and mortality, in spite advances in diagnosis and treatment. It is due to changed life style and environmental factors. The effect of *Sida acuta* burm.f leaves, a herbal alternative, on bacterial enzymes as a prognostic marker in azoxymethane - induced experimental colon cancer is the aim of this study. A total of 21 male Wistar albino rats (120-150g) divided into seven groups of three rats in each group. Experimental colon carcinogenesis was induced by subcutaneous administration of azoxymethane 15mg/kg bw weekly once for two weeks. Following induction animals were subjected to treatment with different doses of ethanolic extract of *Sida acuta*. At the completion of the course of experimental duration, fecal matter and colon tissues was collected, homogenized and subjected for the assay of bacterial enzymes such as  $\beta$ -glucosidase, glucuronidase, and Mucinase. The ethanolic extract of *S. acuta* showed significant protective effect with the manifestation of significant reduction in enzyme activity of fecal matter and colon tissues  $\beta$ -glucosidase, glucuronidase, and Mucinase. Thus this study ascertains the hypothetical use of ethanolic extract of *S. acuta* burm.f leaves as a chemo protective agent for colon cancer development.

**Keywords:** *Sida acuta*,  $\beta$ -glucuronidase,  $\beta$ -glucosidase, mucinase, colon cancer, azoxymethane

## INTRODUCTION

Colorectal cancer occupies third position as the most frequently diagnosed neoplasm worldwide and contributes to commonly diagnosed malignancy in advanced provinces in terms of higher ratio of disease-progression and death [1]. Changes in food habits and life style of mankind again responsible for increased incidence of colon carcinoma [2]. Extrinsic factors such as smoking, alcohol, aging, diet and sedentary lifestyle are the crucial environmental factors responsible for colon cancer [3]. The colonic microbial flora may play an important part in the progression of colon carcinoma [4]. Changes in the constitution and concentrations of certain intestinal flora were found to be progressively increased in high risk colon cancer groups [5]. In recent research there is increased demand to develop an in vivo model for better understanding of gastrointestinal tumors [6]. Commonly used inducers in colonic malignancy in in vivo model constitute DMH (1,2-dimethylhydrazine) and AOM (azoxymethane). Chemically induced colon tumors, for example, may effect from procarcinogen activation possibly mediated by bacterial enzymes [7,8]. Carcinogens are excreted in bile as glucuronides and activated in the intestinal tract through enzymatic hydrolysis by  $\beta$ -

glucuronidase [9-11]. Alternatively, introduction of a  $\beta$ -glucuronidase inhibitor narrowed the incidence of azoxymethane induced colon carcinoma in rats [12]. These bacterial enzymes are visible in rat feces and their level usually shows a proportionate increase with the advancement of malignancy. A convincing decline in enzyme levels on treatment with herbal extract can be directly correlated with the chemo preventive potential of a particular plant and can be assessed for further anticancer evaluation.

*S. acuta* (Malvaceae) Family Malvaceae is vertical constant bush distributed across the humid tropical areas of Nepal and India [13]. It is believed to have originated from Central America and is considered as a weed. In some areas the entire plant is broadly used in traditional medication and ayurvedic formulations [14]. *S. acuta* is also prescribed as a remedy for treatment of asthma, cold, malaria, diarrhea, headache, fever, skin diseases, urinary disease, ulcer, snake bite, facial paralysis and sterility, and used as a sedative too [15-19]. Thus this study aims to analyze the activity of *Sida acuta* upon fecal bacterial enzymes in azoxymethane-induced investigational colorectal cancer.





# INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

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Journal Home Page: [www.pharmascope.org/ijrps](http://www.pharmascope.org/ijrps)

## Phytochemical and chromatographic characterization of *Mimosa diplotricha* Wright ex. Sauvalle ethanolic leaf extract and assessment of antioxidant potential and anti-proliferative effect on colorectal cancer (HCT-116) cell lines

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### Article History:

Received on: 22 Feb 2020  
Revised on: 17 Mar 2020  
Accepted on: 17 Apr 2020

### Keywords:

*Mimosa diplotricha*,  
GC-MS,  
HPTLC,  
Antioxidant,  
Anti proliferative,  
HCT-116

### ABSTRACT



Present study aims to evaluate phytochemical and chromatographic profile, along with antioxidant and anti proliferative properties of *Mimosa diplotricha* ethanolic leaf extract. Qualitative screening of phytoconstituents by consecutive solvent extraction in increased polarity basis and standardization of potential extract based on phytochemical elution profile was done. Selected secondary metabolites like phenols, flavanoids, tannins and alkaloids were quantified in ethanolic extract. Chromatographic profile was determined by HPTLC and GC-MS analysis. *In vitro* antioxidant potential was assessed by DPPH, superoxide, nitric oxide, hydrogen peroxide and hydroxyl radical scavenging assay. Ferric-reducing antioxidant power assay (FRAP) and reducing potential of the respective extract were also determined. Anticancer potential was confirmed by cytotoxic screening in colorectal (HCT-116) cancer cell lines by MTT assay. Qualitative phytochemical analysis and chromatographic profile reveal a phytoconstituent rich profile for the ethanolic leaf extract. The amount of, phenols ( $56 \pm 0.57$  mg/g), flavanoids ( $27 \pm 0.76$  mg/g), tannins ( $33 \pm 0.15$  mg/g) were quantified as equivalent of gallic acid, quercetin and tannic acid standards respectively and alkaloids ( $2.51 \pm 0.47$  mg/g of extracted plant material) were expressed based on respective analysis. Results also reveal convincing antioxidant potential for respective extract. *In vitro* cytotoxicity confirmed by MTT assay represents an  $IC_{50}$  value of  $97.82 \mu\text{g/ml}$ . From the above results it can be concluded that *M. diplotricha* has got pharmacologically significant phytoconstituents and therapeutic active ingredients as evident in HPTLC and GC-MS analysis. This is further supported by considerable antioxidant and anti proliferative properties observed in respective assays.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i3.2656>

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### INTRODUCTION

Plant kingdom with its medicinally significant herbs and pharmacologically active phytochemical principles constitute the foundation basis of therapeutics historically, traditionally and also in folk lore remedies. Literature reference of plants as cure to pathogenesis dates back to vedic times (*Rigveda*, 4500-1600 BC); Egyptian papyrus, 1550 BC and Hippocrates holistic system which sets the beginning of modern system of medicine (Agrawal and Paridhavi, 2007; Atanasov *et al.*, 2015). Secondary





Received on 20 June 2018; received in revised form, 03 October 2018; accepted, 05 October 2018; published 01 March 2019

## IDENTIFICATION OF ACTIVE PHARMACEUTICALS OF *SIDA ACUTA* BURM. F. LEAVES USING GC-MS AND HPTLC FINGERPRINTING

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### Keywords:

*Sida acuta*,  
Sesquiterpenoids, Terpenes,  
Glutathione

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**ABSTRACT:** *Sida acuta* is one of the medically active plants used for the treatment of multifaceted diseases. However, an elaborated investigation on the phytochemical composition of the ethanolic extract of the leaves of this plant is yet to be deciphered. So, in this quantification of phytochemicals, *in-vitro* free radical scavenging activity, enzymatic and non-enzymatic antioxidant levels in the fresh leaves, HPTLC fingerprinting and GC-MS analysis in the ethanolic extract of *Sida acuta* leaves were done. *In-vitro* antioxidant activities were assayed using DPPH, ABTS, nitric oxide, hydroxyl radical and ferric ions, while ascorbic acid is used as the standard. The results indicated the presence of flavonoids, tannins, phenols, and alkaloids in a reasonably good amount which has substantiated the results of HPTLC. All the tested antioxidants were present prominently in the leaves, specifically catalase and glutathione peroxidase, which may be responsible for the prominent radical scavenging tendency of the extract against the tested free radicals. The GC-MS analysis observed the presence of 35 different compounds each belonging to different classes such as sterols, flavonoids, terpenes, heterocyclic aromatic compounds, phenols, fatty acids, vitamins, alkaloids, and sesquiterpenoids. The results indicate that the ethanolic extract of *Sida acuta* leaves collected from the Tuticorin District of Tamil Nadu is an effective scavenger of free radicals and has the potential to be used as a natural antioxidant which is attributable to the rich presence of its secondary metabolites.

**INTRODUCTION:** The importance of herbal extracts and phytochemical formulation in the treatment of various ailments are gaining much attention due to their various pharmacological effects as well as their affordability to common people in many parts of the world.

Though plenty of pharmaceutical companies manufacture a wide range of allopathic medicines, due to their nature of causing increasing side effects, the public who suffer from chronic diseases tends to opt for alternative/traditional medicines<sup>1</sup>.

It is an inevitable fact that increasing research on ethnomedicine could pave the way for the discovery of novel therapeutic agents against plenty of outstanding diseases in the current scenario. Interestingly, WHO has recognized the significance of traditional medicine in the health-care sector and has assessed that approximately eighty percent of the population living in the developing countries

<p>QUICK RESPONSE CODE</p> 	<p>DOI: 10.13040/IJPSR.0975-8232.10(3).1194-07</p> <p>The article can be accessed online on <a href="http://www.ijpsr.com">www.ijpsr.com</a></p> <p>DOI link: <a href="http://dx.doi.org/10.13040/IJPSR.0975-8232.10(3).1194-07">http://dx.doi.org/10.13040/IJPSR.0975-8232.10(3).1194-07</a></p>
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## Effect of Hydro Alcoholic Extracts of *Boswellia serrata* and *Terminalia bellerica* Against Cyclo-Oxygenase and Lipoxygenase Enzymes- An *In Vitro* Approach

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Received: 11<sup>th</sup> Jul, 17; Revised 19<sup>th</sup> July, 17, Accepted: 15<sup>th</sup> Aug, 7; Available Online: 25<sup>th</sup> Aug, 17

### ABSTRACT

**Introduction:** Inflammation is a key mediator in plenty of important physiological abnormalities like cancer, myocardial infarction and arthritis. Natural anti-inflammatory agents are of great demand owing to its decreased side effects and increased curative properties. **Aim:** To investigate the *in vitro* inhibitory effect of three different concentrations of hydroalcoholic extract of *Boswellia serrata* (BS) and *Terminalia bellerica* (TB) on COX-2 and LOX-2 enzymes. **Materials and Methods:** Three different concentrations of hydroalcoholic menstruum of BS and TB were prepared using the standard procedures. The *in vitro* inhibitory activities of COX-2 and LOX-2 were performed using previously mentioned methods with minor modifications. **Results:** Among the different concentrations used the 90:10 menstruum of BS at 12 mg/ml displayed maximum inhibitory potential against COX-2 enzyme when compared to the same concentration of TB extract. This is suggestive that the majority of bioactive compounds present in BS was alcohol soluble and hence elicited maximum inhibition potential at 90 % ethanol ratio. A similar pattern of results were observed against LOX-2 enzyme as well. **Conclusion:** From the results it is concluded that the 90:10 hydroalcoholic extract of *Boswellia serrata* and *Terminalia bellerica* exhibit appreciable percentage of COX-2 and LOX-2 inhibition, which could be attributed to the ethanol soluble bioactive components present in the extract.

**Keywords:** Inflammation, *Boswellia serrata*, *Terminalia bellerica*, cyclooxygenase activity, Lipoxygenase activity

### INTRODUCTION

*Boswellia serrata* is one of the most valuable medicinal plants used in ayurvedic medicine and also the extracted active components are key ingredients in allopathic medicines. The exudates from this family (Burseraceae) of tree called *Salai*, an oleo gum-resin, is collected by making incision made on the trunk of the tree, which is then stored in a specially made containers. Earlier research indicates that the major components of the exudates constitute resin and essential oils in the ranges of 30-60% and 5-10%, respectively<sup>1</sup>. Interestingly this resin and oils are soluble in organic solvents. The remaining part of this exudates is made up of polysaccharides (65% arabinose, galactose, and xylose) which are water soluble. The key phytochemicals of the resinous part is identified as monoterpenes ( $\alpha$ -thujene), diterpenes (incensole, incensole oxide, iso-incensole oxide), a diterpene alcohol (serranol), triterpenes ( $\alpha$ - and  $\beta$ -amyrins), pentacyclic triterpenic acids (boswellic acids), tetracyclic triterpenic acids (tirucall-8,24-dien-21-oic acids) and many more to be listed<sup>2&3</sup>. It has been proved that the clinical trials of gum-resin of *Boswellia serrata* has displayed improved symptoms in osteoarthritis and rheumatoid arthritis patients<sup>4</sup>. In addition to this, other researchers have summarized the ameliorative actions of boswellic acids

extracted from the same tree on the molecular level of animal trials and human patients suffering from inflammation and cancer<sup>5</sup>. Despite these two roles there are plenty of other available research data suggesting importance of this tree.

*Terminalia bellerica* belongs to the family of Combretaceae is also a well-known tree used for folklore potential uses. Eventhough various parts of the tree contains different action levels, the fruits of this tree are massively used because of its multifaceted herbal implications such as laxative, astringent, anti-helminthic and antipyretic, treatment of hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhea, coughs, hoarseness of voice, eye diseases and scorpion-sting. Kernel of the fruit is useful as a narcotic as well as has purgative action and chronic usage is well tolerated in mice<sup>6</sup>. The crude extracts from various parts of this plant have been fractionated and purified and the results identified that the extract possesses constituents such as glucoside, gallo-tannic acid, essential oils, ellagic acid, gallic acid, lignans, tannins, ellagic acid, ethyl gallate, galloyl glucose and chebulic acid, phyllembin,  $\beta$ -sitosterol mannitol, glucose, fructose and rhamnose<sup>7</sup>. These compounds might be the responsible factor for the pharmacological activities such as antimicrobial,

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## Phytochemical Screening and Free Radical Scavenging Activity of Chloroform Extract of *Sida acuta* Burm. F.

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### ABSTRACT

*Sida acuta* is one of the Indian medicinal plant which belongs to the family Malvaceae. The whole plant is reported to have many biological activities such as abortifacient, anthelmintic, antiemetic, demulcent, diuretic, aphrodisiac, stomachic, diaphoretic, antipyretic and wound healing properties. Therefore main aim of the present study is to evaluate the phytochemical constituents and the free radical scavenging properties of the chloroform extract of *sida acuta*. Screening of phytochemical constituents and free radical scavenging potential were analyzed by DPPH radical scavenging assay, Nitric oxide radical scavenging assay, Hydroxyl radical scavenging assay, Reducing power assay and FRAP assay. The preliminary phytochemical screening has shown the presence of Steroids, flavonoids, tannins and Glycosides. The chloroform extract of *Sida acuta* hold restrained free radical scavenging activities. Based on the results this study can be concluded that, *sida acuta* has rich free radical scavenging activities, may be which the presence these secondary metabolites in it. In future by isolating and identifying these compounds, if may be used to treat various diseases.

**Keywords:** *Sida acuta*, Chloroform extract, Phytochemical screening and Free radical scavenging activity.

### INTRODUCTION

Medicinal plants are the backbone of traditional medicines and variety of bioactive substances present in medicinal plants are widely used against various diseases<sup>1</sup>. About 80% of the population in various developing countries depends on traditional medicine for human alleviation due to its fewer side effects<sup>2</sup>. It is the property of most of the plant-based drugs to be simple, effective and offering a broad spectrum of activity with greater emphasis on preventive action<sup>3</sup>. In addition to that large numbers of secondary metabolites are also produced by some of the higher plants. The demand for natural food constituents has resulted in broad research on naturally occurring antioxidants which are able to deactivate highly reactive free radicals<sup>4</sup>. As a base for further pharmacological studies, there is a need to screen medicinal plants for their secondary metabolites and bioactive compounds. In the last century, roughly 121 pharmaceutical products were formulated based on the traditional knowledge obtained from various sources<sup>5</sup>. *Sida acuta* Burm.f. (*Sida acuta*) (Family of Malvaceae) is an erect perennial shrub found throughout the hotter parts of India and Nepal<sup>6</sup>. The bark is smooth, greenish, the root is thin, long, cylindrical and very rough; leaves are lance late, nearly glabrous, peduncles equal to the petioles, the flowers are yellow, solitary or in pairs; seeds are smooth and black. In Indian traditional medicine, the root of *sida acuta* is extensively used as a stomachic, diaphoretic and antipyretic<sup>7</sup>. It is regarded as cooling, astringent, tonic and useful in treating

nervous and urinary diseases and also disorders of the blood, bile and liver<sup>8</sup>. The whole plant is used to treat snake bite and it lessened the hemorrhagic effect of Bothrops atrox venom. *sida acuta* has significant antiplasmodial activity due to its alkaloid content<sup>9</sup>. The paste of leaves is mixed with coconut oil and applied on head regularly for killing dandruffs and also for strengthening hair. It is naturally used in the treatment of malaria, diarrhea and many other diseases<sup>10</sup>. Therefore the present study is aimed to analyze the presence of phytochemical and evaluate the free radical scavenging activity of chloroform extract of *sida acuta*.

### MATERIALS AND METHODS

#### Plant collection

The whole plant of *sida acuta* was collected in and around area of K. Vengadeshwarapuram, Kalugumalai, Tuticorin District, Tamil Nadu and it was authenticated by Dr. GVS Moorthy, Scientist G, Botanical Survey of India, TNAU Campus, Coimbatore, Tamil Nadu India. The voucher number is BSI/SRC/5/23/2016/Tech./348. Collected whole plant material was washed under running tap water, air dried and powdered and stored in air tight container for further studies.

#### Preparation of extract

The powder was continuously soaked with petroleum ether, chloroform, ethyl acetate, ethanol and water. The extracts were collected and concentrated at 40°C under

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## WOMEN EMPOWERMENT HURDLES AND PROPOSED SOLUTIONS

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### Abstract

Women's Empowerment has been an issue of immense discussions and contemplation over the last few decades world-wide. This as an agenda has been on top of the lists of most government plans & programs as well. Efforts have been made on a regular basis across nations to address this issue and enhance the socio-economic status of women. However, it has been observed that most of the policies and programs view empowerment in the economic sense only working in the belief that economic self-reliance empowers women ignoring other variables like health, education, literacy etc. Introduction In the history of human development, woman has been as important as man. In fact, the status, employment and work performed by women in society is the indicator of a nation's overall progress. Without the participation of women in national activities, the social, economic or political progress of a country will be stagnated. Women constitute half of the humanity, even contributing two-thirds of world's work hours. She earns only one-third of the total income and owns less than one-tenth of the world's resources. This shows that the economic status of women is in pathetic condition and this is more so in a country like India. "Women constitute nearly 50 per cent of population, perform two-thirds of the work and produce 50 per cent of food commodities consumed by the country. They earn one third of remuneration and own 10 per cent of the property or wealth of the country" (Reddy et al., 1994).

**Keywords:** *Empowerment, Issues, Problems, Women.*

### Concept of empowerment

Empowerment refers to policies and measures designed to increase the degree of autonomy and Self-determination in the lives of people and in communities in order to enable them to represent their interests in a responsible and self-determined way, acting (again) on their own authority. Empowerment refers both to the process of self-empowerment and to professional support of People, which enables them to overcome their sense of powerlessness and lack of influence, and To recognize and eventually use their resources and chances. Empowerment is a multi-Dimensional process, which should enable women or group of women to realize their full identity

EMPOWERMENT OF WOMEN IN INDIA

ISBN : 978-93-5768-748-5

ISSUE: February 2023



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# Identification of Toxic Blooms of Cyanobacteria in Mangrove Forest

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Silambarasan Tamil Selvan, Sanjivkumar Muthusamy, and Bhuvaneswari Santharam

## Abstract

Cyanobacteria or blue green algae are the most predominant group of photosynthetic and prokaryotes. The cyanobacteria are presented in the widespread of natural environment such as lakes, rivers, and ponds and have different pigments like chlorophylls, phycocyanin, and phycoerythrin. Hence, the cyanobacteria are involved in photosynthesis process through aerobic as well as anaerobic conditions. The association of cyanobacterial mass found on the reservoirs are called as cyanobacteria bloom. The blooms were highly accumulated on the surface of aquatic system, which are enriched with biological wastes or nutrients like nitrogen and phosphorus. The cyanobacterial blooms are typically denoted during in the season of spring (*Planktothrix* spp.) or in season of late summer (*Microcystis* spp.). These cyanobacterial blooms may produce metabolically active chemical components called as cyanotoxins against different aquatic predators. It may be characterized into dermato, cyto, hepato, and neurotoxins. These toxins are produced either dangerous effects to aquatic organisms as well as human beings or as any therapeutically importance. In this study, such metabolically active toxin producing cyanobacterial blooms were identified.

## Keywords

Cyanobacteria · Cyanotoxins · Plankton net · Marine agar medium · PCR

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N. Thajuddin et al. (eds.), *Protocols for Cyanobacteria Sampling and Detection of Cyanotoxin*, [https://doi.org/10.1007/978-981-99-4514-6\\_4](https://doi.org/10.1007/978-981-99-4514-6_4)





ISSN 0975-4407

Research J. Pharmacology and  
Pharmacodynamics. 3(2): March –  
April, 2011, 81-87

## Research Article



www.anvpublication.org

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Received on 07.12.2010

Accepted on 25.12.2010

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## Evaluation of Wound Healing Activity of *Coscinium fenestratum* (Gaertn.) Colebr in Albino Rats

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### ABSTRACT:

The objective of this investigation was to ascertain the scientific basis for the use of the ethanolic extract of *Coscinium fenestratum* for the treatment of wound. *Coscinium fenestratum* are used traditionally for the treatment of various diseases. The wound healing activity of *Coscinium fenestratum* was evaluated for its wound healing potential in two types of experimentally induced in wound models in albino rats excision wound model and incision wound model. Povidone iodine ointment (5% w/w) was used as standard wound healing agent for comparison. In the excision wound model treatment with ethanolic extract ointment at 5% and 10%w/w concentration, enhanced significantly the rate of wound contraction. In the incision wound model the ethanolic extract ointment at 5% and 10%w/w concentration, facilitated the healing process as evidenced by increase in tensile strength. The results suggested that *Coscinium fenestratum* extract ointment applied possessed significant wound healing activity. Ethanol extract of *Coscinium fenestratum* was examined in the form of 5% w/w extract and 10% w/w extract in the excision wound extracted on the dorsal side of the experimental animals, the 10% w/w extract ointment showed considerable difference in wound models and the result were compatible to that of the standard drug povidone iodine (5% w/w) in terms of wound contracting ability, epithelisation period and tensile strength.

**KEYWORDS:** *Coscinium fenestratum*, wound healing.

### INTRODUCTION:

Wound may be defined as a loss or breaking of cellular and anatomic or functional continuity of living tissues<sup>1</sup>. Wound healing is the body's natural process of regenerating dermal and epidermal tissue. The healing cascade is activated when platelets come in contact with exposed collagen leading to platelet aggregation and the release of clotting factors resulting in the deposition of a fibrin clot at the site of injury. The fibrin clots serve as a provisional matrix and sets the stage for the subsequent events of healing<sup>2</sup>. The process of wound healing occurs in different phases such as coagulation, epithelisation, granulation, collagenation and tissue remodeling<sup>3</sup>. Several factors delay or reduce wound healing including bacterial infection, necrotic tissue, and interference with blood supply, lymphatic blockage and diabetes mellitus. Generally if the above factors could be altered by any agent, an increased healing rate could be achieved<sup>4,5</sup>. Wound healing is a process, which is fundamentally a connective tissue response; initial stage of this process involves an acute inflammatory phase followed by the synthesis of collagen and other extracellular macromolecules which are later remodeled to form a scar<sup>6</sup>.





## HETEROGENEITY IN TELOMERE LENGTH ON HUMAN CHROMOSOME

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### ABSTRACT

Telomere sequence perceived at the end of each chromosome serve as an effective biomarker of a cell's replicative history. The average telomere length from blood and cheek cells of three persons of same age are found out by (terminal restriction fragment) TRF analysis. The concentration of isolated genomic DNA was determined and then double digested with restriction enzyme. By means of electrophoresis the length of telomere is calculated by comparing with DNA marker. Genetic variation in these telomeric region was also found out by DNA sequencing. The telomere from blood sample of third person showed a maximum length of more than 10,000kb. Even though the blood sample and cheek cells from first and third person respectively showed same length, they differ in their genetic sequences. Various diseases like aging, cancer, anemia, Alzheimer, atherosclerosis, cardiovascular disease, hepatitis, chronic inflammatory bowel disease, and chronic HIV infection can be diagnosed by having a good knowledge on telomere length.

### KEY WORDS

Biomarker, Cheek cells, DNA sequencing, Genetic variation, Telomere, Terminal restriction fragment.

### INTRODUCTION

Each end of a chromosome is capped by a telomere, a nucleoprotein complex, which consists of non-coding TTAGGG double strand repeats, a 30 single strand overhang and associated telomere binding proteins <sup>[1]</sup>. Telomeres play an essential role in the maintenance of genomic stability because they act to protect the ends of chromosomes from DNA damage and prevent chromosomal end to end fusions <sup>[2]</sup>. Telomere content may serve as an effective biomarker of a cell's replicative history <sup>[3]</sup>. Variations in the length of Telomere can induce replicative senescence, which blocks cell division. Alzheimer's disease (AD), a

neurodegenerative disease is an example of premature ageing syndrome associated with telomere shortening.

Determining telomere length in case of abnormalities is a significant deed to eradicate complications. Telomere length can be assessed by a number of methods such as Telomere restriction fragment (TRF) analysis, quantitative PCR, single telomere length analysis (STELA), fluorescence *in situ* hybridization (FISH) and primed *in situ* (PRINS) labeling technique. Telomere length is measured from genomic DNA, cells and chromosomes. TRF analysis is the simplest and commonly used method. Here the genomic DNA is digested with specific restriction



## ANTI ULCER ACTIVITY OF ETHANOLIC, AQUEOUS AND TOTAL AQUEOUS EXTRACTS OF *COCCINIA GRANDIS* LINN. VOIGT IN PYLORIC LIGATURE INDUCED ULCERS IN ALBINO RATS

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Received: 11 Mar 2013, Revised and Accepted: 12 Aug 2013

### ABSTRACT

**Objectives:** *Coccinia grandis* Linn, otherwise called *Coccinia indica* has been used in ayurvedic medicine in India and Sri Lanka to treat diabetes. As there is no indication of publications regarding the anti ulcer property of the plant, the present study was designed to investigate the antilulcer potential of ethanolic, aqueous and total aqueous extracts of *Coccinia grandis* Linn.

**Methods:** Ulcer was induced by pylorus ligation in Wistar albino rats. Drugs were administered in two different dose levels (200mg/Kg bwt, 400mg/ Kg bwt).

**Results:** Though all three extracts of *Coccinia grandis*, dose dependently reduced, the total acidity, ulcer index, and increased pH of gastric juice, ethanol extracts exhibited markedly significant results. However, ethanol extract has shown (78.57%) a highly significant ulcer curative potential and decreased ulcer formation also. A preliminary phytochemical analysis revealed the presence of different phytoconstituents such as alkaloids, carbohydrate, glycosides, phyto sterol, saponins, volatile oil, tannins etc which may impart their anti ulcer activity by acting as anti secretory and cytoprotective agents

**Conclusion:** The present result suggests that both anti-secretory and cytoprotective mechanisms of different extracts of *Coccinia grandis* exerted protective effect. However further studies are required to propose the mechanism of action of the extracts for their human use.

**Keywords:** Antilulcer activity, *Coccinia grandis*, Pylorus ligation, Antisecretory, Cytoprotective.

### INTRODUCTION

Gastric ulcer is one of the most prevalent gastrointestinal disorders, affecting approximately 5-10% of people during their life [1]. Ulcers are produced when any factor causes an imbalance between the protective factors (mucus and bicarbonate) and aggressive factors (acid and pepsin) in the stomach [2]. Herbal medicine is fast emerging treatment as an alternative to available synthetic drugs for treatment of ulcer, possibly due to lower costs and reduced side effects. Various chemical compounds have been isolated from medicinal plants with anti ulcer activity [3-4]. Fruits of *Coccinia grandis* Linn. (Cucurbitaceae) is commonly used as a vegetable throughout India especially in southern parts. Apart from their use as vegetable, leaves of the plant are reported to possess medicinal values such as anti convulsant, anti pyretic, anti-inflammatory, anti helminthic, digestive, liver tonic, depurative and expectorant [5-7]. The present study assesses the effect of ethanolic, aqueous and crude aqueous extracts of leaves of *Coccinia grandis* Linn. on pyloric ligation induced gastric ulcers in rats to determine its effect on gastric secretion, and development of gastric ulcers in rats.

### MATERIALS AND METHODS

#### Plant material

The leaves of *Coccinia grandis* Linn. were collected from Sivakasi, Virudhunagar district, Tamil Nadu and was authenticated by Mrs. M. Shanthi, Botanist, Department of Botany, S.F.R. College of Arts and Science, Sivakasi. The collected leaves were washed with tap water followed by distilled water to remove adhering dust, shade dried, and size reduced into small pieces. Dried materials were coarsely powdered and macerated with alcohol and aqueous solvents for 72 hours. The total aqueous extract was also prepared separately by cold maceration method [8]. The final product was filtered dried and the percentage yield was calculated.

#### Animals

Albino Wistar rats of either sex weighing between 150-250g were used. Animals were housed under standard conditions of temperature (24 ± 2°C) and relative humidity (30-70%) with a 12:12 light-dark cycle. The animals were given standard diet supplied by Kamadhenu agencies, Bangalore and water *ad libitum*. All

procedures involving animals were carried out under the institutional animal ethical committee approval (SBCP/2009-2010/IAEC/ CPSCEA/ 13).

#### Toxicity studies

Toxicity studies of all the three extracts were carried out in Swiss albino mice weighing between 20-25 g. All three extracts were found to be safe till 2000 mg/kg Bwt.

#### Anti ulcer activity-Pyloric ligation induced ulcer

Animals were starved for 48hrs with free access to drinking water in individual cages with raised bottoms of wide wire mesh to avoid cannibalism and coprophagy [9]. Animals were divided into 8 groups of six animals each. Group I served as solvent control and group II was administered with Omeprazole 2 mg/kg *p.o*. The remaining six groups were treated with ethanolic, aqueous and total aqueous extracts of *Coccinia grandis* at 200 and 400mg/kg *p.o*. respectively. Sixty minutes after the administration of drug or vehicle, a midline abdominal incision was made just below the xiphoid process, under ether anaesthesia. The stomach was lifted and the pylorus was ligated, care being exercised that neither damage to the blood supply nor traction on the pylorus occurs. The abdominal wall was closed by interrupted sutures.

The animals were deprived of food and water post operatively and were sacrificed after 19 hours of pyloric ligation. Blood samples were withdrawn from the marginal tail vein and subjected to estimation of serum alkaline phosphatase and serum calcium. The stomach were dissected out along the greater curvature and examined for lesions and the gastric contents were collected. The mucosa was then washed and extent of ulceration was scored as per the method suggested by Kunchandy *et al* [10].

According to the following scale 0 = normal grey coloured stomach, 0.5 = pink to red coloration of the stomach, 1 = spot ulcer, 1.5 = haemorrhagic streak, 2 = number of ulcer < 5, 3 = number of ulcer > 5, 4 = ulcer with bleeding.

Ulcer index was calculated using formula, ulcer index = 10/X

$$\text{Where } X = \frac{\text{Total mucosal area}}{\text{Total ulcerated area}}$$



IN VITRO ANTIOXIDANT ACTIVITY OF DIFFERENT EXTRACTS OF WHOLE PLANT OF *CALYPTERIS FLORIBUNDA* (LAM.)BHUVANESWARI SANTHARAM<sup>1\*</sup>, GANESH P<sup>2</sup> AND SORANAM R<sup>3</sup><sup>1</sup>Department of Biochemistry, KR College of Arts and Science, Kovilpatti, Tamilnadu, <sup>2</sup>Department of Microbiology, Annamalai University, Annamalai Nagar, <sup>3</sup>Department of Environmental Biotechnology, M.S University, Alwarthurichal. Email: bhuvan@gmail.com

Received: 04 Feb 2014, Revised and Accepted: 14 Mar 2014

## ABSTRACT

**Objective:** The aim of the present study was to investigate the in vitro antioxidant potential of various extracts of whole plant of *Calypterus floribunda* (Lam.) as well as to establish the best procedure to obtain extracts containing active principles.

**Methods:** In this context, we conducted a bioassay of the extracts using DPPH ( $\alpha, \alpha$ -Diphenyl- $\beta$ -Picryl Hydrazyl) radical scavenging activity, superoxide anion scavenging activity and iron chelating activity. The results were compared with reference standard antioxidants rutin, quercetin and EDTA respectively.

**Results:** The ethyl acetate extract of *Calypterus floribunda* exerted effective DPPH radical scavenging activity. The IC<sub>50</sub> Values of ethyl acetate of *C. floribunda* and Rutin were found to be 510 $\mu$ g/ml and 480 $\mu$ g/ml respectively. The lower the IC<sub>50</sub> Value indicates the higher free radical scavenging ability. An IC<sub>50</sub> value was found that ethyl acetate extract of *C. floribunda* is more effective in scavenging superoxide radical when compared to methanol and petroleum ether extracts. But when compared to all the three extracts with Quercetin (standard) the ethyl acetate extract of *C. floribunda* showed similar result. The Iron Chelating activity of the ethyl acetate extracts of the whole plant of *C. floribunda* was found more superior than the other two plant extracts.

**Conclusion:** It is concluded that a whole plant of ethyl acetate and methanolic extracts of *C. floribunda* possessed pharmacologically important phyto constituents like phenolic compounds and flavonoids which impart strong antioxidant and free radical scavenging activities. The result of the current study indicated potential of the plant in modulation of oxidative stress.

**Keywords:** *Calypterus floribunda*, antioxidant activity, DPPH assays, Superoxide anion, Iron chelating activity.

## INTRODUCTION

Reactive oxygen species (ROS), which include free radicals such as superoxide anion radicals ( $O_2^-$ ) and hydroxyl radicals ( $OH^\cdot$ ), singlet ( $^1O_2$ ) as well as non-free radicals species ( $H_2O_2$ ) are various forms of activated oxygen and often generated by oxidation of biological reactions [1-3]. Free radicals which have one or more unpaired electrons are produced during normal and pathological cell metabolites. Damage induced by ROS includes DNA mutation, protein oxidation and lipid peroxidation contributing to the development of degenerative diseases like cancer, diabetes, atherosclerosis, inflammation and premature aging [4]. Antioxidants help organisms deal with oxidative stress caused by free radical damage. Recently, interest has increased considerably in finding naturally occurring antioxidants for use in foods or medicinal material to replace synthetic oxidants which are being restricted due to its side effects such as carcinogenicity [5].

Several substances from natural sources have been shown to contain antioxidants and are under study. Antioxidant compounds like phenolic acids, polyphenols and flavonoids scavenge free radicals such as peroxide, hydro peroxide or lipid peroxyl and thus inhibit the oxidative mechanisms that lead to degenerative diseases [6]. Many researchers have focused on the antioxidant activity of plant extracts or isolated substances from plants due to fact that free radicals have been related to some diseases as well as to aging process [7]. Recent reports indicate that there is an inverse relationship between the dietary intake antioxidant-rich foods and the incidence of human diseases [8]. There is a plethora of plants that have been found to possess strong antioxidant activity [9].

*Calypterus floribunda* Lam. (Combretaceae) commonly known as Kokkarai in Hindi, Minnarakoti in Tamil, a scandent woody and climbing shrub which is 5-10cm long with slender brown streaked branches with vine storing water abundantly. So it is referred as a life-saver by the forest dwellers during summer when streams dry up, people quench their thirst by using this plant [10-12]. The leaves have reported to possess anti-diabetic activity [13]. The hepato protective activity of various stem and leaf extracts have been

reported [14-15] and even fruits claimed to treat jaundice. Calypteronone, Isocalypteronone and 4- dimethyl-calypteronone showed a wide range activity against solid cell lines [16].

The leaves are reported to have medicinal uses as a laxative and anti-helminthic while the juice derived from the young twigs is used for the treatment of diarrhoea, dysentery and malaria [17].

Volatile oil extracted from the leaves of *C. floribunda* and reported it to exhibit high antimicrobial activity [18]. Previous phytochemical studies have reported on the isolation of the flavonoids, calypteronin, quercetin and five bi flavonoids [19-20]. An Ethnomedicinal survey conducted in Uttara Kannada district, evidence the wound healing activity [21]. The calypteronin is used to synthesize many flavonies displaying high antiproliferative activity [22]. Toxicity studies of *C. floribunda* reported in Calf, rabbit and rats [23].

As far as our literature survey could ascertain, no reports concerning the in vitro anti-oxidative activities of the whole plant of *C. floribunda* given here. Therefore we undertook the present study to investigate the antioxidant activities of various extracts of the whole plant of *C. floribunda* through various in vitro models.

## MATERIALS AND METHODS

## Collection and Identification of Plant materials

The whole plant of *C. floribunda* (Lam.) was collected from Pulliyankudi, Nellai District of Tamil Nadu, India. Taxonomic identification was made from Botanical Survey of Medical Plants Unit Siddha, Government of India.

Palayamkottai. The whole plant material of *C. floribunda* (Lam.) was dried under shade, segregated, pulverized by a mechanical grinder and passed through a 40 mesh sieve.

## Preparation of Extracts

The above powdered materials were successively extracted by hot continuous percolation method in Soxhlet apparatus [24] for 24 hrs





Research Article

ISSN : 0975-7384  
CODEN(USA) : JCPRC5

Evaluation of *invitro* free radical scavenging potential of various extracts of whole plant of *Calycopteris floribunda* (Lam.)

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ABSTRACT

The present study was aimed to investigate the free radical scavenging potential of various extracts from whole plant of *Calycopteris floribunda* with the help of two in-vitro antioxidant models were carried out for total antioxidant activity (phosphomolybdic acid method), ferric reducing antioxidant potential (FRAP) assay and estimation of total flavonoids using spectrophotometric methods. Ascorbate was used as standard and positive control for above models. Ethyl acetate extract of *Calycopteris floribunda* was found to be extremely effective in total antioxidant activity. The  $IC_{50}$  values of ethyl acetate extract of *Calycopteris floribunda* and ascorbate were found to be 360  $\mu$ g/ml and 410  $\mu$ g/ml respectively. The ethyl acetate extract of *Calycopteris floribunda* was found more efficient in FRAP assay than that of petroleum ether and methanolic extract. Results indicate that ethyl acetate extract have marked amount of flavonoids, which could be responsible for antioxidant activity. Our findings revealed that ethyl acetate extract of *Calycopteris floribunda* possess interesting antioxidant activity, which may provide protection against free radicals induced damage to biomolecules. It is also worth noting that these results validate with invitro tests, the therapeutic use of the plant in traditional medicine.

**Key words:** *Calycopteris floribunda*, antioxidant activity, FRAP assay, flavonoids, free radicals.

INTRODUCTION

Free radicals or ROS are formed in our body as result of biological oxidation; over production of the same contributes to the oxidative stress, [1-2] which leads to the damage of proteins, DNA and lipid that is associated with the chronic degenerative diseases including cancer, coronary artery diseases, hypertension and diabetes etc [3].

Iron is known to be involved in the generation of reactive oxygen species (ROS) and in the formation of highly toxic hydroxyl radical from other active oxygen species such as hydrogen peroxide [4,5]. Antioxidant compounds may function as free radical scavengers, complexing agents for pro-oxidant metals, reducing agents and quenchers of singlet oxygen formation [6]. Naturally occurring antioxidants in leaf vegetables and seeds, such as ascorbic acid, Vitamin E and phenolic compounds possess the ability to reduce the oxidative damage associated with many diseases [7-9]. So many researchers have focused on natural antioxidants and in plant kingdom numerous crude extracts and pure natural compounds were previously reported to have antioxidant properties.





ANTI-UROLITHIATIC ACTIVITY OF DIFFERENT EXTRACTS OF *AGERATUM CONYZOIDES* (LINN.)

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DOI: 10.7897/2277-4572.04231

Received on: 17/01/15 Revised on: 16/02/15 Accepted on: 23/03/15

ABSTRACT

*Ageratum conyzoides* Linn. (Asteraceae) is a soft hairy annual weed with powerful traditional uses. Aqueous, ethyl acetate and ethanolic extracts were prepared from the whole plant of *A. conyzoides* (L.). Urolithiasis was induced by using 5 % ethylene glycol in wistar albino rats. Rats were treated with different extracts of *A. conyzoides* (L.) at a dose level of 500 mg/kg bwt while Calcurel at same dose level was used as standard. The results of the study proved that all the plant extracts significantly reduced calcium and oxalate concentration in the excreted urine and the deposition of the same in the kidney, while the highest reduction in the calcium and oxalate in the urine and kidney was noted with the ethanolic extract. Preliminary phytochemical analysis revealed the presence of a number of phytochemical constituents in different extracts which may help in the identification of plant. The present result advocates the anti-urolithiatic activities of different extracts of the plant.

**Keywords:** Anti-urolithiatic activity, *Ageratum conyzoides* (L.), Ethylene glycol, calcium oxalate, urine volume.

INTRODUCTION

Urolithiasis is the third most common disorder of the urinary tract is manifested by the formation of stones in the urinary tract. The overall prevalence of urolithiasis is ~12 % with a recurrence rate of 70-80 % in males, 47-60 % in females<sup>1</sup>. These stones are classified according to their chemical constituents, like calcium containing stones made of calcium oxalate monohydrate, calcium oxalate dihydrate and basic calcium phosphate, magnesium ammonium phosphate, uric acid and cystine. The most commonly occurring stones are calcium containing stones 75-90 % and magnesium ammonium phosphate 10-15 %<sup>2,3</sup>. Whenever the excretion rate is increased and the urine is supersaturated with insoluble materials, crystals are formed anywhere in the urinary tract as the course of repeated accumulation of salts. The process is accelerated by conditions like hepatic dysfunction, obesity and hypertension and is powerfully related to the dietary habits<sup>4-8</sup>. *Ageratum conyzoides* Linn. (Asteraceae) is a soft hairy annual weed grows up to a height of 90 cm with alternate or opposite leaves which are hairy on both sides. Traditionally roots or leaves are used for the treatment of various ailments. Roots are digestive, lithontriptic, appetizer used in conditions like dyspepsia, anorexia renal and vesicle calculi and pharyngopathy. Leaves are used to stop local bleeding and heal wounds and sores<sup>9</sup>. The literature survey about the plant support the anti inflammatory, analgesic and antimicrobial and wound healing properties of the plant<sup>10-16</sup>. The present study was undertaken to investigate the anti-urolithiatic activity of *Ageratum conyzoides* Linn.

MATERIALS AND METHODS

Preparation of plant extracts

The plant material was collected from Tirunelveli district, India and was identified. A voucher specimen was deposited in the herbarium

of department of pharmacology, Sankaralingam Bhuvaneswari College of pharmacy, Sivakasi, India for future reference. The whole plant was washed under running tap water followed by distilled water to remove extraneous materials and shade dried. Coarsely powdered plant material was extracted with petroleum ether, ethyl acetate, ethanol and water successively under cold maceration procedure for 72 h. The resultant extracts were filtered concentrated in a rotary flash evaporator and was dried in a vacuum desiccator. The dried extracts were weighed and color, consistency and the percentage yield were noted for each extract. All extracts were subjected to preliminary phytochemical evaluation<sup>17,18</sup>.

Animals

Wistar albino rats of either sex weighing 150-200 g maintained in the animal house of the Sankaralingam Bhuvaneswari College of Pharmacy were selected for the study. The females were nulliparous and non pregnant. All animals were kept in the standard environmental conditions of temperature 24 ± 1°C, at 12: 12 dark light cycle and fed with commercial standard pellet diet supplied by Kamadhenu agencies, Bangalore, India and drinking water *ad libitum*. The animal experimental protocol for the present study was approved by our college Institutional Animal Ethical Committee [SBCP/2008-2009/IAEC/CPSCEA/10].

Ethylene glycol induced urolithiasis

Urolithiasis was induced by ethylene glycol in experimental animals by mixing 5 % Ethylene glycol (v/v) in drinking water for 7 days. Group I was the vehicle control group which received 0.5 % (w/v) gum acacia solution (5 ml/kg p.o). Group II-VI received 0.75 % (v/v) ethylene glycol in drinking water. Group III received standard drug calcurel (500 mg/kg, p.o.) and Group IV-VI received 500 mg/kg bwt of aqueous, ethyl acetate and ethanolic extracts of *A. conyzoides*



# FREE RADICAL SCAVENGING ACTIVITY OF VARIOUS EXTRACTS OF WHOLE PLANT OF *CALYPTERIS FLORIBUNDA* (LAM.): AN IN-VITRO EVALUATION

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Received: 27 January 2015, Revised and Accepted: 04 February 2015

## ABSTRACT

**Objective:** The present research was subjected to screen the free radical scavenging activity of various extracts of whole plant of *Calypterus floribunda* by different in-vitro models.

**Methods:** The antioxidant activity was evaluated by hydroxyl radical scavenging activity, nitric oxide radical scavenging activity with reference standard ascorbate and total phenol content respectively.

**Results:** An inhibitory concentration 50% (IC<sub>50</sub>) value was found ethyl acetate extract of *C. floribunda* is more effective in hydroxyl radical scavenging activity than that of methanolic and petroleum ether extract. The IC<sub>50</sub> values of ethyl acetate extract of *C. floribunda* and ascorbate were found to be 530 µg/ml and 410 µg/ml respectively. The ethyl acetate extract of *C. floribunda* was found more effective in the nitric oxide scavenging activity. The IC<sub>50</sub> values of ethyl acetate extract of *C. floribunda* and ascorbate were found to be 570 µg/ml and 410 µg/ml respectively. But when compared to all the three extracts with ascorbate (standard), the ethyl acetate extract of *C. floribunda* showed the better result. In addition, the ethyl acetate extract of *C. floribunda* was found to contain a noticeable amount of total phenols, which play a major role in controlling antioxidants. The results were observed in a concentration dependent manner.

**Conclusion:** Our findings revealed that ethyl acetate extract of *C. floribunda* possesses interesting antioxidant activity, which may provide protection against free radicals induced damage to biomolecules.

**Keywords:** *Calypterus floribunda*, Antioxidant, Ascorbate, Scavenging activity, Inhibitory concentration 50%.

## INTRODUCTION

Now a days, the role of free radicals in many ailments and disease including inflammation, rheumatoid arthritis, cancer and cardiovascular diseases has been widely established [1]. Oxygen free radicals are formed in tissue cells by many endogenous and exogenous causes such as metabolism, chemicals, and ionizing radiation [2]. Oxygen free radicals may attack lipids and DNA giving rise to a large number of damaged products [3]. It is commonly recognized that antioxidant radicals can neutralize potentially harmful reactive free radicals in body cells before they cause lipid and protein oxidation and may reduce potential mutation and therefore, help to prevent cancer or heart diseases [4]. Antioxidants may be a great benefit in improving the quality of life by preventing or postponing the onset of degenerative diseases. Therefore, there is a growing interest day by day in the substances exhibiting antioxidant properties, which are supplied to humans and animals as food components or as specific preventative pharmaceuticals [5]. Recently, there has been an upsurge of finding natural antioxidants from plant materials to replace synthetic antioxidants because the former ones are accepted as green medicine to be safe [6] for health management, whereas the latter ones are quite unsafe and their toxicity is a problem of concern [7]. Recent reports indicate that there is an inverse relationship between the dietary intake of antioxidant rich foods and the incidence of human diseases [8].

*Calypterus floribunda* Lam. (Combretaceae) commonly known as kokkarai in Hindi, Minnarakoti in Tamil, a scandent woody and climbing shrub which is 5-10 cm long with slender brown streaked branches with vine storing water abundantly. So it is referred as a life saver by the forest dwellers during summer when streams dry up, people quench their thirst by using this plant [9-11]. The leaves have reported to possess anti-diabetic activity [12]. The hepato productive activity of

various stem and leaf extracts have been reported [13,14] and even fruits claimed to treat jaundice. Calypterone, isocalypterone and 4-dimethyl-calypterone showed a wide range activity against solid cell lines [15]. The leaves are reported to have medicinal uses as a laxative and anti-helminthic while the juice derived from the young twigs is used for the treatment of diarrhea, dysentery and malaria [16].

Volatile oil extracted from the leaves of *C. floribunda* was reported to exhibit high antimicrobial activity [17]. Previous phytochemical studies have reported on the isolation of the flavonoids, calypterin, quercetin and five bi flavonoids [18,19]. An ethnomedicinal survey conducted in Uttara Kannada district, evidence the wound healing activity [20]. The calypterin is used to synthesize many flavones displaying high anti-proliferative activity [21]. Toxicity studies of *C. floribunda* reported in calf, rabbit and rats [22]. As far as our literature survey could ascertain, this is the first report that envisages the free radical scavenging activity of the whole plant of *C. floribunda* given here.

## METHODS

### Collection and identification of plant materials

The whole plant of *C. floribunda* (Lam) was collected from Pulliyankudi, Nellore District of Tamil Nadu, India. Taxonomic identification was made from Botanical Survey of Medical Plants Unit Siddha, Government of India, Palayamkottai. The whole plant material of *C. floribunda* (Lam) was dried under shade, segregated, pulverized by a mechanical grinder and passed through a 40 mesh sieve.

### Preparation of extracts

The above powdered materials were successively extracted with petroleum ether (40-60°C) by hot continuous percolation method in





## HYPOLIPEDMIC EFFECT OF VARIOUS EXTRACTS OF WHOLE PLANT OF *CALYOPTERIS FLORIBUNDA* (LAM) IN RAT FED WITH HIGH FAT DIET

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Article Received on  
16 June 2015,

Revised on 07 July 2015,  
Accepted on 27 July 2015

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### ABSTRACT

**Objective:** The present study was designed to investigate the hypolipidemic activity of various extracts of whole plant of *Calyopteris floribunda* in High Fed Diet induced male wistar rats and to compare it with a standard hypolipidemic drug Atrovastatin.

**Methods:** Adult male wistar rats of six numbers in each group were undertaken for study and also evaluated. Group I served as normal control, Group II received HFD, Group III received HFD along with petroleum ether extract of *C. floribunda*, Group IV received HFD along with ethyl acetate extract of *C. floribunda*, Group V received HFD along with methanolic extract of *C. floribunda*, Group VI received HFD along with standard drug Atrovastatin. Blood and tissues

like liver, heart, aorta was examined for lipid profile. **Results:** In Group II animals (HFD) showed significant ( $P < 0.001$ ) elevation in plasma and LDL – cholesterol, triglycerides, phospholipids and atherogenic index when compared to that of normal rat. Administration of ethyl acetate extract of *C. floribunda* at the dose of 200 mg / kg b.wt / day p.o along with high fat diet significantly ( $P < 0.001$ ) prevented the rise in the above mentioned biochemical parameters with significant rise in the level of HDL – cholesterol than that of the other two extracts. **Conclusion:** The result suggests that ethyl acetate of *C. floribunda* extended protection against various biochemical changes in blood and tissues which have therapeutic



**ANALYSIS OF ANTIOXIDANT AND LIPID PEROXIDATION EFFECT OF ORGANIC EXTRACTS OF *CALYPTERIS FLORIBUNDA* (LINN) IN RAT FED WITH HIGH FAT DIET****Bhuvaneswari Santharam<sup>\*1</sup>, Ganesh Punamalai<sup>2</sup>, Soranam Ramiah<sup>3</sup>, Vengadachalapathy Lakshmanan<sup>4</sup> and Packia Lekshmi Narayana Chellaiya Johnson<sup>5</sup>**<sup>1</sup>Department of Biochemistry, KR College of Arts and Science, Kovilpatti, Tamilnadu.<sup>2</sup>Department of Microbiology, Annamalai University, Annamalai Nagar.<sup>3</sup>Department of Environmental Biotechnology, M.S University, Alwarkuricki.<sup>4</sup>Head of Stem Cells KMS Health Private Limited, Chennai, Tamilnadu.<sup>5</sup>Department of Microbiology, Udaya College Of Arts And Science, Vellamodi, KK District.**\*Correspondence for Author: Bhuvaneswari Santharam**

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Article Received on 22/12/2015

Article Revised on 13/01/2016

Article Accepted on 03/02/2016

**ABSTRACT**

The aim of this study was to investigate effect of various extract of *Calypterus floribunda* on the lipid peroxidation and in vivo antioxidant systems in tissue (Liver, Heart and Aorta) of high fat fed rats. High fat diet rats showed significantly ( $P < 0.001$ ) reduced the levels of tissue enzymatic antioxidant and non enzymatic antioxidant (Glutathione). The level of Thiobarbituric reactive substances (TBARS) are elevated in HFD rats (group-II) When compared with control rats (Group I). After administration of ethyl acetate extract of *Calypterus floribunda* in high fat diet rats showed significantly ( $P < 0.001$ ) increased the levels of antioxidant enzymes (CAT, SOD, GPx, GR) and non enzymatic antioxidant glutathione (GSH, CAT, SOD, GPx, GR) and lowered the concentration of TBARS when compared with other two extracts. The ethyl acetate extract of *Calypterus floribunda* in high fat diet rats were found reduced the concentration of TBARS (a measure of lipid peroxidation) than that of HFD rats (Group II). In conclusion, ethyl acetate extract of *Calypterus floribunda* could be an option to enhance the supply of antioxidants and to safeguard against oxidative stress and thereby preventing the formation of atherosclerotic plaques.

**KEYWORDS:** *Calypterus floribunda*, Antioxidant, High Fat diet, Rats, Lipid peroxidation.**1. INTRODUCTION**

Currently, the investigation for natural sources of antioxidants from plants is a strong propensity.<sup>[1]</sup> An imbalance between protector system and production of free radicals causes the oxidative stress.<sup>[2]</sup> Biomolecules are oxidized by the high levels of free radicals in living systems leading to tissue damage, cell death or various diseases such as cancer, cardiovascular diseases arteriosclerosis, neural disorders, skin irritations and inflammation.<sup>[3,4]</sup> Reactive oxygen and nitrogen species participate in normal physiological process, including cellulose life / death process, production from pathogens, various cellular signaling pathways and regulation of vascular tone.<sup>[5]</sup> Pathogenesis of atherosclerosis has been implied by the free radical induced lipid peroxidation and reactive oxygen sepsis (ROS) are known to be the initiators of lipid peroxidation.<sup>[6]</sup> The organisms use endogenous and exogenous antioxidant defenses to protect against harms of oxygen and nitrogen reactive species. They are classified in enzymatic: catalase (CAT), glutathione peroxidase (GPx) and superoxide dismutase (SOD); and non-enzymatic systems; thiol

reduced (GSH), vitamins, minerals and polyphenols.<sup>[7]</sup> Antioxidant substances and enzymes in the body are not wholly effective in preventing oxidative damage especially in conditions like hyperlipidemia and diabetes mellitus where free radicals are produced in excess. Currently available hypolipidemic drugs have been associated with a number of side effects.<sup>[8]</sup> However, most people cannot successfully control their blood cholesterol because of the modern life style. Therefore, a medication is considered the lost option for these individuals. Antioxidant compounds can deactivate and scavenge the free radicals. Recently, investigation of new sources of natural antioxidant became very important for human health. Natural antioxidants commonly exist on plants which contain polyphenolic compounds.<sup>[9-11]</sup> In recent times, antioxidants from plant sources have received a lot of attention and are preferred to synthetic ones. There is a plethora of plants that have been found to possess strong antioxidant activity.<sup>[12]</sup>

*Calypterus floribunda* Lam. (Combretaceae) commonly known as Kokkarai in Hindi, Minnarakoti in



# *In silico* identification of newer potential spleen tyrosine kinase and protein arginine deiminase 4 inhibitors as potent antirheumatoid arthritic agents

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## ABSTRACT

**Background:** Over the past few decades, rheumatoid arthritis (RA) has become a major global health problem which accentuates the need for newer drugs. Spleen tyrosine kinase (SYK) is a cytoplasmic, non-receptor tyrosine kinase involved in signal transduction in a variety of cell types and plays an important role in uncontrolled growth of tumor cells and protein arginine deiminase 4 (PAD4), a calcium-dependent enzyme, mainly expressed in granulocytes and the only isoform localized in the cell nucleus which catalyzes the conversion of peptidyl-arginine to peptidyl-citrulline. **Aim:** This Prompted us to design newer YK and PAD4 inhibitors as efficient therapeutic drugs for the treatment of rheumatic arthritis. **Materials and Methods:** Based on the common pharmacophoric features for the inhibition of SYK and PAD4, a series of leads were designed using computational methods. A virtual library consisting of newly designed 60 molecules as SYK and PAD4 inhibitors of 30 each, has been constructed using features such as hydrogen bond acceptor, hydrogen bond donor, and hydrophobic features. The binding mechanism of newly designed ligands with target enzyme SYK and PAD4 was studied using Arguslab 4.1 and AutoDock tools 1.5.6. **Conclusion:** The designed compounds were subjected and filtered by applying ADMET properties, Lipinski rule of five, molecular docking and found to be more effective SYK and PAD4-inhibitors for treatment of RA.

**KEY WORDS:** ADMET properties, Docking studies, Lipinski rule of five, Protein arginine deiminase 4 inhibitors, Rheumatoid arthritis, Spleen tyrosine kinase inhibitors

## INTRODUCTION

Rheumatoid arthritis (RA) is a long-lasting autoimmune disorder that primarily affects joints. It typically results in warm, swollen, and painful joints. Most commonly, the wrist and hands are involved, with the same joints typically involved on both sides of the body. This may also result in a low red blood cell count, inflammation around the lungs, and inflammation around the heart. Fever and low energy may also be present.<sup>[1,2]</sup> The disease can begin at any age, but the commencement is most frequent in woman older than 65 years.<sup>[3]</sup> It has been projected that 55–70% of patients with RA have progressive disease, resulting in joint destruction, and disability. Thus, there is a need for the newer anti-RA drugs that selectively inhibit the target enzyme that is responsible for

causing RA. Spleen tyrosine kinase (SYK) is a cytoplasmic, non-receptor tyrosine kinase involved in signal transduction in a variety of cell types and plays an important role in uncontrolled growth of tumor cells and Protein arginine deiminase 4 (PAD4), a calcium-dependent enzyme, mainly expressed in granulocytes and the only isoform localized in the cell nucleus which catalyzes the conversion of peptidyl-arginine to peptidyl-citrulline.<sup>[4-6]</sup> Selective inhibition of SYK and PAD4 which may be promising targets for B-cell inhibition in treatment of RA. Hence, computer-aided drug design approaches were used to identify potent and novel SYK and PAD4 inhibitors which can cause inhibition of SYK and PAD4. By reviewing efficient journals and research articles, common pharmacophoric features responsible for inhibiting SYK and PAD4 are identified. A series of leads is designed that selectively modulates the activity of SYK and PAD4 for exhibiting anti-RA activity. A virtual library consisting of newly designed 30 molecules each of SYK and PAD4

Access this article online

Website: prsolutions.info

ISSN: 0974-6943

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*International Multidisciplinary Innovative Research Journal*  
-An International refereed e-journal - Science Issue

ISSN: 2456-4613  
IMIRJ, 1(2), 2017 [1-13]

**PRELIMINARY PHYTOCHEMICAL SCREENING OF VARIOUS EXTRACTS OF  
WHOLE PLANT OF *CALYPTERIS FLORIBUNDA* LAM.**

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**ABSTRACT**

Medicinal plants are a rich source of bioactive phytochemicals or bionutrients. Herbal medicines as the major remedy in traditional system of medicine have been used in medical practices since antiquity. The present study was designed to investigate the presence of various phytochemicals in the three different extracts of the whole plant of *Calypterus floribunda* which evokes various therapeutic effect. The whole plant of *Calypterus floribunda* were extracted with the appropriate three solvents (Harborne, 1984) and these were evaluated for the qualitative phytochemical analysis and these can be further studied for the novel compounds and their biological activities. The petroleum ether and methanol extracts have much lesser compounds when compared with ethyl acetate extracts. When compared to the three extracts, ethyl acetate extracts have high affinity towards the biological activities. The qualitative phytochemical analysis mainly focused on different chemical compounds which can be useful for the drug discovery and effective medicine improvement from the natural resources. The ethyl acetate extract has more phyto constituents than the remaining solvents, contains phenols, flavonoids, steroids, tannins, saponins and reducing sugars. Our findings provided evidence that ethyl acetate extracts of the tested plant *Calypterus floribunda* contain



FARMERS FACING PROBLEMS AND COMMERCIAL OPPORTUNITIES OF  
TINNEVELLY SENNA IN INDIAG. Sathiyabalan<sup>1</sup>, T. Venkata Rathina Kumar<sup>1</sup>, Bhuvaneshwari Santharam<sup>2</sup> and P. Senniappan<sup>3</sup><sup>1</sup>Department of Pharmacognosy College of Pharmacy Madurai Medical College Madurai-625002.<sup>2</sup>Department of Biochemistry, KR College of Arts and Science, Kovilpatti-628501 Thoothukudi, Tamilnadu.<sup>3</sup>Department of Pharmacognosy, Vinayaka Mission's College of Pharmacy, Vinayaka Mission's Research Foundation (Deemed to be university) Salem-636008.

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Article Received on 22/07/2019

Article Revised on 12/08/2019

Article Accepted on 02/09/2019

## ABSTRACT

Senna or Nila avarai or avuri (*Cassia angustifolia* (Vahl.) belongs to the family fabaceae, Senna is a largest genus of flowering and important medicinal plants in India and it is drought tolerant. Hence it is cultivated under rainfed condition in rich clay rise fields of drained soils by small and marginal farmers in Tamilnadu, south India. Senna is a small, perennial, branched under-shrub grown for its medicinal value of leaves and pods which contain sennosides A,B,C,D, rhein, aloë-emodin, kempferol and iso-rhein in free and glycosides forms. It is one of the most useful purgatives, especially in case of habitual constipation. Besides being a laxative, senna is in splenic enlargements, anemia, thypoid enlargements, anaemia, typhoid, cholera, jaundice, rheumatism, tumours, foul breath and bronchitis, and probably in leprosy. The ease of cultivation and high price for the leaves is attracting farmers for large scale cultivation. The future is excellent for extending its cultivation and production of numerous value-added products from its leaves and pods. The challenges for Senna cultivation and business are: Market exploitation of farmers by middlemen, price fluctuations of leaves, demand-supply fluctuations of leaves, limited exports, the Indian domestic market is not support to the senna based herbal products.

KEYWORDS: Cultivation, Senna, farmers, facing challenges, south India.

## INTRODUCTION

In India, Tinnevely Senna (*C. angustifolia*) Andhra Pradesh and Karnataka, Pune (Maharashtra), Gujarat (Anand and Mehsana), Rajasthan (Kodhpur), Delhi and dry coastal districts of Tamil Nadu in Thoothukudi, Tirunelveli, Ramanathapuram and Madurai are the major states are concentrating on the cultivation of Senna. The total annual production of senna herbage is estimated to be around 8600 tonnes. The leaves and pods of a few other species of *Cassia* also possess laxative properties similar to those of *C. angustifolia*. Alexandrian senna is found growing in the wild in North African countries, including Ethiopia and Sudan. The international market receives leaves and pods of Alexandrian senna obtained from the North African countries in substantial quantities, accounting for about 25% of the international trade.<sup>[1,2]</sup>

Tirunelveli is a place in south India where senna was introduced in India for the first time in the mid-eighteenth century and it is extensively cultivated, processed, and exported to various countries through traditional port Tuticorin under the brand name "Tirunelveli senna" hence the name. The drug senna is widely used as a purgative, laxative, expectorant, wound dresser,

antidysenteric, and carminative. Senna leaves are commonly used as natural laxative both in modern as well as in traditional systems of medicine.

The calcium sennoside is a popular form of dispensation useful in habitual constipation in modern medicine.<sup>[3]</sup> However, leaves are having international demand and preferred as ingredient of herbal tea in Europe.<sup>[4]</sup>

## Chemical constituents

The principal active constituents of senna are dimeric glycosides called Sennosides A, B, C, and D. The aglycones are composed of aloë-emodin + rhein for A and B and rhein + rhein for C and D. Other Phytochemicals sennoside C, sennoside D, rhein, chrysophanol, aloë-emodin, kempferol, myricyl alcohol, salicylic acid, palmitic acid, stearic acid.

## Medicinal uses

Senna is a powerful cathartic used in the treatment of constipation, working through a stimulation of intestinal peristalsis. Senna also used as an expectorant, a wound dressing, an antidysenteric, and a carminative agent. It is useful in the treatment of gonorrhea, skin diseases, dyspepsia, fevers and hemorrhoids. The herb is used in





# INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare &amp; Pharmascope Foundation

Journal Home Page: [www.pharmascope.org/IJRPS](http://www.pharmascope.org/IJRPS)

## Estimation of flavonoids and screening of *In vitro* antioxidant activity of various extracts of aerial parts of *Blepharis maderaspatensis* by hydroxyl radical and total antioxidant activity

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## Article History:

## ABSTRACT

Received on: 20 Jul 2020

Revised on: 15 Aug 2020

Accepted on: 18 Aug 2020

## Keywords:

*Blepharis maderaspatensis*,  
hydroxyl radical,  
total antioxidant activity,  
flavonoids

Antioxidants are substances that hamper or inhibit the oxidation of oxidizable substrates in the cells. The aerial parts of *Blepharis maderaspatensis* dry powder was extracted with various solvents (PE, EA and methanol) through Soxhlet extractor. The aerial parts of different concentrates (Pet. ether, ethyl acetate and methanol) of *Blepharis maderaspatensis* was evaluated for its *in vitro* antioxidant potential by hydroxyl radical, total antioxidant activity taking ascorbate used as standard for the both methods and total flavonoids content was estimated as equivalent to rutin. The methanolic concentrates of *Blepharis maderaspatensis* & standard exhibited antioxidant potential possessing IC<sub>50</sub> 210 µg/ml & 62 µg/ml (hydroxyl radical) 200 µg/ml & 57 µg/ml (Total antioxidant activity) respectively. An IC<sub>50</sub> value was originate that methanolic concentrates of *Blepharis maderaspatensis* more efficient in hydroxyl radical, total antioxidant activity compared EA & PE concentrates. The methanolic and EA concentrates of *Blepharis maderaspatensis* showed the total flavonoids content (11.230±0.22 and 2.858±0.56 mg of rutin equivalent/g of powder) respectively. The difference in scavenging potential of the extracts can be due to variation in the percentage of bioactive compound flavonoids present in methanolic extracts. *In vitro* antioxidant studies obviously show methanolic concentrates of *Blepharis maderaspatensis* have better antioxidant activity due to the presence of total flavonoids content.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/IJRPS.V11ISPL4.4266>

Production and Hosted by

Pharmascope.org

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## INTRODUCTION

Antioxidants are substances that hamper or inhibit the oxidation of oxidizable substrates in the cells. They resist the onslaught of free radicals ROS by triggering a battery of detoxifying enzymes or quenching the generation of ROS (Halliwell *et al.*, 1992). The human body is continuously bombarded with an array of free radicals (ROS, RNS) and non-radical entities. Radicals are more reactive and less stable compared to non-radical Oxidants. Free radicals can also be generated from these non-radical derivatives and Oxidants via biochemical responses in the living system (Diplock *et al.*, 1998). Hydroxyl





# International Journal of Research in Pharmacology & Pharmacotherapeutics (IJRPP)

URPP | Vol.13 | Issue 4 | Oct - Dec -2024

www.ijrpp.com

ISSN: 2278-2648

DOI : <https://doi.org/10.61096/ijrpp.v13.iss4.2024.505-509>

## Review

### Unravelling *Chamaecrista nigricans* (Vahl)greene: A comprehensive literature review

Mohana Krishnan.P<sup>1</sup>, Ponmadasamy.M<sup>1</sup>, G. Sathiyabalan<sup>2\*</sup>, T. Venkata Rathina Kumar<sup>3</sup>, Bhuvaneshwari santharam<sup>4</sup>

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	<b>Abstract</b>
Published on: 06 Nov 2024	<p><i>Chamaecrista nigricans</i> (Vahl) greene, also known as chiruvuri in Tamil, is an annual shrub native to Cape Verde, tropical Africa, Arabia, and India. It grows in Thoothukudi, Tirunelveli, and Virudhunagar districts of Tamil Nadu, India, and can grow 30-150 cm tall and woody from the base. The plant is a medicinal plant commonly used in Africa, where it is harvested from the wild for local use as a medicine and plant protection agent. The genus <i>Chamaecrista</i> (L.) Moench (Leguminosae) includes about 330 species, most commonly found in Africa, Asia, and South America. 11 species have been reported from India, with 2 being endemic. The leaves of <i>Chamaecrista nigricans</i> are used to treat skin diseases, appetite, fever, sore throat, gastrointestinal ailments, family planning, and wounds in Senegal, Guinea, and the Bamako region, Mali, West Africa. Chemical constituents like emodol, emodolanthrone, and leucoanthocyanin have been reported from the leaves.</p>
Published by: DrSriram Publications	
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	<p><b>Keywords:</b> <i>Chamaecrista nigricans</i>(vahl)greene, plant description, phytochemistry, plant distribution</p>

## INTRODUCTION

*Chamaecrista nigricans* (Vahl) greene locally known as siruvuri in Tamil, It is an annual shrub native to Cape verde, Tropical Africa and Arabian Peninsula, and India commonly found in Thoothukudi, Tirunelveli and Virudhunagar districts of Tamil Nadu State in India It typically grows in the seasonally dry tropical biome <sup>(1)</sup>. The plant





## BIODIVERSITY AND PHARMACEUTICALLY ACTIVE SECONDARY METABOLITES OF MARINE ACTINOMYCETES

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### ABSTRACT

#### Keywords:

Actinomycetes,  
secondary  
metabolites,  
Marine  
environment,  
Pharmacological.

Actinomycetes (Actinobacteria) are gram-positive bacteria having a filamentous structure similar to that of fungi. They may thrive in many different environments. It is thought that marine actinomycetes may produce distinctive bioactive compounds due to the significant variations between terrestrial and marine settings. According to recent studies employing both culture-dependent and culture-independent approaches, native marine actinomycetes are discovered in the oceans and are widely distributed in many marine ecosystems. It has become easier to isolate new actinomycetes from samples collected in different marine environments. Numerous new types of secondary metabolites are produced by these marine actinomycetes. Many of these metabolites are physiologically active and could one day be applied to medicine. Marine actinomycetes are a rich and underutilized resource that can be used to identify novel secondary metabolites. Marine actinomycetes are one of the most significant producers of diverse groups of secondary metabolites and provide a huge scope for pharmaceutical and other industries.





# In-Vivo Anti-Arthritic Potential of Ethanol Extract of *Acacia nilotica* L. Leaves in Gout Model

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## Abstract

*Acacia nilotica* L. was commonly known as babul and gum arabic tree which is renowned for its wide medicinal properties. In this study, total phenols, *in-vitro* antioxidant assay, antimicrobial effect against *Pseudomonas aeruginosa*, and *in-vitro*, *in-vivo* anti-arthritic properties of *Acacia nilotica* L. leaf ethanol extract in Sprague Dawley rats in potassium oxonate-induced arthritis model were assessed followed by *in-silico* analysis. The test drug showed dose-dependent antioxidant and antimicrobial properties. The extract prevents uric acid crystals *in-vitro* and had anti-arthritic activity similar to Allopurinol in test animals at 200mg/kg. Disease markers such as serum uric acid, xanthine oxidase, TNF- $\alpha$ , IL-10, and IL-1 $\beta$  were found to be downregulated in the test system. Scoring on inflammation and dysfunction index showed that the animals recovered from arthritis at 48 h of test drug administration and recovered to normal at 72 h. After the sacrifice of the animal, it is evaluated for its ultra-microscopic structural changes in ankle joint tissues, it showed the presence of collagenous fibres in extract treated test system similar to that of a healthy animal via histopathology.

**Major Findings:** The *in-silico* analysis showed a majority of genes involved in the activation of innate and adaptive immune response, maintaining homeostasis in the calcium and Vitamin D, anti-inflammatory process, and apoptosis induction. It proves that the drug has the potential to treat gouty arthritis.

**Keywords:** *Acacia nilotica* L., Anti-Arthritis, Gouty Arthritis, Leaves, Septic Arthritis, *Vachellia nilotica* L.

## 1. Introduction

Arthritis means joint swelling or inflammation. Since 1990, the prevalence of arthritis has increased to 113% (528 million) as per WHO statistics. In humans, above 55 years of age, obese females, and injured people, suffer from chronic arthritis with gradually progressive

pain, affecting their quality of life by making them inactive. The inactive state of an individual progresses to cardiovascular, and metabolic disorders like diabetes, etc.,<sup>1-3</sup>. In India by 2050, the number of arthritis cases is forecasted to be 96.7 million population<sup>4</sup>. The Indian Rheumatology drugs market shows that USD 1.110 billion was spent in 2022 and by 2023, it will be about

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## UNVEILING THE WOUND HEALING POTENTIAL OF FABACEAE PLANTS IN DIABETIC FOOT ULCER TREATMENT

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Article Received on: 13/05/2025

Article Revised on: 02/06/2025

Article Accepted on: 23/06/2025



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### ABSTRACT

Diabetic foot ulcers (DFUs) are a common complication of diabetes, leading to significant morbidity, mortality, and healthcare costs. Traditional medicine has utilized plants from the Fabaceae family to treat various ailments, including wounds and ulcers. This review aims to summarize the current evidence on the use of Fabaceae family plants in treating DFUs. A comprehensive literature search identified several Fabaceae plants with promising wound healing properties including *Mellilotus officinalis*, *Buteo monosperma*, *Prosopis farcta*, *Tephrosia purpurea*, *Astragalus propinquus*, *Cassia auriculata*, *Acacia catechu*, *Cicer arietinum*, *Vigna unguiculata*, *Phaseolus vulgaris*, *Prosopis africana* and *Senna occidentali*. These plants possess bioactive compounds with antimicrobial, anti-inflammatory and antioxidant properties, which may aid in wound healing and tissue repair. While the available evidence is promising, further clinical trials are necessary to fully elucidate the efficacy and safety of these plants in treating DFUs. This review highlights the potential of Fabaceae family plants as adjunct therapy for managing DFUs and emphasizes the need for continued research in this area.

**KEYWORDS:** Diabetic foot ulcers, Fabaceae, Traditional medicine, Antioxidant and Wound healing.

### INTRODUCTION

Diabetic Foot Ulcer (DFU) is a serious and devastating result of unmanaged and extended diabetes, typically appearing on bottom of the foot.<sup>[1]</sup> It may result in diminished quality of life and high medical expenses for those affected.<sup>[2]</sup> About 18.6 million people around the globe deal with diabetic foot ulcer.<sup>[3]</sup> Approximately, 25% of individuals with diabetes in India are expected to develop diabetic foot ulcer. This may worsen due to insufficient general awareness, inadequate medical infrastructure and economic constraints.<sup>[4]</sup> The process of abnormal foot ulcer in diabetic patient is characterized by several factors, including chronic inflammation, impaired angiogenesis, abnormal proliferation and migration of keratinocytes and extra cellular matrix remodeling. Furthermore, diabetic patients frequently experience foot ulcers that are linked to bacterial infections.<sup>[5]</sup>

Fabaceae are among the largest families of flowering plants, containing more than 727 genera. Fabaceae is also known as Leguminosae. Fabaceae plants produce a wide variety of natural substances including flavors, toxins, dyes and they play an essential role in medicine.<sup>[6]</sup> *Acacia catechu*, *Bauhinia variegata*, *Cassia*

*fistula*, *Erythrina suberosa*, *Lathyras aphaia*, *Medica polymorpha*, *Mimosa pudica*, *Saraca indica*, *Tamarindus indica* are the some reported medicinal plants belonging to Fabaceae.<sup>[7]</sup> Fabaceae family plants contain phytoconstituents such as polyphenols, flavonoids, tannins, terpenes, alkaloids, steroids and carbohydrates. Due to these bioactive compounds, Fabaceae plants exhibit diverse pharmacological activities such as estrogenic, antibacterial, antioxidant, antifungal, ulcer protective, anti-inflammatory, sedative, neuroprotective and digestive properties.<sup>[8,9]</sup> The Fabaceae family includes some of the most thoroughly researched medicinal plants, with numerous scientific publications addressing their applications in treating diabetic foot ulcer. Consequently, this review intends to deliver an updated overview of some species belonging to Fabaceae, concentrating on the active constituents extracted from the plants used in the treatment of diabetic foot ulcer.

### Botanical characterization of fabaceae species

Fabaceae is the third largest family of flowering plants, characterized by significant diversity.<sup>[10]</sup> It includes woody plants, shrubs and flowering perennials or annuals, which might be easily recognized by their



# Species

## Two new Species of *Garra* from Mizoram, India (Cypriniformes: Cyprinidae) and A General Comparative Analyses of Indian *Garra*

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### Publication History

Received: 22 May 2014

Accepted: 04 July 2014

Published: 17 September 2014

### Citation

Arunachalam M, Nandagopal S, Richard L. Mayden. Two new Species of *Garra* from Mizoram, India (Cypriniformes: Cyprinidae) and A General Comparative Analyses of Indian *Garra*. *Species*, 2014, 10(24), 58-78

### ABSTRACT

*Garra khawbung* sp. nov. is described from the Tuipui River, Khawbung Village, Mizoram, India. This species is closely related to *Garra nigricollis* but is distinguished by having more lateral-line scales, fewer predorsal scales, fewer branched caudal-fin rays, presence of a transverse groove on snout, and absence of a black band across the posterior margin of the head and between left and right side pectoral-fin bases. *Garra tyao* sp. nov., from the Tyao River, Tyao Village, Mizoram, India, is differentiated from *G. dampensis* in having more branched dorsal-fin rays, more branched pelvic-fin rays, fewer branched caudal-fin rays, more lateral-line scales, fewer predorsal scales, fewer upper transverse scale rows; from *G. namyaensis* in having fewer predorsal scales; and from *G. lissorhynchus* by the position of the "W"-shaped dark band in the caudal fin and fewer lateral-line scales. *Garra tyao* is distinct from *G. nambulica* in having more branched pectoral and pelvic-fin rays and fewer predorsal scales and from *G. paralissorhynchus* by more pectoral-fin rays and fewer predorsal scales.

**Keywords:** *Garra*, Asia, Cyprinidae, Freshwater fishes, taxonomy, morphometrics, India

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Two new Species of *Garra* from Mizoram, India (Cypriniformes: Cyprinidae) and A General Comparative Analyses of Indian *Garra*, *Species*, 2014, 10(24), 58-78,

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## Species

A New Species of the Genus *Garra* Hamilton, (Cypriniformes: Cyprinidae) from Nethravathi River, Western Ghats, IndiaMuthukumarasamy Arunachalam<sup>✉</sup>, Subramaniyam Nandagopal

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## Publication History

Received: 04 May 2014

Accepted: 28 June 2014

Published: 17 September 2014

## Citation

Muthukumarasamy Arunachalam, Subramaniyam Nandagopal. A New Species of the Genus *Garra* Hamilton, (Cypriniformes: Cyprinidae) from Nethravathi River, Western Ghats, India. *Species*, 2014, 10(24), 43-57

## ABSTRACT

*Garra nethravathiensis* sp. nov. a new garrinae cyprinid fish species is described from the upstream of Nethravathi, a west flowing river in Karnataka state of peninsular India. The new species differs from the congeners from Western Ghats mountain ranges by the following combination of characters: snout broadly rounded with deep transverse groove with pointed tubercles arranged irregularly but approximately three rows in each side; lesser lateral-line counts of 30-31 and 16 circumpeduncular scales with thick body and pompous size. It is similar to *Garra mulya* in having weakly developed transverse groove on snout and similar to *G. maclellandi* in having well developed scales on chest and belly. *Garra nethravathiensis* sp. nov. is distinguished from *Garra mulya* by less lateral-line scales (30-31 vs. 32-35); less number of scales between lateral-line to pelvic-fin scales (2.5 vs. 3.5); less number of scales between lateral-line to anal-fin (3.5 vs. 4.5). *Garra nethravathiensis* sp. nov. differs from *Garra maclellandi* by less lateral-line scales (30-31 vs. 35); less number of transverse rows (4.5/2.5/3.5 vs. 4.5/3.5/4.5); less number of anal scale rows (3-4 vs. 7) and more pre anus scales (20-23 vs. 20).

Keywords: Freshwater fish, Karnataka, Indian cyprinid, *Garra nethravathiensis*

Muthukumarasamy Arunachalam and Subramaniyam Nandagopal,

A New Species of the Genus *Garra* Hamilton, (Cypriniformes: Cyprinidae) from Nethravathi River, Western Ghats, India, *Species*, 2014, 10(24), 43-57,

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## ***Garra palaruvica*, A NEW CYPRINID FISH (CYPRINIFORMES: CYPRINIDAE) FROM KERALA, WESTERN GHATS, PENINSULAR INDIA**

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Received: August 22, 2013; Accepted: October 21, 2013

**Abstract-** *Garra palaruvica* sp. nov., a new cyprinid fish, is described from the Palaruvi Falls, Kallada River basin near Thenmala in Kerala, India. It is distinguished from all other Indian species of the genus *Garra* by intermediate development of mental disc and central pad, long maxillary barbels and well exposed isthmus region. Other characters are compared and in diagnoses with closely and distantly related species. This new species, with the morphology of its mental disc, shows close similarities with species of *Garra* from Arabia and Ethiopia.

**Keywords-** Freshwater fish, Kerala, Indian cyprinid, *Garra palaruvica*

**Citation:** Arunachalam M., et al (2013) *Garra palaruvica*, A New Cyprinid Fish (Cypriniformes: Cyprinidae) from Kerala, Western Ghats, Peninsular India. International Journal of Zoology Research, ISSN : 2231-3516 & E-ISSN : 2231-3524, Volume 3, Issue 1, pp.-62-68.

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### **Introduction**

Species of the bottom-dwelling genus *Garra* Hamilton [1], together, form the most widely distributed group of cyprinid fishes, ranging from Borneo to West Africa through southern China, South and Southeast Asia, the Middle East, the Arabian Peninsula and East Africa [2]. Species of *Garra* inhabit a wide range of substrates (muddy, sandy, rocky) in streams, rivers, pools and lakes. They are primarily freshwater species but are also reported from brackish waters [3]. The genus is represented by 11 species from the Western Ghats, one of the biodiversity heritage sites of India. These include *Garra mullia* [4], *G. gotyla stenorhynchus* [5], *G. bicornuta* [6], *G. McClellandi* [5], *G. menoni* [7], *G. hughi* [8], *G. kalakadensis* [9], *G. periyarensis* [10], *G. surendranathanii* [11], and the recently described *G. emarginata* and *G. mlapparaensis* from the Periyar river, Kerala [12]. From north and northeastern India 20 species have been reported. These include *G. lamta* [1], and the following 19 species: *G. gotyla* [13], *G. rupecula* [14], *G. nasuta* [15], *G. lisso-rhynchus* [16], *G. kempii* [17], *G. annandalei* [17], *G. naganensis* [17], *G. abhoyai* [17], *G. manipurensis* [18], *G. litanensis* [19], *G. compressus* [20], *G. elongata* [21], *G. nambulica* [22], *G. paralisso-rhynchus* [23], *G. arupi* [24], *G. kalpangi* [25], *G. namyaensis* [26], *G. dampensis* [27], *G. magnidiscus* [28].

During a recent identification (January 2013) on the fish collections of Manonmaniam Sundaranar University Museum of Natural History (MSUMNH), the authors observed *Garra* specimens with dramatic morphological differences in a single lot identified as *Garra mullia* collected from southern part of Western Ghats. These specimens were without a transverse groove on snout, lengthy maxillary bar-

bels, no chest scales, fewer pre-anal scales, fewer anal scale rows, and intermediate development of the mental disc and central pad, and a well-exposed isthmus region. Further investigation of these specimens and comparisons with a larger sample of *Garra mullia* and other species across India revealed that the lot represents an additional species of *Garra* described herein, making 12 described species from Peninsular India.

### **Materials and Methods**

Measurements were taken to the nearest 0.1mm using digital calipers. Methods for measurements and counts follow those of Hubbs and Lagler [29] additional characters such as disc length, disc width, central-pad length, central pad width, post-dorsal length, and body depth followed by Kullander and Fang [30]. Head characters are expressed as proportion of Head Length (%HL), Head length and body characters are expressed as proportion of standard length (%SL). Number in parenthesis following meristic data denote numbers of specimens examined with that count. Type specimens were deposited in Southern Regional Station, Zoological Survey of India, Chennai (ZSI/SRS), Manonmaniam Sundaranar University Museum of Natural History (MSUMNH), Alwarkurichi, Tamil Nadu, India and Collections of M. Arunachalam, (CMA).

### **New Species Description**

***Garra palaruvica* sp. nov.**

**Holotype:** ZSI/SRS F8661, 1 ex. Male, 43.91mm SL, Palaruvi, near Thenmala, Kallada River basin, Kollam (District), Kerala, India, (N 08° 53' 16.8" E 77° 7' 38.2"), Collectors: M. Arunachalam, A. Manimekalan, A. Johnson, M. Muralidharan, R. Soranam. 4 Nov. 2000.





## ***Garra palaruvica*, A NEW CYPRINID FISH (CYPRINIFORMES: CYPRINIDAE) FROM KERALA, WESTERN GHATS, PENINSULAR INDIA**

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Received: August 22, 2013; Accepted: October 21, 2013

**Abstract-** *Garra palaruvica* sp. nov., a new cyprinid fish, is described from the Palaruvi Falls, Kallada River basin near Thenmala in Kerala, India. It is distinguished from all other Indian species of the genus *Garra* by intermediate development of mental disc and central pad, long maxillary barbels and well exposed isthmus region. Other characters are compared and in diagnoses with closely and distantly related species. This new species, with the morphology of its mental disc, shows close similarities with species of *Garra* from Arabia and Ethiopia.

**Keywords-** Freshwater fish, Kerala, Indian cyprinid, *Garra palaruvica*

**Citation:** Arunachalam M., et al (2013) *Garra palaruvica*, A New Cyprinid Fish (Cypriniformes: Cyprinidae) from Kerala, Western Ghats, Peninsular India. International Journal of Zoology Research, ISSN : 2231-3516 & E-ISSN : 2231-3524, Volume 3, Issue 1, pp.-62-68.

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### **Introduction**

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During a recent identification (January 2013) on the fish collections of Manonmaniam Sundaranar University Museum of Natural History (MSUMNH), the authors observed *Garra* specimens with dramatic morphological differences in a single lot identified as *Garra mulya* collected from southern part of Western Ghats. These specimens were without a transverse groove on snout, lengthy maxillary bar-

bels, no chest scales, fewer pre-anal scales, fewer anal scale rows, and intermediate development of the mental disc and central pad, and a well-exposed isthmus region. Further investigation of these specimens and comparisons with a larger sample of *Garra mulya* and other species across India revealed that the lot represents an additional species of *Garra* described herein, making 12 described species from Peninsular India.

### **Materials and Methods**

Measurements were taken to the nearest 0.1mm using digital calipers. Methods for measurements and counts follow those of Hubbs and Lagler [29] additional characters such as disc length, disc width, central-pad length, central pad width, post-dorsal length, and body depth followed by Kullander and Fang [30]. Head characters are expressed as proportion of Head Length (%HL), Head length and body characters are expressed as proportion of standard length (%SL). Number in parenthesis following meristic data denote numbers of specimens examined with that count. Type specimens were deposited in Southern Regional Station, Zoological Survey of India, Chennai (ZSI/SRS), Manonmaniam Sundaranar University Museum of Natural History (MSUMNH), Alwarcurichi, Tamil Nadu, India and Collections of M. Arunachalam, (CMA).

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Threatened fishes of the world: *Garra kalakadensis* Remadevi, 1992,  
(Cyprinidae: Cypriniformes)Muthukumarasamy Arunachalam<sup>\*</sup>, Subramaniyam Nandagopal

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## Publication History

Received: 19 February 2014

Accepted: 11 March 2014

Published: 26 March 2014

## Citation

Muthukumarasamy Arunachalam, Subramaniyam Nandagopal. Threatened fishes of the world: *Garra kalakadensis* Remadevi, 1992, (Cyprinidae: Cypriniformes). *Species*, 2014, 8(20), 13-18

## Keywords

*Garra kalakadensis* – Endangered species, Western Ghats, South India.

## Common name

English – Kalakad Stone Carp, Kalakad *Garra*

## 1. INTRODUCTION

*Garra kalakadensis* described by Rema Devi (1993) from Pachaiyar, east of Sengaltheri, Kalakad Wildlife Sanctuary, Tirunelveli District, Tamil Nadu, India. The holotype and paratypes kept in the Zoological Survey of India, Southern Regional Station, Chennai are almost in dried condition and the measurements and counts are almost not possible and hence topotypes from the same locality were collected and presented.

## 2. CONSERVATION STATUS

*Garra kalakadensis* is listed as Endangered because its extent of occurrence is less than 5,000 km<sup>2</sup>, its area of occupancy is less than 500 km<sup>2</sup>, and it is known only from two locations (IUCN, 2013).

Muthukumarasamy Arunachalam et al.

Threatened fishes of the world: *Garra kalakadensis* Remadevi, 1992, (Cyprinidae: Cypriniformes),*Species*, 2014, 8(20), 13-18,© The Author(s) 2014. Open Access. This article is licensed under a [Creative Commons Attribution License 4.0 \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).





## MORPHOLOGICAL DIAGNOSES OF GARRA (CYPRINIFORMES: CYPRINIDAE) FROM NORTH-EASTERN INDIA WITH FOUR NEW SPECIES DESCRIPTION FROM BRAHMAPUTRA RIVER

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Received: August 17, 2013; Accepted: October 31, 2013

**Abstract-** *Garra minimus* is described from the Ranga River of upper Brahmaputra River Drainage, *Garra kimini* is described from the tributary of Ranga river, *Garra nigricauda* is described from Pasighat and *Garra alticaputus* is described from Dikrong river at Boorum village from the Indian State of Arunachal Pradesh. *Garra minimus* is unique in its size in comparisons with all other species of *Garra* reported/published from North East India and also with more number of branched pectoral-fin rays. *Garra alticaputus* is diagnosed in having a deeper head and lacking any coloration on fins and body relative to other species from these drainages and the region that have distinctive colour patterns either on the body or in their fins. *Garra nigricauda* is diagnosed from other species of *Garra* from this region with its distinctive robust body size and by the forked caudal-fin tipped black and the upper lobe of caudal-fin being pointed and shorter than the lower lobe. *Garra kimini* is diagnosed in moderately large headed, height less than its length; width almost equal to height with more pectoral-fin rays like the other three species described herein.

**Keywords-** *Garra minimus*, *Garra alticaputus*, *Garra nigricauda*, *Garra kimini*

**Citation:** Arunachalam M., Nandagopal S. and Mayden R.L. (2013) Morphological Diagnoses of *Garra* (Cypriniformes: Cyprinidae) from North-Eastern India with Four New Species Description from Brahmaputra River. Journal of Fisheries and Aquaculture, ISSN: 0976-9927 & E-ISSN: 0976-9935, Volume 4, Issue 3, pp.-121-138.

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### Introduction

Since first described by Hamilton [1] in his book on the fishes of the Ganges River, the genus *Garra* (type species *Cyprinus lamta* (= *Garra lamta*)) has been, and continues to be, one of the most enigmatic and taxonomically difficult cyprinid genera of the Asian region. As traditionally recognized the species occur from Borneo to West Africa through China, South and Southeast Asia, Middle East, Arabian Peninsula and East Africa. The genus, however, is an extremely difficult group for biodiversity studies and warrants extensive studies as to the morphology, taxonomy, and phylogenetics. Two of the most significant factors underlying difficulties with the group include a combination of its diversity and its taxonomic instability, both serving as major impediments for researchers. Similar complications exist even for the subfamily to which this genus is allocated, Labeonini, through the constant flux in its composition and internal taxonomy, two recalcitrant qualities, that are only to be compounded by current phylogenetic evidence that the genus is not monophyletic [2,3].

In addition to the underlying issues outlined above, multiple, even more basic hindrances contribute to difficulties and/or complications for anyone working with or hoping to work on "*Garra*" [3] or *Garra* as traditionally recognized. These include the fact the traditionally recognized *Garra* is very widespread, has a great diversity of species (over 100) and many undescribed species, confusing morphological

variation often seen in species without thorough evaluation across the genus, notably complex and frequently confusing literature on its diversity and taxonomy, and many issues surrounding types specimens for species and type species for genera in Cyprinidae. Some examples include the descriptions of or placement of species in different genera, including *Discognathus* Heckel [4], *Chondrostoma* and *Gobio* [5], *Gonorrhynchus* and *Platyca* [6-8] and *Gonorrhynchus* [9]. Day [10] subsequently allocated all of these species to *Garra*.

To date, 20 species of *Garra* have been reported to occur cross north and northeastern India. These include the type species for the genus, *G. lamta* [1] and the following 19 species: *G. gotyla* [12], *G. nasuta* [7], *G. rupecula* [8], *G. lissohynchus* [9], *G. kempi* [13], *G. annandalei* [13], *G. naganensis* [13], *G. abhoyai* [13], *G. manipurensis* [14], *G. litanensis* [15], *G. compressus* [16], *G. elongata* [17], *G. nambulica* [18], *G. paralissohynchus* [19], *G. arupi* [20], *G. kalpangi* [21], *G. namyaensis* [22], *G. dampensis* [23], *G. magnidiscus* [24].

Species so far reported from the Indian state of Arunachal Pradesh include *G. annandalei*, *G. gotyla gotyla*, *G. kempi*, *G. lissohynchus*, *G. maclellandi*, *G. lamta* and *G. naganensis* [25]. Recently, an additional species, *Garra arupi* was described from upper Brahmaputra basin in Arunachal Pradesh [20] and also *Garra magnidiscus* was described from the same basin [24] and is also a member of the "*Garra* fauna" of this region. In recent inventory surveys of fishes



## Research and Reviews: Journal of Ecology and Environmental Sciences

### Identity and Description of *Garra maclellandi* (Jerdon, 1849) from the Type Locality, and a Neotype Designation from Cauvery River Basin, Southern India.

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#### Research Article

Received: 19/04/2014

Revised: 27/06/2014

Accepted: 08/08/2014

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**Keywords:** neotype, *Garra maclellandi*, mananthavadi River, Wynad, Kerala.

#### ABSTRACT

*Gonorrhynchus maclellandi* was described from Bhavani River at the foothills of Nilgiris in Tamil Nadu and Manantawady River in Wayanad (Kerala), of Western Ghats (Jerdon, 1849). As there are no types available for all the species described by Jerdon from southern India, *Gonorrhynchus maclellandi* was redescribed by Silas (1958) and placed in the genus *Garra*. However, the species description and figure provided for *G. maclellandi* seems to be doubtful as per the original description of this species. We collected one specimen from the type locality and upon close examination we found that the specimen was consistent in features as outlined in the description by Jerdon. *Garra maclellandi* is part of the group of species of *Garra* in India having 16 circumpeduncular scales. This species is distinguishable from closely related species, *Garra platycephala* and *Garra jerdoni*, and diagnosed from all other species of *Garra* reported from Peninsular India. With the findings reported herein and the absence of any types for *Garra maclellandi* (Jerdon) we designate a neotype for the species.

#### INTRODUCTION

*Gonorrhynchus maclellandi* was described from Bhavani River at the foothills of Nilgiris in the Tamil Nadu and Manantawady River in Wayanad (Kerala) part of Western Ghats [4]. The species is characterized (as per Jerdon) by having 36 scales along the body (lateral line) in 9 rows (lateral transverse) and a dorsal profile rising from occiput to dorsal-fin origin. Since its description the identity of this species has been largely controversial. Since no types are available for almost all the species described by Jerdon and revisionary studies are underway for the genus *Garra* it is now essential to designate a neotype for this species after a period of 163 years. Silas [8] tried to identify *Gonorrhynchus gotyla* (Jerdon) and *Gonorrhynchus maclellandi* as *Garra stenorrhynchus* and *Garra maclellandi*, but the figure provided for *G. maclellandi* appears untenable. Furthermore, a recent collection from Manantawady River in Wayanad contains a single specimen almost identical to *G. maclellandi* as described by Jerdon. Here we redescribe *G. maclellandi* based on the topotype and designate the specimen as neotype. We compared All recognized and valid species of *Garra* thus far reported from the Western Ghats, peninsular India, were examined and are compared to the species.

#### MATERIALS AND METHODS

Abbreviations used herein include SL = Standard Length, HL = Head Length, ZSI/SRS/SRC = Zoological Survey of India/Southern Regional Station/Southern Regional Centre, F = Fish, FF = Freshwater



Range Extension of an Endemic Ornamental Fish Species *Puntius halakkudiensis* from Southern Kerala River, India.

Muthukumarasamy Arunachalam<sup>1\*</sup>, Manickam Raja<sup>1</sup>, Subramaniyam Nandagopal<sup>1</sup>, Appukuttan Chandran<sup>2</sup>.

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Research Article

Received: 16/10/2013  
Revised: 13/11/2013  
Accepted: 19/11/2013

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**Key words:** Cyprinidae, *Puntius halakkudiensis*, Kerala, Pamba, Endemic, New record

ABSTRACT

The ornamental cyprinid, *Puntius halakkudiensis* which resembles the popular aquarium fish *Puntius denisonii* (Day 1865), was described by Menon, Rema Devi & Thobias, 1999 from the upper reaches of Chalakkudy River of the Western Ghats of peninsular India and its distribution was confined only to this system in central part of Kerala except a recent record <sup>[1]</sup> from Achankoil River, in south Kerala. Major distinguishing character of *P. halakkudiensis* from *P. denisonii* is the presence of a distinct black blotch on its dorsal fin (absent in *P. denisonii*). The recent record of *Puntius halakkudiensis* from Pamba River at Plappally village, Pathanamthitta district of south Kerala is of Ichthyological interest.

INTRODUCTION

Montane streams of Western Ghats are known for fish diversity and its high degrees of endemism <sup>[2, 3]</sup> described *P. halakkudiensis* from the upper reaches of Chalakkudy River of the Western Ghats and its distribution was so far confined to this river. *Puntius halakkudiensis* can be distinguished from all other *Puntius* species by its inferior mouth (terminal or subterminal in all other species) and a distinct black blotch on its dorsal fin from *P. denisonii*. Ichthyofaunal reports on various rivers from Kerala state <sup>[4]</sup> and also from Pamba River <sup>[5]</sup> have not documented *Puntius halakkudiensis* outside its distributional range. However, the occurrence of this species since its description was reported <sup>[1]</sup> from Achankoil River from southern Kerala along with *Puntius denisonii*. During a recent fish survey from Pamba River in Plappally village (Fig. 1), Pathanamthitta district of southern Kerala, we collected 3 specimens of *Puntius halakkudiensis*, which confirms the presence of this ornamental fish from another river system. Herein, we report the distributional range extension of *Puntius halakkudiensis*.

MATERIALS AND METHODS

Fish samples were collected from Pamba River in Plappally village in Pathanamthitta district in Kerala state during September 2012 using gill nets and cast nets. Fishes were identified, preserved in 10% formalin and the specimens were deposited in Manonmaniam Sundaranar University Museum of Natural History (MSUMNH), Alwarthurichi, Tamil Nadu, India and also preserved as Collections of M. Arunachalam, (CMA). MSUMNH 61, 2 ex. 111.5-116.4mm SL; CMA 21, 1 ex, 94.6 mm SL. Kerala,



# Research and Reviews: Journal of Ecology and Environmental Sciences

## Range Extension of Endangered Earthworm Eel *Pillaia Indica* Yazdani, 1972 (Synbranchiformes: Chaudhuriidae) from West Bengal, India.

Muthukumarasamy Arunachalam<sup>1\*</sup>, Manickam Raja<sup>1</sup>, Subramaniyam Nandagopal<sup>1</sup>, Chinnian Vijayakumar<sup>2</sup>, Punniyam Malaiammal<sup>1</sup>, and Showket Ahmad Bhat<sup>1</sup>.

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Received: 11/11/2013

Revised: 12/12/2013

Accepted: 15/12/2013

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**Keywords:** *Pillaia Indica*, New record, Biogeographic relict, Darjeeling district, West Bengal.

#### ABSTRACT

*Pillaia indica* Yazdani 1972, was described from Khasi hills of Meghalaya state, India and the distributional range is restricted to less than 10 km<sup>2</sup> and based on that it was concluded that it is a biogeographic relict confined to a very small geographic location. However, in a recent survey we collected 10 specimens from Darjeeling district, West Bengal indicated that this species is widely distributed and the sampling needs skill as these species dwell inside the exposed roots of riparian canopy along the streams.

#### INTRODUCTION

The South Asian Mastacembeloid fish family Chaudhuriidae is popularly called as earthworm eels and this family includes six genera eight species. They are small, living in buried riparian vegetation and in bottom substrate or with substrate mixed with fine sand and clay. They differ externally from the family Mastacembelidae in having only soft fin instead of spines anteriorly in dorsal and anal fins [3] and the distributional range of this family is from Brahmaputra river basin, India. Described the species *Chaudhuria caudata* as the type species of the genus *Chaudhuria* from Inle Lake, Myitkyina in Myanmar and the distribution of this family extends to peninsular Thailand and Malaysia, Mekong basin in Laos and Cambodia, Borneo and Sumatra [1,2,3,4].

Currently, the Chaudhuriid genus *Pillaia* Yazdani and the type species *Pillaia indica* was described from two streams one from Sumer (22km north of Shillong, Meghalaya) and another at Umsingh (13km north of Shillong) both in Khasi and Jaintia Hills of present Meghalaya state [5]. [3] described one more species *Pillaia kachinica* from Myitkyina in the Ayeyarwaddy drainage, northern Myanmar and it differs from *Pillaia indica* in having more dorsal and anal fin rays. [1] collected *P. indica* again from nearby areas of type locality from Khasi hills. Later [2] collected 81 specimens from Khasi hills and this leads to a conclusion of the restricted distribution of *Pillaia indica* (> 10 Km<sup>2</sup>) stating that this species is a biogeographic relict. They further emphasized that the distributional record is so limited though the species of co-occurring members belong to the families of Channidae and Anabantidae were very well distributed from north-eastern part to peninsular India.

In a recent fish survey in Anthojora stream (Fig.1) in Darjeeling district, West Bengal, we collected 10 specimens of this earthworm eel which on close examination showed to be *Pillaia indica* and herein, we report the range extension of *Pillaia indica* from Khasi hills Meghalaya to West Bengal.





## RESEARCH PAPER

## Comparative analysis of genetic diversity among three species of the freshwater fish genus *Garra* (Osteichthys: Cyprinidae) using restriction fragment length polymorphism

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Received: 04 August 2011

Revised: 14 September 2011

Accepted: 16 September 2011

**Key words:** *Garra*, morphometric, meristic, RFLP, genetic diversity, Western Ghats.

### Abstract

The genetic variation in three species of the freshwater cyprinid *Garra* was studied using the traditional morphometric, meristic and Restriction fragment length polymorphism as molecular tool analysis. Samples were collected from their respective geographic locations of southern Western Ghats. Based on the 46 morphometric and 18 meristic characters employed during this study 23 characters showed variation among the three species and hence were utilized for the PCA ordination. The principal component analysis was performed using 15 morphometric and 8 meristic characters of which 12 components were extracted and the first three axes showed eigenvalues >1 and they explained the variance about 81.46 % of the total variance. The genome size of the species *Garra mullia* ranged from 3.8-6.15 µg/mg, *Garra kalakadensis* ranged from 3.25- 6.3 µg/mg and *Garra gotyla stenorrhynchus* ranged from 3.9-6.15 µg/mg. Based on the electrophorogram, different bands of fragments in each lane and band volume were analyzed. According to *Hind III* enzyme the electrophorogram analysis showed maximum fragment length polymorphism in *Garra mullia* which had four fragments and the total volume of bands was 12.582 nmoles. Based on the *Eco RI* enzyme digestion the electrophorogram analysis revealed that the maximum fragment length polymorphism in *Garra mullia* composed of four fragments and the total volume of bands in the entire lane was 10.5965 nmoles. Based on the *Hind III* and *Eco RI* restriction enzymes, the cluster analysis clearly showed that the *Garra mullia* and *Garra kalakadensis* grouped together while *Garra gotyla stenorrhynchus* with distinct genetic distance did not cluster with the other two species. *Garra gotyla stenorrhynchus* can also be distinguished morphologically from *Garra mullia* and *Garra kalakadensis*.

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ijcrr

Vol 03 issue 11  
Category: Research  
Received on: 27/07/11  
Revised on: 12/08/11  
Accepted on: 20/08/11

## NON-DESTRUCTIVE GENETIC SAMPLING IN TWO CYPRINID FISH SPECIES OF SOUTHERN PART OF WESTERN GHATS-INDIA

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### ABSTRACT

Non-destructive genetic sampling for DNA isolation in two cyprinid endemic fishes of the species *Danio aequipinnatus* and *Puntius tambraparniei* was attempted. The total genomic DNA was isolated from fin clips, scales, liver and muscles by using Phenol: chloroform method by different storage method like Ethanol/EDTA and air dry in the different cell lysis buffer like TNES- urea and TNES. In *Puntius tambraparniei* showed higher quantity of genomic DNA (402.36µg) in the liver tissues by using the TNES cell lysis buffer in the ethanol/ EDTA storage method. *Danio aequipinnatus* also showed the high quantity of genomic DNA (415.26µg) in the muscle tissue by using TNES cell lysis buffer in the Ethanol/ EDTA storage method.

**Key words-** Non-destructive, genetic sampling, DNA extraction, fin clips, scale, muscle, cyprinid fish.

### INTRODUCTION

In recent years many vertebrate species are at risk and their methods of conservation is possible without destruction and based on this DNA based studies gain importance to gain information on the diversity and population analysis (O'Brien 1994). DNA analysis will help to study the phylogeny, determination of population size and level of genetic polymorphism within and between populations. Liver and muscle tissues are used for DNA analysis and this method implies the sacrifice of the animals and hence it called as destructive method. The non-destructive sources of DNA are hair, faeces, urine, shed feathers, snake skin, sloughed whale skin, eggshells and

even skulls. However, this method usually results in a low quantity and poor quality of DNA. Non-destructive sampling also includes the use of blood, skin and scales (Hilsdorf *et al.* 1999). Muscle tissues and blood samples are used for DNA isolation without sacrificing the fish especially large population of threatened fishes. (Cummings *et al.* 1994) and (Estoup *et al.* 1996)

Even this can be overcome by using fins and scales. Hence an attempt has been made to compare the destructive method of extracting DNA from muscle and liver tissues and a non-destructive method of extracting DNA from fins and scales of two freshwater fish species of India.

One is an ornamental fish *Danio aequipinnatus* which has the natural distribution in clear water streams/ rivers of India, and another species is *Puntius*





## Research Journal of Pharmaceutical, Biological and Chemical Sciences

### Monitoring and Assessment of Fluoride Contamination in Industrial Environment [South India] and Removal of Fluoride

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#### ABSTRACT

In the present work detailed studies were carried out to understand the effect of adsorbent dose [Ball clay], temperature on kinetics, and competing anion concentrations. Characterization studies on the adsorbent by XRD, SEM and FT-IR analysis before and after fluoride adsorption were carried out to understand the adsorption mechanism. XRD and FT-IR studies revealed significant changes after fluoride adsorption and showed formation of new complexes on adsorbent surface. Applicability of different sorption kinetic models was studied. The surface sites are heterogeneous in nature and followed heterogeneous site binding model. The presence of phosphate, sulphate and arsenate showed adverse effect on fluoride removal efficiency of ball clay adsorbent. The efficiency of material towards ground water samples treatment was tested with and without adjusting pH, and the results are discussed.

**Key words:** Adsorption; Effects of Fluoride; Fluoride contamination; Fluoride removal; Kinetics; South India.

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## WOUND HEALING ACTIVITIES OF *EUGENIA JAMBOLANA* LAM. BARK EXTRACTS IN ALBINO RATS

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**ABSTRACT:** Wound healing is physiological process, which takes place by body's natural regenerative capacity. Due to various reasons there may be delay in healing and this prolonged healing may sometimes lead to scar formation. Currently attention has been focused on natural products to prevent infection and to promote healing. In the present study, *Eugenia jambolana* bark extracts was taken to investigate its wound healing property. Full thickness deep burn wound model in Albino rats, were used to study the healing efficiency. Formulations (10% ointment) of crude ethanolic extract of the *Eugenia jambolana* bark was applied topically over thermal wound. It was found that ointment treated rats showed accelerated healing than the control. It was observed that 10% extract of the *Eugenia jambolana* bark has progressive effects on wound healing in the experimental groups. This study suggests that *Eugenia jambolana* bark powder could be developed as a therapeutic agent for wound healing.

**Keywords:** *Eugenia jambolana*, wound healing activity

## INTRODUCTION

Wound healing is a complication interaction of many factors. This phenomenon has mystified early and modern man. This is evident from Archeological findings which showed that ancient man also had to use a variety of tools to deal with various injuries inflicted on him under hard conditions and during wars (Manjo, 1991). The screening of plant extracts has been of great interest to scientist for the discovery of new drugs effective in the treatment of several diseases (Cragg *et al.*, 1997). *Eugenia jambolana* Lam. (Syn. *Syzygium cumini* (L) Skeels or *Syzygium jambolana* DC.) belonging to the family Myrtaceae is a large evergreen tree up to 30 m high. Bark pale brown, slightly rough on old stems. Fruit is one seeded berry and blue. It is widely distributed through out India, Ceylon-Malaya and Australia and known as Jamun, Jam, Jambul in India. It has been valued in Ayurveda and Unani systems of medicine for possessing variety of therapeutic properties. Most of the plant parts of *E. jambolana* are used in traditional systems of medicine in India. According to Ayurveda, its bark is acrid, sweet, digestive, astringent to the bowels, anthelmintic and in good for sore throat, bronchitis, asthma, thirst, biliousness, dysentery, blood impurities and to cure ulcers (Kirtikar and Basu, 1975). It is also acts as a gargle in sore throat; spongy gums etc. and when externally used, bark shows good wound healing properties (Priyavtra Sharma and Mehta, 1969; Nadkarni, 1954). This study was designed to explore the healing effects of topically applied ointment prepared from *Eugenia jambolana* leaves extracts in rat intraoral wound.

## MATERIALS AND METHODS

### Collection of plant materials

Barks of *Eugenia jambolana* Lam. were collected in Perambular district, Tamil Nadu during the month of January 2005. The collected plant were botanically identified and dried at room temperature.



The enigmatic genus Garra (Hamilton, 1822) was represented by 39 species from India. To date, 14 species of Garra have been reported in southern Western Ghats of India. 25 species of Garra have been reported to occur across north and northeastern India. Among the Indian fresh-water fishes few have greater interest in the study of evolution than those belonging to the genus Garra. Great confusion has prevailed in the taxonomy of this genus, partly because many of the species exhibit considerable individual variability, and partly because ichthyologists have attempted to apply to them specific standards unsuitable for forms apparently still in the process of adaptation to their environment. This book deals with establishing a baseline understanding the species of the genus Garra in streams/rivers of India. An identification key is presented for all species of Garra. A brief description including diagnostic characters is provided for each species. Results obtained from this study is to provide easily-used identification keys to the species of Garra of India in order to encourage species level identifications by other ichthyologists.

Taxonomy of Indian Sucker Fish Garra



Subramaniyam Nandagopal  
Muthukumarasamy Arunachalam

# Monograph & Revision of the Indian Cyprinid Fishes of the Genus Garra

Taxonomy of Indian Cyprinid Sucker Fish Garra

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978-3-659-77865-0

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