

## Bioactivities of some ethno-medicinal Rubiaceous plants available from Assam – a review

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### Abstract

Rubiaceae is one of the large families found in tropical and subtropical regions around the world with great ethnomedicinal importance. Currently, there are about 660 genera and 13,200 species in this family. Most of the species are reported to have a wide variety of biological activities such as antimicrobial, antimalarial, antioxidant, antileukemic, antifeedant, antitumour, analgesic, antivenom, hepatoprotective and so many other interesting biological activities and used by various tribes all over the world. Assam is a north eastern state of India, rich in biodiversity. From Assam 45 genera and 140 species of Rubiaceae are reported along with several ethno medicinal practices by different workers. Assam is a state where 12.8 % of the total tribal populations from North eastern region inhabit with rich indigenous traditional knowledge about the use of medicinal plants. Present paper provides an overview of ethnomedicinal utility of members of Rubiaceae of Assam with a focus on uses of these plants by different tribal populations inhabiting in this region.

**Key words:** Rubiaceae, antileukemic, antioxidant, antimalarial, hepatoprotective, antivenom.

### INTRODUCTION

Nature by its very design provides remedy for nearly any disease that may afflict a human being. Plants are the human's chemist from time immemorial. Through trial and error people discovered various plants which can be used as medicines to cure various diseases. In India medicinal plant sector has traditionally occupied an important position in the lives of rural and tribal peoples. In India about 2,500 plant species belonging to more than 1,000 genera are used by traditional healers (Retham *et al* 2006). Indigenous medicine systems in India, namely Ayurvedic, Siddha and Unani have been in existence for several centuries (Retham *et al* 2006). World Health Organization (WHO) estimates about 80 % of the people in developing countries are depending on traditional medicines for primary health care and 85 % of traditional medicines are prepared from plant extracts (Pareek 1996; Mukhopadhyay 1996).

Assam, the gateway of North East India, located south of the Eastern Himalaya, comprises the Brahmaputra and the Barak river valleys along with the Karbi Anglong and the North Cachar Hills. The state extends longitudinally from 24° 09' to 27° 58' N and latitudinally from 89° 42' to 96° 01' E covering an area of 78,523 sq km (Tribes of Assam. Indian Tribes. [www.indianetzone.com/Indian Tribals](http://www.indianetzone.com/Indian_Tribals)). It is a part of the Indo-Burma Biodiversity Hotspot region of North East India and is a home for rich varieties of flora and fauna. Traditionally various tribes and rural communities in Assam have been using medicinal plants from time immemorial. More than 200 different ethnic tribal groups inhabit in North Eastern region of India and most of them have rich indigenous traditional knowledge system on the use of medicinal plants (Mao & Hynniewta 2000). Assam comprises 12.8 % of total tribal population in India. Approximately 23 tribal communities inhabiting

in two hill districts, Karbi Anglong and North Cachar Hills and 9 plain tribes of the Brahmaputra valley and Barak valley (Prabhakara 2005). Their rich traditional knowledge of medicinal plants might play invaluable role in the drug discovery processes.

Rubiaceae is one of the larger families among dicotyledons and abundant in tropical and subtropical regions around the world. Plants of this family are mostly shrubs and trees, infrequently herbs consisting of about 660 genera and 13,200 species including some lianous forms (Nifio *et al* 2006). A large number of Rubiaceae plants are ethnomedicinally important and also reported to have a wide variety of biological activities such as antimicrobial, antimalarial, hepatoprotective, antioxidant, and so many other interesting biological activities (Robbrecht 2009). From Assam Rubiaceae is represented by 45 genera and approximately 140 species (Kanjilal *et al* 1938). Present review paper deals with the ethnomedicinal practices and biological activities of the members of Rubiaceae by different communities in Assam. This paper also has a focus on use of the members of Rubiaceae amongst different tribal and rural communities inhabiting in this region.

### **Ethnomedicinal plants of Rubiaceae available in Assam**

Assam is a place inhabited by a total of 14 hill tribes and 9 plain tribes (Tribes of Assam. Indian Tribes. [www.indianetzone.com/Indian Tribals](http://www.indianetzone.com/Indian_Tribals)). The history reveals that most of the tribal economies have been engaged in subsistence agriculture or hunting and gathering. With the passage of time, they have developed a great deal of knowledge on the use of plants and plant products in curing various ailments. They have a deep belief in their native folklore medicine for remedies and they rely exclusively on their own herbal cure (Prabhakara 2005). Treatment of diseases with medicinal plants in different ethnic groups of Assam is widespread, because of effectiveness, easy availability, lack of modern health care alternatives, cultural preferences and century old association with the plants. Some of the Rubiaceae ethnomedicinal plants used by the tribes and rural peoples of Assam are presented in Table 1.

### **Biological activities of the plants of Rubiaceae**

On the basis of the traditional knowledge, researchers are carrying out research works on biological activities of various ethno medicinally important plants and isolated a large number of biologically active compounds from various plant sources (Kumar *et al* 1997).

Malaria exhibits a wide range of clinical manifestations which arise from the destruction of red blood cells and the resultant disruption of metabolism. A large number of members of Rubiaceae are reported to possess some well known antimalarial drugs which can inhibit such destruction process. From the bark extracts of *Cinchona* a large number of alkaloids like quinine, quinidine, chinchonine, quinoline, etc are isolated having antimalarial property (Brossi 1988). The concentrations of quinine alkaloids in the bark extracts of *C. officinalis*, *C. calisaya*, *C. ledgeriana* and *C. succirubra* are 1.75-10.6%, 4%, 4.13% and 0.82-1.37% respectively (Kanjilal *et al* 1938) and their antimalarial actions are concentration and species dependant. Besides the extracts of *C. ledgeriana* shows amebicidal activity. Keene *et al* (1986) experimented out the cytotoxic activity of *Cinchona* and Ray & Majumder (1976) showed antimicrobial activity of *Cinchona* bark extracts. The alkaloids are active against gram positive bacteria, but have no effects on gram negative one. Some other activities executed by *Cinchona* are weak anesthetic activity, analgesic activity. Quinoline is found to be active against Potato Virus X Disease (Brossi 1988). Two new alkaloids, myrionidine and myrionamide obtained from *Myrionneuron nutans* showed a significant antimalarial activity on *Plasmodium falciparum* (Pham *et al* 2008). Cancer hazards are increasing day by day resulting in increasing cancer-deaths all over the world. A pentacyclic alkaloid camptothecin isolated from *Ophiorrhiza mungoes* displays potent antineoplastic activity and has the probability of playing role as an anticancer agent (Ellis & West 1988). Damnacanthal, a novel compound isolated from *Damnacanthus* shows anti-ras activity

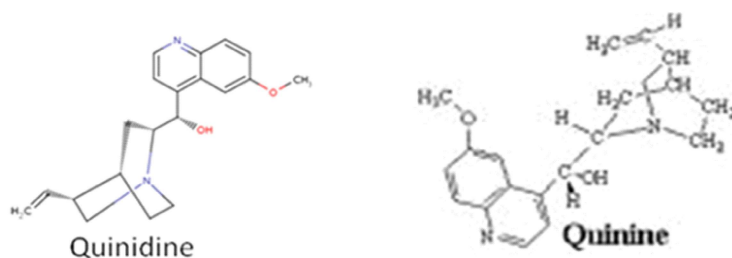
58 Bioactivities of ethno-medicinal Rubiaceae plants from Assam and useful in suppression of cancer (Umezawa 1995). This compound also has the capability to stimulate T cell activity, prevents Lewis lung carcinoma and precancerous cells (Faltynek *et al* 1995). Anticancer property is also exhibited by *Rubia manjith* Roxburg *ex* Fleming (common name- *Manjistha*), a very important medicinal plant available in this region (Trivedi 2006).

A wide range of medicinal plants are found to exhibit antimicrobial property against various pathogens. *Mussaenda macrophylla* shows antibacterial property against the topathic bacterium, *Porphyromonas gingivalis* (Kim *et al* 1999). Four new triterpenoid glycosides were isolated from the root bark of the plant shows activity against the said bacterium, but inactive against *Streptococcus mutans* (Kim *et al* 1999). A new anthraquinone isolated from *Morinda angustifolia* is demonstrated to have significant antimicrobial activity against *Bacillus subtilis*, *Escherichia coli*, *Micrococcus luteus*, *Sarcina lutea*, *Candida albicans* and *Saccharomyces sake* (Xiang *et al* 2008). Antifungal activity against *Aspergillus nidulans* is reported from *Coffea arabica* (Yuvamoto & Said 2006).

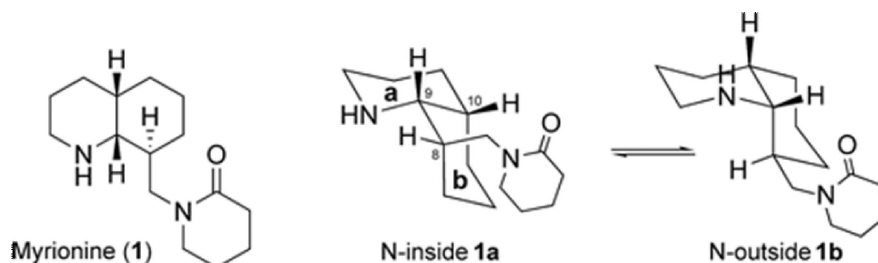
*Borreria hispida*, a Rubiaceae weed is being used from time immemorial as an alternative therapy for diabetes. Experiments reveal that the plant extract enhances the protein expression of some receptors revealing the antidiabetic potential of *Borreria* (Vasanthi *et al* 2009). Antidiabetic activity is also reported from the root extracts of *Rubia manjith* (Kaur *et al* 2008).

The lipid lowering activity of *Anthocephalus chinensis* root extract has been studied in induced hyperlipidemia in rats. The results demonstrated both lipid lowering activity and antioxidant activity in root extract of *A. chinensis*, which could help prevention of hyperlipidemia and related diseases (Kumar *et al* 2010). Antioxidant property is also reported from ethanolic leaf extracts of *Mitragyna parvifolia* and the anti-inflammatory activity was screened using Carrageenan-induced paw edema at various doses (Mors *et al* 2000).

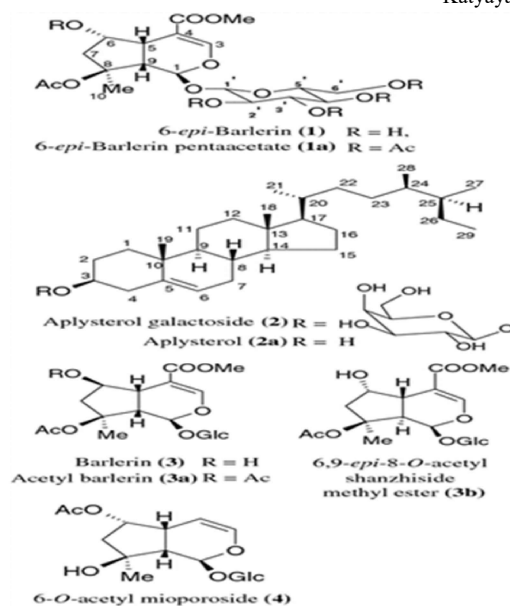
Antivenom activity is investigated out from *Anotis wightiana* against the lethal action of the venom of the jararaca (*Bothrops jararaca*) snake. The antivenom micromolecules present in this plant neutralizes the action of snake venom by replacing endogenous antitoxic serum proteins (Kaur *et al* 2008).



**Figure 1.** Structures of alkaloids obtained from *Cinchona*



**Figure 2.** Structures of Myrionine



**Figure 3:** Structures from *Mussaenda macrophylla*

## DISCUSSION

From Assam near about 140 species of Rubiaceae have been recorded (Kanjilal *et al* 1938). Literature survey reveals 59 ethnomedicinally important species available in this region, out of which bioactivity studies have been carried out only on 28 species.

**Table 1.** Ethnomedicinal practices of the plants belonging to the family Rubiaceae available in Assam

Name of the species	Plant part used	Ethnomedicinal uses	References
<i>Adina cordifolia</i> Hooker f.	Bark	Body weakness, toothache, skin problems, uterus problems	Revathi & Parimelazhagan 2010
<i>Anotis wightiana</i> Wallich	Whole plant	Snake bite	Hynniewta & Kumar 2008
<i>Borreria hispida</i> K. Schumann	Whole plant, leaves, roots, barks, seeds	Diabetes, gallstones, diarrhoea, dysentery, toothache, headache	Khare 2007
<i>Cephalanthus occidentalis</i> Linnaeus	Leaves, bark, roots, fruits	Diarrhea, dysentery, stomach complaints, hemorrhages, eye inflammations, constipation, malaria, toothaches, fevers, menstrual problems	Foster & Duke 1990; Williams 2006
<i>Chasalia ambigua</i> Wight & Arnott	Leaves	Jaundice	Krishnan <i>et al</i> 1996
<i>Coffea arabica</i> Linnaeus	Leaves	Headache, nervous shock, back pain	van der Vossen & Wessel 2000
<i>Damnacanthus indicus</i> Gaertner	Leaves	Rheumatism, headache, piles	Thomas 2006
<i>Gardenia turgida</i> Roxburgh	Whole plant	Bronchial asthma, Increases memory power	Prusti & Behera 2007
<i>Gardenia ternifolia</i> Linnaeus	Dried fruits	Haemorrhoids lesions	Rasoanaivo <i>et al</i> 1992
<i>Gardenia jasminoides</i> Ellis	Leaves	Liver ailments	Kotoky & Das 2008
<i>Hedyotis scandens</i> Roxburgh	Leaves, young	Mouth sore, abscess	Sikdar & Dutta

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<i>Gardenia ternifolia</i> Linnaeus	Dried fruits	Haemorrhoids lesions	Rasoanaivo <i>et al</i> 1992
<i>Gardenia jasminoides</i> Ellis	Leaves	Liver ailments	Kotoky & Das 2008
<i>Hedyotis scandens</i> Roxburgh	Leaves, young twigs, root	Mouth sore, abscess, malaria, eye diseases, after birth troubles	Sikdar & Dutta 2008
<i>Hedyotis lineata</i> Linnaeus	Roots	Pneumonia	Sikdar & Dutta 2008
<i>Hedyotis uncinella</i> Hooker & Arnott	Leaves	Insect sting, skin diseases	Despande <i>et al</i> 1965
<i>Hedyotis tenelliflora</i> Blume		Cold, penis gall, sore throat, bleeding of gums	Prusti & Behera 2007
<i>Hymenodictyon excelsum</i> Wallich	Bark	Astringent, antiperiodic	Yineger & Yewhalaw 2007
<i>Hyptianthera stricta</i> (Roxburgh) Wight & Arnott	Leaves	Cuts and wounds	Kotoky & Das 2008
<i>Lasianthus cyanocarpus</i> Jack	Leaves	Fever, bleeding	Kanjilal <i>et al</i> 1938
<i>Lasianthus lucidus</i> Blume	Leaves	To stop bleeding	Sikdar & Dutta 2008
<i>Meyna laxiflora</i> Linnaeus	Fruits	Abortion	Hynniewta & Kumar 2008
<i>Mitragyna parvifolia</i> (Roxburgh) Kunth	Root	Skin problems	Huai & Pei 2004
<i>Mitragyna rotundiflora</i> (Roxburgh) Kuntze	Leaves	Tuberculosis	Singh <i>et al</i> 2002
<i>Morinda angustifolia</i> Roxburgh	Whole plant	Cold, inflammation, wounds, stomach upset	Jaiswal 2001
<i>Mussaenda glabrata</i> Vahl	Leaves, roots	Jaundice, leprosy	Biswas <i>et al</i> 2010
<i>Mussaenda frondosa</i> Linnaeus	Leaves	Ulcers, wounds, sores	Rethy <i>et al</i> 2010
<i>Mussaenda roxburghii</i> Hooker	Leaves	Bone fracture	Buragohain 2011
<i>Myrioneron nutans</i> Wallich	Leaves	Malaria	Rout <i>et al</i> 2009
<i>Oldenlandia diffusa</i> Roxburgh	Leaves	Hepatitis, sores, tonsil, urethral infection, appendicitis, cancers	Saikia <i>et al</i> 2010
<i>Oldenlandia corymbosa</i> Linnaeus	Whole plant	Liver trouble, burning sensation of palms	Rethy <i>et al</i> 2010
<i>Ophiorrhiza mungos</i> Linnaeus	Roots	Snake bite	Rethy <i>et al</i> 2010
<i>Paederia foetida</i> Linnaeus	Whole plant, leaves, roots	Inflammations, diarrhoea, dysentery, intestinal motility	Das <i>et al</i> 2009
<i>Paederia scandens</i> (Loureiro) Merrill	Whole plant, leaves, roots	Inflammation of spleen, pain in chest and liver, herpes,	Pham <i>et al</i> 2008

Name of the species	Plant part used	Ethnomedicinal uses	References
<i>Ophiorrhiza mungos</i> Linnaeus	Roots	Snake bite	Rethy <i>et al</i> 2010
<i>Paederia foetida</i> Linnaeus	Whole plant, leaves, roots	Inflammations, diarrhoea, dysentery, intestinal motility	Das <i>et al</i> 2009
<i>Paederia scandens</i> (Loureiro) Merrill	Whole plant, leaves, roots	Inflammation of spleen, pain in chest and liver, herpes, rheumatoid	Pham <i>et al</i> 2008
<i>Pavetta indica</i> Linnaeus	Leaves, root juice	Cobra bites, diabetes, pain	Saikia <i>et al</i> 2010
<i>Pristometoris albidiflora</i> Thwaites	Leaves	Stomach ache	Kanjilal <i>et al</i> 1938
<i>Psilanthus bengalensis</i> (Roxburgh <i>ex</i> Schultes) J.F. Leroy	Leaves	Eye boil	Williams 2006
<i>Psychotria adenophylla</i> Wallich	Roots	Mouth sore, rheumatoid, lung ailments	Sikdar & Dutta 2008
<i>Psychotria denticulata</i> Wallich	Roots	Toothache	Kottaimuthu 2008
<i>Psychotria montana</i> Blume	Leaves	Pain, colitis	Srivastava & Tiwari 1973
<i>Randia longifolia</i> Lamarck	Leaves	Oral hygiene	Pullaiah 2006
<i>Randia dumetorum</i> Lamarck	Fruits, seeds, bark	Piles, dysentery, asthma, jaundice, diarrhoea, gonorrhoea	Ganesan <i>et al</i> 2009
<i>Randia tetrasperma</i> Roxburgh	Fruits	Dysentery	Kanjilal <i>et al</i> 1938
<i>Rubia manjith</i> Roxburgh	Leaves	Stomach ache, scorpion sting	Biswas <i>et al</i> 2010
<i>Saprosma ternatum</i> Hooker <i>f.</i>	Leaves	Stomach ache, after birth troubles	Khare 2007
<i>Uncaria macrophylla</i> Wallich	Leaves, roots	Piles, skin diseases	Maikhuri & Gangwar 1993
<i>Uncaria homomalla</i> Miquel	Leaves	Blood cleanser	Reinhard 1999
<i>Vangueria spinosa</i> Roxburgh	Seeds, roots, leaves	Malaria, chest ailments, pneumonia, toothache, swollen limbs	Kola <i>et al</i> 2005
<i>Wendlandia exserta</i> DC.	Roots, fruits, leaves, bark	Ulcer, wounds, swellings, dysentery, diarrhoea, urinary ailments, colds and coughs, skin diseases, fever	Kirtikar & Basu 1935

No data is available for the genera viz *Brachytome*, *Webera*, *Mycetia*, *Polyura*, *Silvianthus* and *Hymenopogon*, available in the state regarding their practices as traditional medicine and also no biological activity studies have been reported for these plants. Some of the plants showing wide range of ethnomedicinal practices and various folds of bioactivities representing the said

**Table 2.** The number of species of Rubiaceae available in Assam responsible for various bioactivities

Biological activity	Number of species	Biological activity	Number of species
Antimicrobial	17	Antioxidant	05
Antimalarial	07	Anti-inflammatory	07
Antiviral	03	Antidiabetic	01
Antitumor	06	Antitubercular	01
Hepatoprotective	03	Analgesic	01
Aniperiodic	01	Immunomodulatory	02
Antiulcer	01	Anti-feedant	01
Neuroprotective	02	Radioprotective	01

family include *Paederia foetida*, *Rubia manjith*, *Cinchona sp*, *Wendlandia excreta*, *Oldenlandia diffusa*, *Randia dumetorum*, etc.

Now-a-days there is a worldwide movement towards finding out chemical constituents from various plant sources and the bioactivity studies of the novel drugs isolated (Kumar *et al* 1997). As diverse kinds of medicinal activities are displayed by members of the Rubiaceae, they need special attention by researchers for isolating their chemical backgrounds and their related biological applications.

As Assam occupies a huge land area inhabited by different communities of rural and tribal people, the reported medicinal plants of Rubiaceae used by traditional peoples are collectively less. Field surveys on various tribal and rural groups should be carried out giving special attention to the members of this family and their characteristic importance on human health care needs.

### CONCLUSION

As a large number of genera of Rubiaceae have ethnomedicinal utilities, extensive studies should be carried out on isolation and characterization of chemical constituents from these ethno medicinally important plants and their related bioactivities.

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