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A review on *Dendrocnide sinuata* (Blume) chew: A medicinal plant utilized by Tribes in North East, India

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Abstract

The objective of this review is to provide a thorough overview of *Dendrocnide sinuata* (Blume) Chew, a plant from the Urticaceae family commonly used by various tribes in North East, India for treating ailments such as swollen muscles, itching, jaundice, and fever. This paper aims to present a comprehensive summary of the plant's profile, including its vernacular names, botanical description, traditional uses, phytochemical compositions, and diverse pharmacological activities such as analgesic, anti-inflammatory, hepatoprotective, antioxidant, and antimicrobial properties. By delving into the pharmacological aspects of the plant, this review aims to offer insights and pave the way for further research in this field.

Keywords: *Dendrocnide sinuata*, traditional uses, pharmacological activities, Northeast India

Introduction

People have been using different parts of plants as phytomedicine since ancient times. Plants are an essential source of bioactive components, which include both primary and secondary compounds [1]. Interestingly, the World Health Organization (WHO) notes that about 80% of people in developed nations use traditional medicine, obtaining strong and efficient medications made from medicinal plants [1, 2]. Fossil evidence suggests that over 60,000 years ago, prehistoric people started using plants as medicines to treat illnesses. It has also been observed that, in addition to plants, animals, fungi, marine species, and microbes provide a sizable share of the natural resources used to create novel lead compounds for medicinal uses [3].

Dendrocnide sinuata is a fascinating poisonous plant from the Urticaceae family. This plant's surface contains highly irritating, small stinging hairs that cause acute burning pain when in contact with the skin [4]. It used medicinally by the different tribes of North East India [5]. Typically growing to a height of three to seven meters, *Dendrocnide sinuata* takes the form of small trees or evergreen shrubs. It has many stinging hairs that cover its stems and branches [6]. In Asia, the Urticaceae family is well-known for its use in herbal medicine. This family of plants includes a number of well-known, fascinating, and useful species, including *Elatostema umbellatum*, *Pilea microphylla*, or gunpowder plant, and *Urtica dioica*, or stinging nettles [7]. It is distributed throughout India, Myanmar, Srilanka, Malaysia, Thailand and China [8]. It grows between 300 and 850 meters high in Indian forests and it is indigenous to areas of Northeastern India, the Indian peninsula, West Bengal, Sikkim, and Bihar [4]. A plant's metabolome is greatly influenced by its geographic origin and the climate in which it grows. To adapt to a variety of geographic, climatic, and soil conditions, plants go through genotypic and phenotypic changes and these changes influenced the production and accumulation of secondary metabolites in plants [9]. This review specifically concentrates on analyzing the chemical composition, pharmacological effects, and traditional uses of *Dendrocnide sinuata* sourced or cultivated exclusively in the North-Eastern region of India. It offers important information for further research and development of herbal formulations.

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Taxonomic description

Table 1: Taxonomic description of *Dendrocnide sinuata* (Bl.) Chew

Taxa	Name
Kingdom	Plantae
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta
Superdivision	Embryophyta
Division	Tracheophyta
Subdivision	Spermatophytes
Order	Rosales
Family	Urticaceae
Genus	<i>Dendrocnide</i>
Species	<i>Dendrocnide sinuata</i> (Bl.) Chew

Vernacular names

In English, it's sometimes referred to as "Devil Nettle" or "Elephant Fever Nettle." However, it goes by different names in other languages. In Assamese, for instance, it is called "Surat,"^[10] and in Bengali, it is called "Chorpata". It is known by various Lepcha names, including "Mealumma," "Ongyalop," or "Sunkroug." It is called as "Anachoriyanam" in Malayalam, as "Moringe" in Nepali, as "Anachoriya," "Ottapilavu," or "Ottarbala" in Tamil^[4] and "Thakpui" in Mizo^[11].

Botanical Description

This tree is small, reaching a maximum height of five meters. It has flat, reddish-brown branches with a few raised spots and smooth, white bark. The leaves are thin, simple, alternating, and shaped like diamonds or ellipses, occasionally like ovals or inverted egg shapes. They measure 13–30 × 6–13 cm. Their tips are sharp, their bases are flat or somewhat heart-shaped, and their edges are either toothed or wavy. The primary vein protrudes from the top of the light green leaves, which have microscopic bumps on both sides. The vein beneath the leaves may be raised or flat. Around 10–12 pairs of side veins is observed on each side; the smaller veins are arranged in a pattern resembling a ladder^[8].



Fig 1: *Dendrocnide sinuata* (Bl.) Chew^[12]

Phytochemical screening

Aqueous extract of the root of *Dendrocnide sinuata* (Bl.) Chew was qualitatively analyzed for the presence of different phytochemical constituents and the extract were found to contain terpenoids, flavonoids, saponins, tannins and cardiac glycosides^[13] while the methanolic extracts showed the

presence of different types of active constituents like flavonoids, terpenoids, and tannins^[5]. Additionally, the ethanolic extract also contains phytochemicals such as alkaloids, flavonoids, triterpenes, saponin, cardiac glycosides, resins and tannins^[6].

Traditional Uses

Dendrocnide sinuata exhibits a rich ethnobotanical significance among diverse tribes in North East India, where it is employed for addressing various ailments. In Assam, the Mishing tribes utilize the root to manage diarrhea^[10], the Karbi tribe utilizes the leaves to manage chronic fever, while the Adibasi tribe formulates a paste from both leaves and roots, applying it to alleviate painful boils. Within the Khasi tribes of Meghalaya, the leaves and roots are utilized to mitigate swelling and blind abscesses. In the state of Arunachal Pradesh, specific tribes, including the Nishi, employ the root to create a paste for treating swollen muscles, injuries, and itching. Concurrently, the Apatani tribes prepare a decoction from the leaves, utilizing it to address urinary disorders and as a remedy for dysentery. In Tripura, the Reang tribe fries young leaves with edible oil, consuming them with rice to alleviate hypersensitivity^[5]. The Bodo tribe of Assam gather the blue blossoms of *Dendrocnide sinuata* and use them in their meals, usually with fish^[14]. Notably, the Mizos in Mizoram treat jaundice with a hot water infusion made from the root^[11], and the *Lotha-Naga* tribes in Nagaland make a paste from the root to apply to body swellings and to treat high fever episodes^[15]. These examples highlight the variety of traditional medicinal applications of *Dendrocnide sinuata*.

Pharmacological activities

Anti-inflammatory activity

Dendrocnide sinuata has been studied for its anti-inflammatory property in various disease models. The anti-inflammatory effect of the aqueous extract of root was checked for 4 hours and extract shown inhibition in rat paw edema induced by carrageenan in dose dependent manner where 30 mg/kg and 100 mg/kg showed 66.29% and 50.56% respectively in inhibition of edema^[13]. The alcoholic extract of the leaves showed an effective inhibition of heat induced albumin denaturation where its IC₅₀ was found to be 95.49 mcg/ml^[6]. The anti-inflammatory property of the methanolic extract of *Dendrocnide sinuata* was also performed by its ability to inhibit heat-induced haemolysis and it was observed that the plant extract showed its inhibitory effects on haemolysis to be dose dependent where the rise in protection of HRBC protection was found to reach maximum at the highest dose of 5000 mcg/ml with 83.2%^[16]. The presence of Flavonoids and saponins in *Dendrocnide sinuata*, may contribute to the anti-inflammatory properties of the plant^[17, 18].

Analgesic Activity

The plant's ability to relieve pain using a variety of experimental techniques, including the tail flick method, Eddy's hot plate, and the acetic acid-induced writhing test was investigated.

Acetic acid-induced writhing test: They assessed how well the *D. sinuata* aqueous extract reduced the writhing that mice experienced when exposed to acetic acid. When the aqueous extract was administered orally at two different doses of 30 mg/kg and 100 mg/kg, it significantly decreased writhing in comparison to the vehicle control, offering 60.75% protection.

These outcomes were in line with those of meloxicam, which showed 46.83% protection.

Tail flick: An analgesimeter calibrated at an Infrared Radiation (IR) level of 55 units was used to measure tail flick latency. Four groups of six adult mice each were created from the twenty-four mice. The aqueous extract of *D. sinuata* was given orally to Groups III and IV at doses of 30 mg/kg and 100 mg/kg, respectively. Compared to Group I (Vehicle), no discernible changes were seen in Group III or Group IV at 30 minutes after treatment. Assessments conducted at 60, 90, and 120 minutes later showed no appreciable differences in latency between the groups.

Eddy's method: 24 adult mice were selected and divided into 4 groups based on their response time on the Eddy's hot plate. Groups III and IV received aqueous extract of *D. sinuata* at doses of 30 and 100 mg/kg orally, respectively. At 0, 30, and 60 minutes post-treatment, mice in all groups were placed on the hot plate, and the time taken for discomfort reactions (paw licking or jumping) was recorded. The Mean reaction times in different groups were compared. Pentazocine and both doses of *D. sinuata* extract showed increased reaction times compared to the control group at all observed time points. Significant differences ($P=0.05$) were observed in reaction times at 0, 30, and 60 minutes post-treatment between the treated groups and the control group.

In the hot plate test, the aqueous extract of *D. sinuata* demonstrated pain-relieving effects that may have been partially mediated by opioid receptors, suggesting the presence of opioid-like compounds in the plant extract. These findings suggest that the opioid-like components in *D. sinuata* extract contribute to its analgesic effects [13].

Hepatoprotective activity

Given that carbon tetrachloride (CCl_4) is frequently used as a hepatotoxin in research, an experimental study was carried out utilizing this compound to cause hepatotoxicity in rats. Changes in liver function, particularly the deterioration of hepatocellular membranes, are brought on by CCl_4 . When activated inside the body, CCl_4 produces a variety of free radicals that cause membrane lipid peroxidation, which ultimately results in cell death. As a result, changes in the levels of certain enzymes occur, which act as markers for liver damage. Rats exposed to CCl_4 showed elevated liver enzyme levels (ALT, AST, and ALP), a sign of damage to the liver. Conversely, cohorts given *Dendrocnide sinuata* extract showed lower levels of certain enzymes, indicating potential liver protective effects. Serum total protein, bilirubin, cholesterol, and triglyceride levels were measured as part of the study. When compared to the group treated with CCl_4 , the administration of the aqueous extract of *Dendrocnide sinuata* (100 mg/kg) led to significant decreases in cholesterol and bilirubin levels [19]. The histological observations supported the hepatoprotective efficacy of *D. sinuata*. Rat liver samples treated with CCl_4 showed evidence of hepatic injury, while samples treated with *Dendrocnide sinuata* extract showed hepatic lobule rejuvenation.

The constituents found in AEDS, such as flavonoids, triterpenoids, and saponins, are recognized for their antioxidant and hepatoprotective properties [20, 21, 22]. Numerous biological effects are exhibited by flavonoids, such as anti-inflammatory, anti-lipemic, spasmolytic, cholagogic, hypotensive, hypoglycemic, estrogenic, and antioxidant properties. Numerous studies mentioned in the literature provide evidence for this information [23].

Antimicrobial Activity

The antimicrobial activity of the plant was determined by disc diffusion method. Gram positive bacteria and gram negative bacteria were used. It was shown that the extracts did not show any inhibitions against gram positive bacteria while the extracts shown inhibition against gram negative bacteria. The methanol extract shown the highest inhibition where a inhibition zone of more than 14 mms in 75 and 100% where the other aqueous extracts shows no or less activity [5]. The presence of phenolic compounds like flavonoids and terpenoids may contribute to its antimicrobial activity [24].

Antioxidant activity

Natural antioxidants such as plants have received increased attention in research over the last decade due to their well-known safety and beneficial properties [25]. DPPH free radical scavenging assay of methanol extract was performed in different concentrations (10, 25, 50, 75 and 100 mcg/ml). The plant's methanol extract shows a remarkable free radical scavenging activity. It was found out that the concentration of 75 mcg/ml and 100 mcg/ml shows the inhibition of DPPH at 64% and 74% respectively [5]. More than 50% inhibition of DPPH radicals is important for antioxidant property of any compounds [26].

Conclusions

Dendrocnide sinuata (Blume) is a highly valuable medicinal plant that is widely used by many tribes in Northeast India. This analysis emphasizes how frequently its leaves and roots are used to treat a wide range of illnesses. Its significance is highlighted by traditional literature and knowledge among Northeast Indian indigenous communities. Different *in-vitro* and *in-vivo* studies had been investigated about the various pharmacological properties of the plants. The presence of different phytoconstituents such as terpenoids, flavonoids, saponins, tannins and cardiac glycosides can contribute to the medicinal property and different pharmacological activities of the plant. With regard to the established pharmacological and phytochemical data as well as its traditional uses, the goal of this review is to give researchers a concise synopsis that highlights the potential of *Dendrocnide sinuata* (Blume). This plant exhibits great promise for additional research into a variety of biological activities.

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