World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 7.409

EVALUATION OF ANALGESIC ACTIVITY OF MARINE SPONGE *TEDANIA ANHELANS*

Madiwalappa Ilkal[1], Siddharam Bagalkote[2], Akshay Kumar S. N.*[3]

[1]Department of Pharmacognosy, V C Akki School of Pharmacy, Ilkal 587125.
[2,3]Department of Pharmacology, Shri Sharanabasaveshwar College of Pharmacy, Vijayapur 586103, Karnataka, India.

***Corresponding Author: Akshay Kumar S. N.**
Department of Pharmacology, Shri Sharanabasaveshwar College of Pharmacy, Vijayapur 586103, Karnataka, India.

DOI: https://doi.org/10.5281/zenodo.17223924

Article Received on 24/7/2025 **Article Revised on 14/08/2025** **Article Accepted on 03/09/2025**

ABSTRACT

In the present study, the methanolic extract of the marine sponge *Tedania anhelans* was evaluated for its phytochemical constituents and analgesic activity. Preliminary phytochemical screening revealed the presence of carbohydrates, steroids, terpenes and terpenoids. Acute toxicity studies indicated no mortality in rats at a dose of 5 g/kg body weight, suggesting a favourable safety profile. Analgesic activity was assessed using the tail immersion test in rats and the acetic acid-induced writhing test in mice, both of which demonstrated significant ($p < 0.001$) dose-dependent reductions in nociceptive responses. These findings suggest that *Tedania anhelans* possesses promising analgesic properties, supporting its potential as a source of bioactive compounds for therapeutic applications.

KEYWORDS: Marine sponge, *Tedania anhelans*, analgesic activity.

INTRODUCTION

Pain and inflammation are complex biological responses that play a central role in maintaining homeostasis and protecting the body from harmful stimuli. Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Although these mechanisms are protective, persistent pain and chronic inflammation are associated with significant morbidity and are implicated in a variety of diseases, including arthritis, cancer, cardiovascular, and neurodegenerative disorders.[1,2]

Current management of pain and inflammation primarily relies on non-steroidal anti-inflammatory drugs (NSAIDs), opioids, and corticosteroids. While these agents are effective, their long-term use is often limited by adverse effects such as gastrointestinal bleeding, renal impairment, cardiovascular risks, tolerance, and dependence.[3] Consequently, there is a growing interest in identifying safer alternatives with potent analgesic and anti-inflammatory activities.

Marine ecosystems, which comprise nearly 70% of the Earth's surface, represent a vast and largely unexplored reservoir of structurally diverse bioactive compounds.[4] Marine organisms such as sponges, soft corals, seaweeds, molluscs, tunicates, and cyanobacteria produce unique secondary metabolites as part of their ecological adaptations to survive in highly competitive and hostile environments.[5] These metabolites, including alkaloids, terpenoids, peptides, polyketides, and sulphated polysaccharides, have demonstrated promising pharmacological activities, including analgesic and anti-inflammatory effects.[6,7]

Several marine-derived compounds are already in clinical use or under clinical evaluation, underscoring the pharmaceutical potential of marine natural products. For example, ziconotide, a peptide derived from the venom of the marine cone snail *Conus magus*, is an FDA-approved analgesic for the treatment of severe chronic pain.[8] Similarly, fucoidans from brown seaweeds have shown significant anti-inflammatory activity through the modulation of NF-κB and MAPK signalling pathways.[9] These findings highlight the role of marine bioresources as a valuable source of novel therapeutic leads for managing inflammation and pain.

Tedania anhelans, a demospongian species belonging to the family Tedaniidae, is widely distributed in marine environments, particularly in tropical and subtropical waters. Previous phytochemical investigations on sponges of the genus *Tedania* have revealed the presence of diverse secondary metabolites, including sterols, fatty acids, alkaloids, and peptides, which are associated with significant pharmacological activities.[10] Extracts of

Tedania species have shown promising antimicrobial, cytotoxic, and anti-inflammatory effects, suggesting their potential as valuable sources of therapeutic agents.[11]

Despite its wide distribution, studies focusing on the pharmacological evaluation of *Tedania anhelans* remain limited. Exploring its bioactive potential, particularly in the areas of analgesic and anti-inflammatory activity, may provide important leads for drug discovery. Therefore, the present study aims to investigate the potential of *Tedania anhelans* in pain management.

MATERIALS AND METHODS

Collection of sponge material

The marine sponge *Tedania anhelans* was collected manually at the Devgad Island, near Karwar Karwar (14°49'12"N 74°7'12"E) of the Arabian Sea. After carefully removing the associated sponge, the material was washed with fresh water, dried in shade.

Preparation of extract[12,13,14]

The dried sponge material was crushed and the crushed sponge was subjected to methanol extraction (maceration) for 3 days. The supernatant was filtered using Whatman filter paper, concentrated under reduced pressure. Fresh methanol was added each time and the extraction was carried thrice. The concentrated extract was stored in airtight container in refrigerator below 10^0C. The preliminary phytochemical screening of methanolic extract of *Tedania anhelans* revealed the presence of carbohydrates, steroids, lipids, terpenes and terpenoids.

Experimental Animals

Albino mice (20-25 g) and wistar rats (150-200 g) were used for this activity. The Animal were housed in poly acrylic cages and maintained under standard laboratory conditions (temperature 25 ± 2C, relative humidity 65±10% and in 12 h dark/light cycle), free access to standard dry pellet diet and water ad libitum.

Acute toxicity Study[15]

Female Swiss albino mice weighing 20-25 g were selected randomly for this study. Oral acute toxicity was performed as per OECD- 425 guidelines. The animals were fasted overnight provided only water. Methanol extract of *Tedania anhelans* was administered orally at the dose level of 5G/kg body weight and the animals were observed for 24h for their behavioural changes or mortality. Then animals were further observed for 14 days. No mortality was observed in animals; therefore the dose was assigned as safe dose. The 1/10 th of safe dose was taken as a dose for study.

Evaluation of Analgesic activity

A. Tail Immersion method

Wistar rats of either sex were divided into five groups of 6 rats each, rats were held in position with a suitable restrainer with the tail extending out. The lower 4 cm portion of the tail was marked and immersed in water bath thermo-statistically maintained at 55 ± 0.5^0C. Reaction time was recorded at 0 hr, 30 min, 60, 120, and 180 min, after the oral administration of vehicle (distilled water), test extract (TAE) and standard drug (aspirin 100mg/kg p.o) to respective groups. The cut off time was 15 sec. The analgesic effect of treated group was be compared with that of control.[16]

B. Acetic Acid-Induced Writhing test

Albino mice of either sex were divided into five groups 6 mice each. Mice were administered orally with standard drug (aspirin 100mg/kg p.o), test extract (TAE) and vehicle (distilled water), 30 minutes before the intraperitoneal (i.p.) injection of 0.6% v/v acetic acid at a dose of 10ml/kg to induce the characteristic writhing. The number of writhes (abdominal contraction, trunk twisting and hind limb extension) noted during the period of 10 min. after the 30 min of drug treatment. The analgesic effect of drug treated animals compared with that of control.[16]

Statistical analysis

Results were expressed in Mean ± SEM. The statistical analysis was determined by using one way ANOVA followed by Dunnett's Comparison and Post-hoc test using GraphPad Prism computer software.

RESULTS

A. Tail Immersion method

The methanolic extract of *Tedania anhelans* exhibited significant analgesic activity in the tail immersion test in rats (Table 1). The reaction time was markedly increased in extract-treated groups compared to the control. At a dose of 250 mg/kg, the extract produced a moderate analgesic effect with 42% inhibition, whereas the higher dose of 500 mg/kg showed a stronger effect (82% inhibition), approaching the standard drug aspirin (100 mg/kg), which exhibited 100% inhibition.

Table 1: Analgesic activity of *Tedania anhelans* in tail immersion method in rats.

Group	Dose mg/kg	Reaction time in sec.	% inhibition
I - Control	Dist. Water	2.05±0.10@	--
II -Standard Aspirin	100 mg/kg	4.02±0.20***	100
III - Extract	250 mg/kg	2.85.20±0.20***	42
IV - Extract	500 mg/kg	3.65±0.10***	82

Values are Mean±SEM, (n=5), where @ $p < 0.001$ compared to control * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ as compared to control.

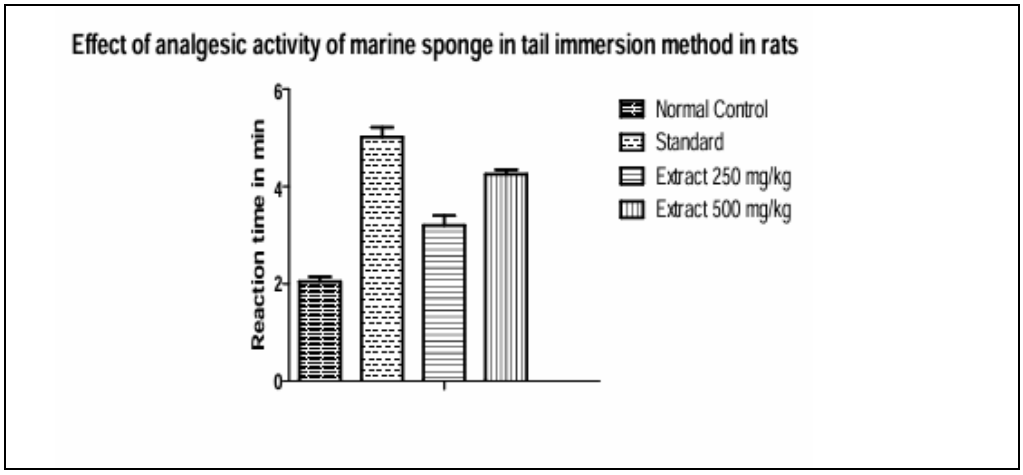

Figure 1.

A. Acetic Acid-Induced Writhing test

The methanolic extract of *Tedania anhelans* significantly reduced the number of writhes in mice in a dose-dependent manner when compared with the control group (Table 2). The control animals showed a mean writhing count of 70.50 ± 2.28, whereas the standard drug aspirin (100 mg/kg) produced a highly significant reduction (30.60 ± 2.19, *p < 0.001) corresponding to 57% inhibition.

The extract at 250 mg/kg reduced the writhing response to 58.90 ± 2.01* with 17% inhibition, while the higher dose of 500 mg/kg showed a more pronounced effect (42.30 ± 2.18*, 40% inhibition). Although the extract was less effective than aspirin, the results indicate a significant peripheral analgesic activity of *T. anhelans*, with the effect being more prominent at the higher dose.

Table 2: Effect of *Tedania anhelans* on acetic acid induced writhing test in mice.

Group	Dose mg/kg	No. of Writhes	% inhibition
I - Control	Dist. Water	70.50±2.28@	
II -Standard Aspirin	100 mg/kg	30.60±2.19***	57
III - Extract	250 mg/kg	58.90±2.01***	17
IV - Extract	500 mg/kg	42.30±2.18***	40

Values are Mean ± SEM, (n=5), where @ p < 0.001 compared to control, * p < 0.05, ** p < 0.01, *** p < 0.001 as compared to control.

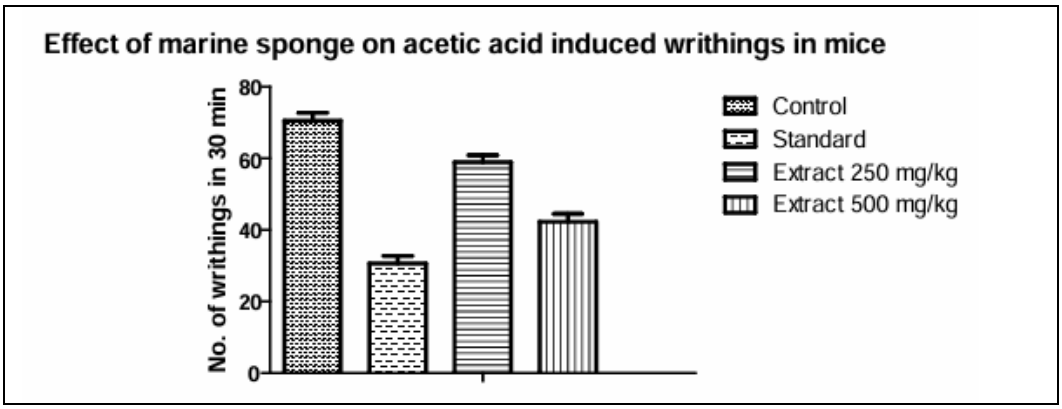

Figure 2.

DISCUSSION

The present study demonstrates that the methanolic extract of *Tedania anhelans* possesses significant analgesic activity, as evidenced by both the tail immersion test and the acetic acid–induced writhing test. These models are widely used to evaluate centrally and peripherally mediated nociception, respectively, and the findings suggest that the extract exerts analgesic effects through both central and peripheral mechanisms.

In the tail immersion test, which is considered a model for central analgesia, the extract significantly increased the reaction time in a dose-dependent manner. At 500 mg/kg, the extract produced 82% inhibition, which was comparable to the standard drug aspirin (100% inhibition

at 100 mg/kg). The lower dose (250 mg/kg) also exhibited moderate analgesia (42% inhibition). This indicates that the extract may modulate central pain pathways, possibly by influencing opioid receptors or inhibiting central transmission of pain signals.

In the acetic acid–induced writhing test, a model of peripheral pain mediated primarily by prostaglandin release and inflammatory mediators, *T. anhelans* extract significantly reduced the number of writhes in mice. The reduction was dose-dependent, with 17% inhibition at 250 mg/kg and 40% inhibition at 500 mg/kg, compared to 57% inhibition by aspirin. Although the activity was lower than the standard, the results clearly indicate that the extract has peripheral analgesic potential, likely due to inhibition of inflammatory mediators such as prostaglandins, histamine, or bradykinin.

The observed analgesic effects may be attributed to the presence of bioactive secondary metabolites in marine sponges, such as terpenoids and steroids, which are known to modulate pain and inflammation pathways.

CONCLUSION

The Methanolic Extract of Marine sponge *Tedania anhelence* has shown significant analgesic activity in dose dependent manner in authentic models such as tail immersion method and acetic acid induced writhing test. This shows that the marine sponge has got potential as analgesic agent. However further studies and investigations are needed to find out potent analgesic compound in the Marine sponge.

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