J. Sci. Innov. Nat. Earth: Vol. 5, Issue 3, 2025, Page 17-18 ISSN (Online) 2583-2093

OPEN ACCESS

Journal of Science Innovations and Nature of Earth

Journal homepage : https://jsiane.com/index.php/files/index

International, Double-Blind, Quarterly, Peer-Reviewed, Refereed Journal, Edited and Open Access Research Journal

Pharmacological Evaluation of Bark Extract of *Cinnamonum zeylanicum* With *Cinchona officinalis* For Its Synergistic Action on Antihelmintic Activity

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DOI: https://doi.org/10.59436/jsiane.418.2583-2093

Abstract

The present investigation aimed to assess the pharmacological potential of a mixed bark aqueous extract (MBAE) prepared from *Cinnamomum zeylanicum* and *Cinchona officinalis* for its synergistic anthelmintic activity. Barks of both plants were sourced from local markets in Vijayawada and Nuzvid, shade-dried, powdered, and extracted with distilled water. The extract was subjected to preliminary phytochemical analysis using standard procedures. Anthelmintic activity of MBAE was evaluated against Indian earthworms (*Pheretima posthuma*) collected from a local vermicomposting unit in Nuzvid. Phytochemical screening revealed the presence of alkaloids, glycosides, flavonoids, phenols, tannins, and phytosterols. Statistical evaluation using one-way ANOVA (Graph Pad Prism) indicated highly significant results ($P < 0.0001$). MBAE reduced the time to paralysis and death in earthworms more effectively than the standard reference drug, albendazole. These findings suggest that the synergistic action of *C. zeylanicum* and *C. officinalis*, likely due to their polyphenolic constituents, plays an important role in enhancing anthelmintic activity.

Keywords: Mixed bark aqueous extract (MBAE), phytochemical analysis, *Pheretima posthuma*, anthelmintic activity, albendazole

Received 03.06.2025 Revised 12.07.2025 Accepted 15.08.2025 Online Available 03.09.2025

Introduction

Helminthic infections remain one of the most prevalent parasitic diseases in humans, affecting a significant portion of the global population. These infections are particularly problematic in developing nations, where they contribute to malnutrition, anemia, impaired growth, eosinophilia, and respiratory complications. Although helminthiasis is rarely life-threatening, it is a major cause of chronic morbidity and reduced quality of life. Helminths inhabit primarily the gastrointestinal tract, but some species migrate into tissues or organs, causing blood loss, nutritional deficiencies, mechanical obstruction, and tissue damage through the release of toxins. Anthelmintic agents are therefore essential in clinical management, as they either immobilize or expel the parasites, thereby reducing disease burden Das *et al*., 2011.

Cinnamomum zeylanicum (commonly known as "true cinnamon") is a tropical evergreen tree belonging to the family Lauraceae. Its bark is widely used as a culinary spice and traditional medicine due to its fragrance, flavor, and diverse pharmacological activities. Historically, the term "cinnamon" is derived from the Hebraic and Arabic word amomon, meaning "fragrant plant".

Cinchona officinalis, popularly referred to as "Peruvian bark," is a member of the Rubiaceae family. Native to the Andean region of South America, it has also been cultivated in India, Indonesia, Vietnam, and several parts of Africa. The bark of Cinchona species is well known as the natural source of quinoline alkaloids, including quinine, which historically revolutionized malaria treatment. Indonesia remains one of the world's leading producers of Cinchona bark Gurung and De 2017.

Materials and Methods

Collection of Plant Material:-Barks of *Cinnamomum zeylanicum* and *Cinchona officinalis* were procured from local herbal markets in Vijayawada and Nuzvid, Andhra Pradesh. The plant materials were authenticated based on their macroscopic and organoleptic features before further use.

Preparation of Extract:- The collected barks were washed, shade-dried, and powdered into coarse material. Approximately 1000 ml of distilled water was added to the powdered sample and the mixture was kept for maceration for seven days with occasional stirring. The extract was filtered sequentially through muslin cloth and Whatman No. 1 filter paper. The filtrate was concentrated by evaporation on a water bath, and the dried residue was stored in an airtight container until use. This preparation was referred to as the mixed bark aqueous extract (MBAE) Lakshmi *et al*., 2022.

Preliminary Phytochemical Screening:-The aqueous extract of *C. zeylanicum* and *C. officinalis* was subjected to standard qualitative phytochemical analysis to detect the presence of alkaloids, glycosides, tannins, flavonoids, phenols, terpenoids, saponins, and other secondary metabolites, following established protocols Apte *et al*., 2014.

Test organism-Adult Indian earthworms (*Pheretima posthuma*), measuring 8–10 cm in length and 0.2–0.5 cm in diameter, were obtained from a local vermicomposting facility in Nuzvid. The worms were washed thoroughly with normal saline to remove soil and fecal matter. Their anatomical and physiological similarities to intestinal roundworms make them suitable for in vitro evaluation of anthelmintic activity Durgawale *et al*., 2017.

Evaluation of Anthelmintic Activity -

The study worms were divided into three experimental groups (n=5 worms per group):

•Group I (Control): Received distilled water.

•Group II (Standard): Treated with albendazole John *et al*., 2009 at concentrations of 50, 100, 200, 300, and 400 mg/ml.

•Group III (Test): Treated with MBAE at concentrations of 50, 100, 200, 300, and 400 mg/ml.

The worms were observed for paralysis (defined as complete loss of movement except upon vigorous shaking) and death (confirmed by absence of motility even after stimulation, along with fading body color and white secretion). Time to paralysis and death was recorded in minutes for each concentration.

Results

Phytochemical Screening:-The preliminary phytochemical analysis of the mixed bark aqueous extract (MBAE) of *Cinnamomum zeylanicum* and *Cinchona officinalis* confirmed the presence of several classes of bioactive compounds (Table 1). Alkaloids, carbohydrates, phenols, tannins, terpenoids, saponins, and glycosides were detected, whereas flavonoids, amino acids, steroids, and fixed oils were absent. These findings suggest that the extract is rich in polyphenolic compounds, which are often reported to possess significant pharmacological properties, including antiparasitic effect.

Table 1: Phytochemical profile of MBAE

Phytochemical Constituents	MBAE Result
Alkaloids	+
Carbohydrates	+
Flavonoids	–
Phenols	+
Saponins	+
Terpenoids	+
Steroids	–
Tannins	+

Phytochemical Constituents	MBAE Result
Amino acids	–
Glycosides	–
Fixed oils and fatty acids	–

(+ indicates presence; – indicates absence)

Anthelmintic Activity: MBAE demonstrated dose-dependent anthelmintic activity in *Pheretima posthuma*. At lower concentrations (50 and 100 mg/ml), the extract produced only moderate paralysis and death times. However, at higher concentrations (200–400 mg/ml), the extract significantly reduced both paralysis and death times compared to the control group (Table 2).

Table 2: Anthelmintic activity of MBAE compared to Albendazole

Group / Concentration	Paralysis Time (min)	Death Time (min)
Control	–	–
Albendazole 50 mg/ml	211.4 ± 1.02	220.8 ± 2.35
Albendazole 100 mg/ml	77 ± 2.02	83.6 ± 2.87
Albendazole 200 mg/ml	20.2 ± 1.31	35.6 ± 0.40
Albendazole 300 mg/ml	15.4 ± 1.24	30.6 ± 0.40
Albendazole 400 mg/ml	12.2 ± 0.86	25.6 ± 0.50
MBAE 50 mg/ml	221.2 ± 2.26	233 ± 1.81
MBAE 100 mg/ml	95.2 ± 1.59	96.4 ± 1.63
MBAE 200 mg/ml	32.2 ± 1.15	55.2 ± 0.73
MBAE 300 mg/ml	28.6 ± 0.50	49 ± 0.37
MBAE 400 mg/ml	17.4 ± 0.67	30.2 ± 0.37

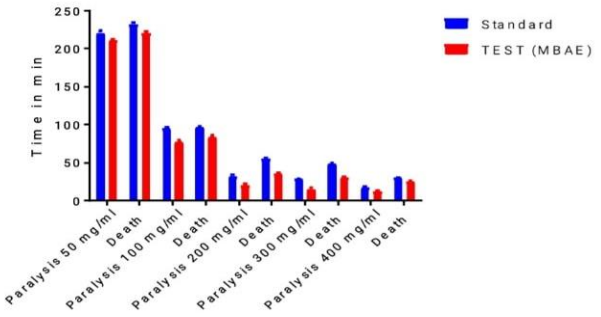


Figure 1: Anthelmintic activity of standard, MBAE, Values is expressed as Mean ± SEM, P < 0.0001.

Figure 2: Standard (Albendazole) -50,100,200,300,400mg/ml- Paralysis and Death

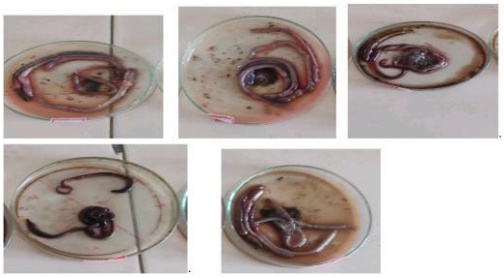
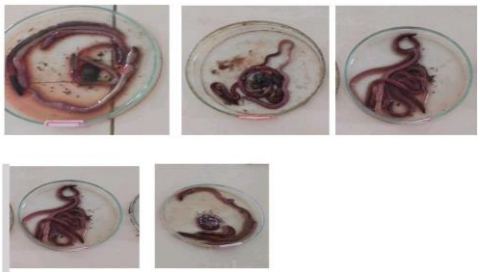


Figure 3: Test (MBAE) -50,100,200,300,400mg/ml- Paralysis and Death



The results indicate that MBAE exhibited significant anthelmintic activity, particularly at 300 and 400 mg/ml concentrations, where its effect was comparable to that of albendazole. Statistical analysis confirmed that these differences were highly significant ($p < 0.0001$).

Discussion

The presence of tannins and alkaloids in MBAE may explain its potent anthelmintic activity. Tannins are known to interfere with parasite physiology by binding to glycoproteins on the cuticle and disrupting structural integrity, ultimately leading to worm paralysis and death. Alkaloids and phenolic compounds, on the other hand, may contribute additional synergistic effects by impairing energy metabolism or neuromuscular transmission in helminths.

The study findings are consistent with earlier reports that highlighted the anthelmintic activity of plant-derived tannins, alkaloids, and saponins .Importantly, the combination of C. zeylanicum and C. officinalis appears to potentiate these effects, suggesting that MBAE offers a broader spectrum of active constituents compared to individual extracts.

Overall, the study supports the traditional use of C. zeylanicum and C. officinalis in parasitic infections and highlights the potential of MBAE as a natural anthelmintic agent with synergistic properties.

Conclusion

The present investigation demonstrated that the mixed bark aqueous extract (MBAE) of *Cinnamomum zeylanicum* and *Cinchona officinalis* exhibits potent, dose-dependent anthelmintic activity in *Pheretima posthuma*. Phytochemical screening confirmed the presence of tannins, alkaloids, saponins, phenols, and terpenoids, which are likely responsible for the observed activity. At higher concentrations, MBAE significantly reduced paralysis and death times in earthworms, showing effects comparable to the standard drug albendazole.

These results suggest that combining C. zeylanicum and C. officinalis enhances the pharmacological potential of both plants, possibly due to synergistic interactions between polyphenolic and alkaloida constituents. The findings validate their traditional medicinal use and provide a scientific basis for developing plant-based alternatives or adjuvants to conventional anthelmintics. Further in vivo studies and mechanistic investigations are recommended to confirm efficacy and safety before clinical applications.

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